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Full Research Papers should contain original research not previously published elsewhere. They should normally be between 4,000 and 7,000 words although shorter or lengthier articles could be considered for publication if they are of merit. The first page of the papers should contain the title and the authors' affiliations, contact details and brief vitae (of about 50 words). Regarding the following pages, papers should generally have the following structure: a) title, abstract (of about 150 words) and six keywords, b) introduction, c) literature review, d) theoretical and/or empirical contribution, e) summary and conclusions, f) acknowledgements, g) references and h) appendices. Tables, figures and illustrations should be included within the text (not at the end), bear a title and be numbered consecutively. Regarding the referencing style, standard academic format should be consistently followed. Examples are given below:

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- Forsyth P. (2002a), 'Privatization and Regulation of Australian and New Zealand Airports', *Journal of Air Transport Management*, 8, 19-28.
- Papatheodorou, A. (2008) The Impact of Civil Aviation Regimes on Leisure Market. In Graham, A., Papatheodorou, A. and Forsyth, P. (ed) *Aviation and Tourism: Implications for Leisure Travel*, Aldershot: Ashgate, 49-57.
- Skycontrol (2007) *easyJet welcomes European Commission's decision to limit PSO abuse in Italy*. 23rd April. Available from: <http://www.skycontrol.net/airlines/easyjet-welcomes-european-commissions-decision-to-limit-pso-abuse-in-italy/> (accessed on 22/08/2008).

Conference Reports should be between 1,000 and 1,500 words. They should provide factual information (e.g. conference venue, details of the conference organizers), present the various programme sessions and summarize the key research findings.

Book Reviews should be between 1,000 and 1,500 words. They should provide factual information (e.g. book publisher, number of pages and ISBN, price on the publisher's website) and critically discuss the contents of a book mainly in terms of its strengths and weaknesses.

Industry Perspectives should be up to 1,000 words and provide a practitioner's point of view on contemporary developments in the air transport industry. Contributors should explicitly specify whether their views are espoused by their organization or not.

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Marcia Urban, Annika Paul and Mara Cole

The growing demand for mobility in general and for air transport in particular puts increasing pressure on today's transportation providers. Supplying sufficient capacity, hence alleviating potential congestion of the entire system, and ensuring seamless and efficient operation of the overall transport system are two of the main challenges for the future. The integration of transport modes along the entire passenger journey can help to streamline the current system and thus increase existing capacities as well as passenger comfort level. Today, there are already some approaches in place that interlink different transport modes by providing single ticketing, or specially dedicated interchange platforms. Four such intermodal transport models are assessed within this paper. For this purpose, a set of key performance indicators is developed and applied to evaluate the intermodal transport performance of each concept. Aspects such as journey time and costs as well as baggage through-handling are considered and data for each concept acquired. Based on the evaluation, the AIRail concept is ranked highest since it best meets the criteria of a seamless passenger journey. However, the results show that there is potential for improvement within each investigated concept.

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Florian Piekert, Nils Carstengerdes, Sebastian Schier, Reiner Suikat and Alan Marsden

Europe's SESAR Program develops a wide range of solutions to increase the performance of the Air Traffic System. At airport level, the Airport Operations Center (APOC) is expected to provide the most benefit in adverse weather conditions, being the ultimate communication platform to pursue the Total Airport Management (TAM) Collaborative Decision Making Process. It will increase mutual and common situation awareness and allows the joint definition and implementation of the operational strategy. The assessment of APOC benefits in a live airport environment is rather limited and requires implementation and "right" weather and traffic situations. This work argues for validation trials in high fidelity artificial airport environments as a more reliable and less costly alternative which allows comparison between operations before and after implementation of new solutions. Based on requirements provided by SESAR concept documentation and from live operations this work presents an approach for such a high fidelity artificial environment.

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Qualitative research methods based on literature review or expert judgement have been used to find core issues, analyze emerging trends and discover promising areas for the future. Deriving results from large amounts of information under this approach is both costly and time consuming. Besides, there is a risk that the results may be influenced by the subjective opinion of experts. In order to make up for such weaknesses, the analysis paradigm for choosing future emerging trend is undergoing a shift toward implementing qualitative research methods along with quantitative research methods like text mining in a mutually complementary manner. The change used to implement recent studies is being witnessed in various areas such as the steel industry, the information and communications technology industry, the construction industry in architectural engineering and so on. This study focused on retrieving aviation-related core issues and the promising areas for the future from research papers pertaining to overall aviation areas through text mining method, which is one of the big data analysis techniques. This study has limitations in that its analysis for retrieving the aviation-related core issues and promising fields was restricted to research papers containing the keyword "aviation." However, it has significance in that it prepared a quantitative analysis model for continuously monitoring the derived core issues and emerging trends regarding the promising areas for the future in the aviation industry through the application of a big data-based descriptive approach.

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Taiwan is a small island with a relatively large number of airports. These airports show great disparity in terms of passenger volume and cargo tonnage. This paper in the first part evaluates the efficiency and productivity of Taiwanese airports using a panel data set, to verify the ones with lower efficiency performances. DEA (Data Envelopment Analysis) and Malmquist index methods are applied. In the second stage the changes of these scores are analyzed in different regression methods to test the influence of the Three Link agreement between China and Taiwan. It reveals that airports in Taiwan with routes to China have lower efficiency scores but their productivity grows faster than that of the other airports. This paper also confirmed that airports on offshore islands have higher efficiency scores and productivity.

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7. AN EVALUATION OF AIRPORT WAYFINDING AND SIGNAGE ON SENIOR DRIVER BEHAVIOUR AND SAFETY OF AIRPORT ROAD ACCESS DESIGN108-129

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8. THE CUSTOMERS' EXPECTATIONS AS A GUIDE TO SERVICE INNOVATION IN THE AIRLINE INDUSTRY130-143

Luciana Padovez, Max Well Elias and Mauro Caetano

According to the strategic innovation paradigm, service companies have their innovative efforts guided by market needs, so customer demand is crucial to successful innovation. However, the service literature about air transportation has been focusing on the evaluation of service quality delivered instead of the identification of market demands. This study applied the Hierarchical Model of air transportation service quality evaluation adapted to identify customer' expectations in a Brazilian domestic airport. The results indicate that customers have higher expectations regarding airline employees' conduct and expertise, which suggests areas where investments should be prioritized in order to optimize efforts on service innovation.

EDITORIAL

SELECTED PAPERS FROM THE 19TH AIR TRANSPORT RESEARCH SOCIETY WORLD CONFERENCE, SINGAPORE, 2015

The 19th Air Transport Research Society World Conference (ATRS) was held in Singapore, from July 2nd to July 5th, 2015 and attracted almost 200 papers. This special issue of the Journal of Air Transport Studies collects eight selected papers covering a wide range of topics presented and discussed at the conference.

In the first paper, **Marcia Urban, Annika Paul and Mara Cole** introduce and apply a quantitative assessment approach to a set of existing intermodal approaches. The paper presents guidance in identifying potential improvements in intermodal connections. The comparison identified the Frankfurt airport high-speed rail and airport (AIRail) connection as the best performing approach.

Sumana Chaudhuri and Ranjan Chaudhuri presents in the second paper a cost benefit analysis for the modernization of the Delhi Airport project. Delhi airport will be capable to cope with the demand for the next few years, when a shortage of capacity may occur. In the analysis provided by the authors the Delhi Airport project has positive net present values as well as greater than the unity benefit-cost ratios.

European SESAR program is the topic of the paper authored by **Florian Piekert, Nils Carstengerdes, Sebastian Schier, Reiner Suikat and Alan Marsden**. The work suggests that the benefits of using an airport operation center are better assessed in a high fidelity artificial airport rather than in a live airport environment. The research concludes by proposing an approach to set a high fidelity artificial environment.

Hyun-jung Kim, Nam-ok Jo, Kyung-shik Shin, Jin-seo Park, Ga-ram Sim and Je-chul Kim make use of big data methodologies in order to establish trending topics in the aviation sector. By establishing a quantitative research approach, the authors extract and monitor the current core areas of aviation research.

The impact of policy over airport efficiency and productivity is evaluated in the work by **Lu Yang**. The effect of the three link agreement between China and Taiwan over the efficiency of Taiwanese airports is estimated applying a two stages DEA approach. The author finds a positive impact of the policy over the productivity of the airports. Moreover, the work shows that the efficiency gap between big and small Taiwanese airports is also increasing.

Wali Mugnhi critically discusses the effects of the Pakistan's national aviation policy. One of the main aims of the aviation policy was to develop an efficient transportation structure to foster economic activity through different strategic measures. Despite this, the Pakistani aviation sector is currently presenting different levels of criticality. In this light, the author presents a set of possible remedial measures to be adopted.

The wayfinding provision is a basic prerequisite on driving behaviours and road safety. In the seventh paper, **Nur Khairiel Anuar, Romano Pagliari and Richard Moxon** study the airport road access wayfinding and the relations between senior driving behaviours and airport road access wayfinding design. The authors find that seniority, complexity of road design and increased traffic congestion distract the drivers and may result in unintentional movements and in exceeding speed limits.

Luciana Padovez, Max Well Elias and Mauro Caetano adapt and apply a hierarchical model of air transportation service quality evaluation to identify customer' expectations in a Brazilian domestic airport. The research aims to assist airlines and airport managers in prioritizing actions and investments in order to meet consumer's needs. The results of the application show that consumers have high expectation on airline employees, mostly valuing their conduct and expertise.

We would like to extend our thanks to the authors and the reviewers for their contribution to this ATRS special issue of Journal of Air Transport Studies. We believe that these works are providing a valuable contribution to the aviation practitioners as well as encouraging further research on the respective topics.

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TOWARDS SEAMLESS PASSENGER TRANSPORT: PERFORMANCE OF INTERMODAL APPROACHES

Marcia Urban¹, Annika Paul², Mara Cole³

ABSTRACT

The growing demand for mobility in general and for air transport in particular puts increasing pressure on today's transportation providers. Supplying sufficient capacity, hence alleviating potential congestion of the entire system, and ensuring seamless and efficient operation of the overall transport system are two of the main challenges for the future. The integration of transport modes along the entire passenger journey can help to streamline the current system and, thus, increase existing capacities as well as passenger comfort level. Today, there are already some approaches in place that interlink different transport modes by providing single ticketing, or specially dedicated interchange platforms. Four such intermodal transport models are assessed within this paper. For this purpose, a set of key performance indicators is developed and applied to evaluate the intermodal transport performance of each concept. Aspects such as journey time and costs as well as baggage through-handling are considered and data for each concept acquired. Based on the evaluation, the AIRail concept is ranked highest since it best meets the criteria of a seamless passenger journey. However, the results show that there is potential for improvement within each investigated concept.

KEYWORDS

Intermodal Passenger Transport; Key Performance Indicators; Benchmarking; Intermodal Approaches; Quantitative Assessment; Performance Assessment.

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1. INTRODUCTION

The air transport system faces great challenges in the future. Capacity shortages within the transport system, for example at airports, complicate the provision of fast door-to-door travel. Passengers complain about time-consuming and inconvenient connections during airport access. In order to enhance and optimize the current transport system, the European Commission, therefore, defined ambitious goals for the air transport system within the Flightpath 2050 document. One of these goals states that 90 per cent of European passengers should be able to complete their door-to-door journey in Europe within four hours (European Commission, 2011). Building on this vision, the Strategic Research and Innovation Agenda (ACARE, 2012) outlines requirements for a seamless intermodal passenger journey in more detail and highlights areas which yield optimization potential towards the four hour door-to-door goal. To this end, the overall passenger journey can be broken down into several process steps, each demonstrating different potential for efficiency improvement.

Passengers access the airport via different transport modes (public transport, private car, taxi etc.). The respective level of connectivity in terms of quantity and quality supplied shapes passenger behaviour and travel times. Furthermore, arrival times differ by passenger type. Leisure passengers, for example, allow more time for airport access and arrive early at the airport since they incorporate potential delays in public transportation or during airport processes in their planning. Business passengers, on the contrary, who are often frequent travellers, are more accustomed to travel related processes and can, hence, anticipate travel process duration more accurately. At Munich Airport, for example, more than 60 per cent of leisure passengers arrive at least 90 minutes prior to departure compared to only about 32 per cent of business travellers. About 35 per cent of the latter arrive 30 to 60 minutes before their flight (Munich Airport, 2010). When investigating overall journey times, the flight time is an important factor to be considered. An analysis of the distribution of the stage length of European flights to the overall travel time shows that about 35 per cent of intra-European flights cover a distance up to 500 kilometres (OAG, 2012) which corresponds to a block time of about 70 minutes. Another 33 per cent of flights take place up to 1000 kilometres and have a respective block time of 105 minutes. In regard to the four hour door-to-door goal and the current distance distribution for intra-European flights, a large share of passengers already spends between 30 per cent and 44 per cent of these four hours in the aircraft.

Since passengers spend a high amount of their overall journey in waiting for or interchange between the different modes of transportation, there is optimization potential in increasing

the efficiency of modal interchange and reducing passenger waiting as well as queuing times. This paper introduces an assessment framework with the purpose to better understand how intermodal approaches can improve the passenger journey and to identify gaps impeding the provision of a seamless intermodal journey. For this purpose, a set of key performance indicators is developed (section 2) which are then applied to investigate the performance of four different intermodal concepts already in place (section 3). The results are presented and discussed in section 4.

2. KEY PERFORMANCE INDICATORS AND INTERMODAL APPROACHES BENCHMARKING

The key performance indicators, defined within this section, are based on the SRIA (2012) goals in regard to intermodal performance, a stakeholder analysis concerning respective requirements (Urban et al., 2014) as well as studies in the field of intermodal applications for seamless passenger travel (e.g. ORIGAMI 2013, KITE 2007). Table 1 depicts the set of key performance indicators used for the analysis. Each indicator is assigned to high-level assessment parameters (left column). The data for all metrics, outlined in the third column, is collected for each of the four intermodal approaches.

Table 1: Indicator set for the analysis of seamless intermodal transport

High-level assessment parameters	Key performance indicators (KPI)	Metrics
Joint booking and ticketing	– Booking of entire journey via a single platform or contact point	– Yes/no
	– Availability of single ticketing	– Yes/no
	– Availability of different ticket types, e.g. digital, print	– Score
Liability issues	– Availability of single contact point for information and complaints	– (0) no, (1) partly, (2) yes
	– Availability of delay compensation	– Ticket price/ delay of journey time
	– Responsibility across transport chain	– (0) mode-specific, (1) partly bundling of modes, (2) single point

Predictability of passenger journey	<ul style="list-style-type: none"> – Information about expected delays – Provision of faster alternative routes – Information about baggage location – Information about additional transport-related services and products 	<ul style="list-style-type: none"> – (0) no, (1) mode-specific inform., (2) single information platform – Same as above – Same as above – Same as above
Integrated journey planning	<ul style="list-style-type: none"> – Planning tool including all available journeys – Comparison of price and time for available alternatives – Planning via different devices/distribution channels 	<ul style="list-style-type: none"> – (0) mode-specific, (1) partly bundling of modes, (2) single point – (0) no comparison, (1) only for one variable (2) for both variables – Available channels/ possible channels
Journey time and costs	<ul style="list-style-type: none"> – Price of different alternatives considered in the analysis – Travel time along the journey – Number of interchanges along the journey – Interchange time between journeys 	<ul style="list-style-type: none"> – Price (in €) – Minutes – Number of interchanges – Minutes
Quality of physical platform for interchange between modes	<ul style="list-style-type: none"> – Number of level changes between modes – Wayfinding aids between modes – Distance between physical infrastructure of different transport modes 	<ul style="list-style-type: none"> – Number of level changes – (0) none, (1) mode-specific, (2) integrated wayfinding – Metres
Baggage through-handling	<ul style="list-style-type: none"> – Luggage transfer without passenger involvement – Cost of baggage through handling – Number of alternatives available for baggage handling 	<ul style="list-style-type: none"> – (0) passenger responsibility, (1) rail station/ car parking/ bus stop, (2) city station, (3) door to aircraft handling – Price (in €) – Score

Based on the data collected, the approaches are ranked on a scale from 0 to 4 for each metric. The best performing approach(es) receive(s) a value of 4 and the worst performing approach(es) receive(s) a value of 1.

Table 2: Example benchmarking of KPI "Price of different alternatives"

Intermodal approach	Price of different alternatives considered in the analysis (in €)	Ranking
AIRail	50	3
SkyFerry	60	2
Bus&Fly	70	1
CarSharing	40	4

In the example in Table 2, which concerns the ticket price of different alternatives (exemplary values), the CarSharing alternative has the lowest price with 40 Euros and the Bus&Fly alternative has the highest price with 70 Euros. Therefore, these approaches receive the scores 4 and 1, respectively. For some of the intermodal approaches no data is available for certain key performance indicators. In this case, a value of 0 is assigned and the specific metric is not further considered in the evaluation. Subsequently, the scores for all metrics are merged in an overall assessment.

3. SELECTED INTERMODAL APPROACHES AND AIRPORTS

Four currently operated approaches are selected for application and validation of the key performance indicators. These concepts include air transport and another different transport mode. Moreover, they provide first indications on the current status of implemented intermodal transport solutions. Table 3 summarizes the considered approaches and respective characteristics which will be evaluated in the following section. Each approach has been structured according to pre-defined characteristics such as involved operators or the ticketing process to ensure the comparability in the subsequent assessment. In the following paragraphs, a short overview for each approach is provided.

Table 3: Overview of selected intermodal approaches

Source: Urban et al. 2014

<i>Approaches</i>	AIRail	SkyPier Ferry	Bus&Fly	CarSharing
		Transfer		
<i>Characteristics</i>				
Modes involved	air, rail	air, sea (boat)	air, road (bus)	air, road (car)
Operator(s)	Deutsche Lufthansa, Deutsche Bahn, Fraport	Hong Kong Int. Airport, various airlines, ferry operator	Iberia, Alsa, Avanza	DriveNow, Car2Go, Munich Airport
Price incl. air fare	train trip included: one ticket, one price	separate price for ferry and flight	bus trip included: one ticket, one price	separate price for car sharing service and flight
Ticketing process	integrated ticketing and booking available	separate tickets, flight ticket mandatory for ferry	integrated ticketing and booking available	car sharing offer independent from flight ticket
Baggage handling	no through-handling available; check-in at airport	upstream check-in possible at selected ports for selected airlines	no through-handling available; check-in at airport	no through-handling available; check-in at airport
Physical inter-change platform	AIRail Terminal incl. check-in and baggage drop-off	Dedicated SkyPier at Hong Kong Int. Airport	Check-in and baggage drop-off at Iberia Terminal (T4) at Madrid (MAD)	Dedicated parking space between two airport terminals
Connection frequencies	2-13 connections per day (depending on route)	ferry shuttle every 1-1.5 hrs each day, not coordinated with flight plan	2-4 connections per day (depending on route)	individual scheduling dependent on car availability

The AIRail approach represents a potential solution for a smooth intermodal cooperation along the transport modes rail and air. It is based upon the cooperation between Deutsche Bahn, Fraport and Deutsche Lufthansa. Fraport provides the infrastructure at Frankfurt International Airport connecting the train platform with the airport gate. Deutsche Lufthansa purchases entire carriages on trains of Deutsche Bahn. One key characteristic of the approach is the integrated ticketing and booking option which allows passengers to travel with only one ticket. Furthermore, train connections to and from the airport are treated like actual flights in the schedule of Lufthansa and intermodal connections are guaranteed. Thus, the passenger has only one focal point providing journey-related information and being responsible for cancellation or delay issues.

Air and maritime transport means are combined within the SkyFerry approach at Hong Kong International Airport. SkyFerry offers a connection from several ports in the Pearl River Delta to the airport via small boat ferries. A baggage service is offered at selected ports. The ferry shuttles operate with high frequencies but independent from flight schedules. However, the passengers need a separate ticket for the ferry transport which is exclusively sold to passengers holding a valid flight ticket.

An approach, which links road and air transport, is operated by Iberia in cooperation with the two bus companies ALSA and Avanza. Similar to the AIRail approach, Bus&Fly includes a selected set of cities and locations in the geographical area surrounding Madrid airport and provides bus connections aligned with the Iberia flight schedule. The approach enables integrated ticketing and booking for the entire journey as well as the provision of delay management and guaranteed connections.

Another type of intermodal airport connection is offered by the two car sharing providers DriveNow and Car2Go in cooperation with Munich Airport. Passengers can book cars in advance, use the reserved car for the individual travel to the airport and then park the car in a dedicated parking space for car sharing vehicles close to the terminal. The car sharing service differs from public transport in terms of individuality. The passenger can book his journey at any time and is not restricted by the schedule of public transport. The passenger has to manage the journey to the airport independently and the service requires separate payment and ticketing.

4. ASSESSMENT RESULTS

This section discusses the results from the quantitative assessment of the performance of the four selected intermodal transport approaches in detail, applying the key performance

indicator set outlined in Table 1. The combination of the findings for each indicator yields a high-level comparison in terms of intermodal performance as shown in Figure 1.

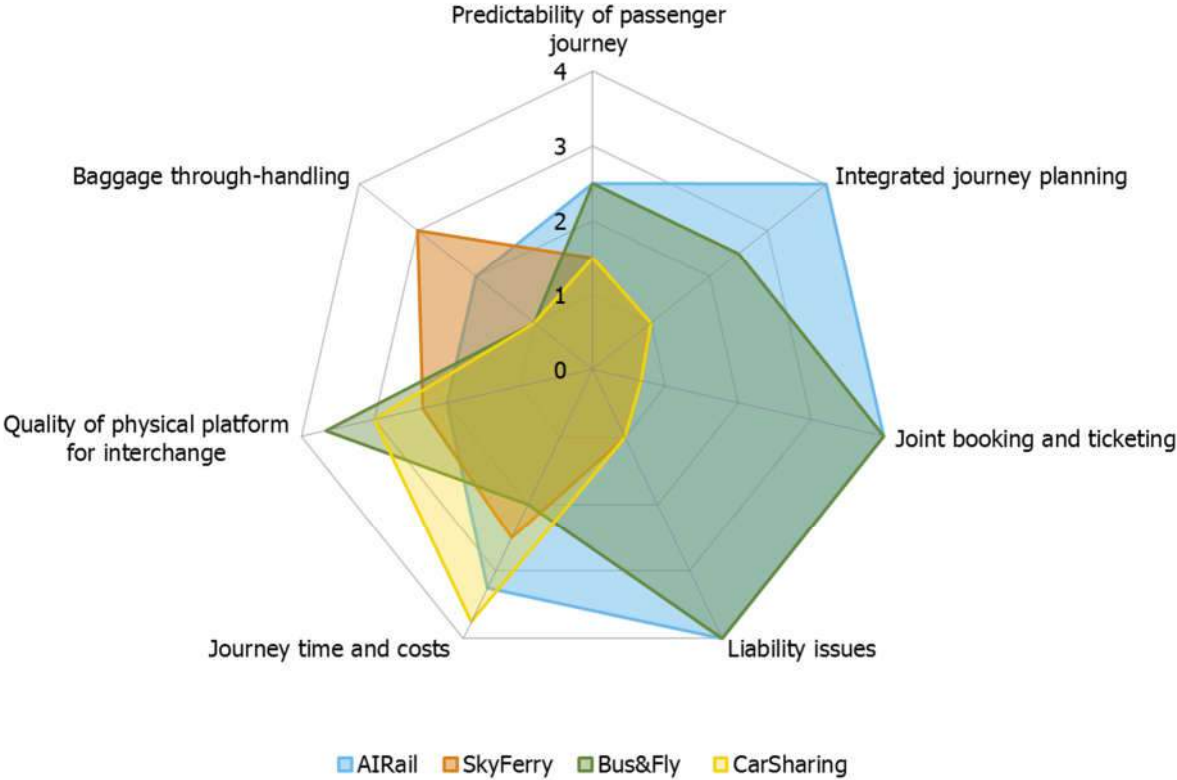


Figure 1: Assessment results for intermodal approaches

The results show that the AIRail approach is the best performing intermodal approach out of the four selected ones with an overall ranking of 67 per cent of the maximum attainable score of 100 per cent, i.e. the concept achieved 62 points out of a maximum of 92 points. However, each of the approaches has different strengths and weaknesses (see Figure 1). In the category “baggage through-handling” AIRail receives a lower score than the SkyFerry approach and in the category “quality of physical platform for interchange” the AIRail approach performs worst. This is due to long walking distances and a high number of required level changes between the rail stop and airport terminal. The Bus&Fly approach receives an overall score of 61 per cent, the SkyFerry 41 per cent and the CarSharing 40 per cent out of potential total points. On a more detailed level, the parameter “quality of physical platform for interchange between modes”, for example, is made up of three different key performance indicators (Figure 2):

- The number of level changes a passenger has to conduct to change between modes
- The availability of wayfinding aids across modes

- The distance between the physical infrastructures of involved transport modes.

For each aspect, data is collected and the approaches are rated accordingly (as described in section 2). Regarding the number of level changes, the Bus&Fly approach performs best, and receives a score of 4, since the bus arrives on the same level as the flight departure area. The AIRail approach performs worst since passengers have to overcome the highest amount of level changes, as outlined above. Furthermore, within all approaches there are mode-specific wayfinding aids and no uniformity across transport modes. Overall, the best performing approach in terms of “quality of the physical interchange platform between modes” is the Bus&Fly approach.

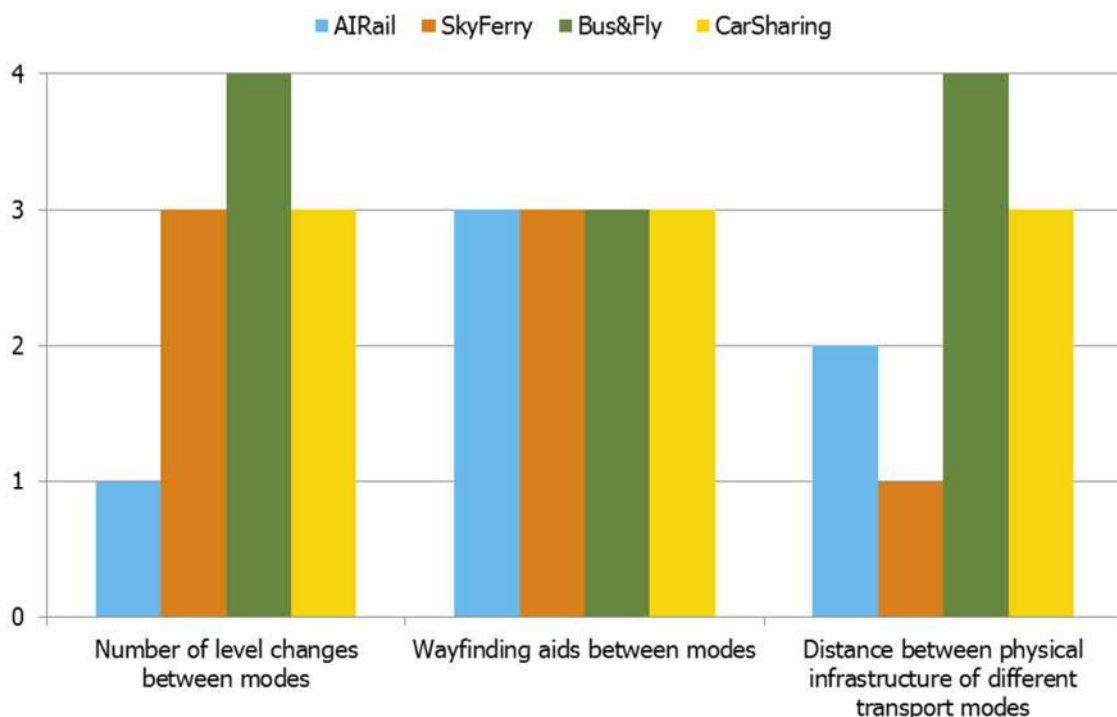


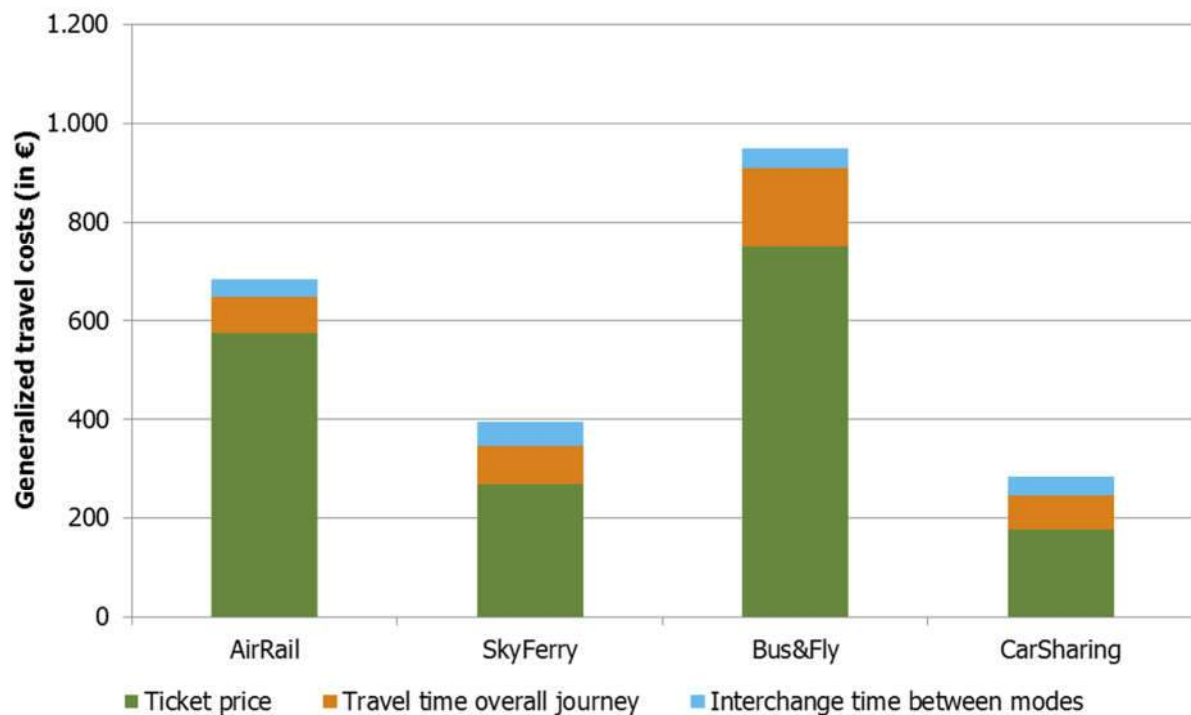
Figure 2: Benchmarking results “Quality of physical platform”

Figure 3 addresses the high-level parameter “journey time and costs” and includes the key performance indicators:

- Price of different alternatives considered in the analysis
- Travel time along the journey
- Interchange time between journeys.

The total costs consist of the actual price, i.e. the flight price and costs for public transportation, and travel time. Travel time is made up of the actual time in a vehicle as well as the time allocated for the interchange and waiting times between different transport

modes. In order to obtain values in the same measuring unit, the travel time values are monetized using the general value of travel time for passengers, published by Eurocontrol (2013), with an average of EUR 27 for both leisure and business travellers. These travel time related costs are added to the ticket price for each journey (Figure 3). The actual ticket price has been extracted for a specific short-haul connection from each of the airports, i.e. the cheapest ticket on a specific day (November 10, 2014) has been selected.



**Figure 3: Generalized travel costs for intermodal approaches (short-haul)
(reference day: Nov 10, 2014)**

For the European intermodal approaches, London Heathrow (LHR) has been selected as short-haul destination, resulting in the routes Madrid Airport (MAD) – LHR (Bus&Fly), Frankfurt Airport (FRA) – LHR (AIRail) and Munich Airport (MUC) – LHR (CarSharing). For Hong Kong Airport, Manila has been selected as short-haul destination since it provides an equivalent to the short-haul routes in Europe. Taking the average generalized travel costs for each approach, the CarSharing approach performs best in this category, and the Bus&Fly offer is the most expensive one, both in regard to ticket price (one-way) and to overall travel time.

5. CONCLUSION AND FUTURE WORK

The paper introduced a quantitative assessment approach including key performance indicators with respective metrics to measure the intermodal performance of four different

intermodal concepts currently in place. The AIRail concept yields the best performance, followed by the Bus&Fly and SkyFerry concepts. The CarSharing approach revealed most drawbacks in regard to intermodal performance and, therefore, ranks last. This assessment approach and results yield a feasible guidance for decision makers in regard to identifying intermodal improvement potential as well as enablers that contribute to the realization of a four hour door-to-door journey for passengers.

These include the establishment of a common platform for data transfer and exchange which requires the involvement of stakeholders from other industries than the transport sector, e.g. providers of data exchange platforms that deliver respective capabilities across all involved transport modes. Data exchange is a necessary prerequisite for passenger comfort, e.g. real-time information provision and ability to react to schedule changes during the journey, as well as for an improved communication among different transport mode operators. Incentives have to be designed for stakeholders, both from the transport industry and other sectors contributing additional expertise, to engage in new approaches. This includes a detailed analysis of the cost and revenue allocation scheme as well as liability aspects across interest groups. If responsibilities and benefits are not clearly defined certain stakeholders will not engage in intermodal solutions. Therefore, it is recommended to conduct a detailed analysis of different stakeholder business models, the regional focus and market segment addressed by their operation, and the passenger groups which are targeted at. A regional train company, for example, might not be interested in investing in infrastructure, technological services and facilities to ensure smooth and hassle-free interchanges between rail and air since its business focus is on a particular region and the respective origin and destination transport. A detailed market analysis also facilitates the establishment of harmonized intermodal framework conditions and a feasible incentive structure for different providers. Other important areas are the improvement of the quality of interchange between transport modes for passengers. This includes the provision of real-time and accurate information along the entire journey, optimization of schedules to reduce passenger waiting times including suggestions for schedule alignment in case of delays as well as the provision of a physical connection platform.

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A COST BENEFIT ANALYSIS OF DELHI AIRPORT PPP PROJECT

Sumana Chaudhuri and Ranjan Chaudhuri¹

ABSTRACT

One of the central tenets of the cost benefit analysis (CBA) literature is the divergence between a project's financial returns and social evaluation of what is desirable from the larger economic priorities and social goals of development. This article focuses on building a base of CBA for Delhi International Airport Limited (DIAL) as a case for Brownfield PPP Airport Project in India. The process of evaluation of the relative merits of the project in terms of the accrued benefits and costs, serves as a template for future frame of reference in similar PPP airport projects.

KEYWORDS

Cost Benefit Analysis (CBA); Externalities; Shadow Pricing; Public Private Partnership.

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1. INTRODUCTION

Airports in India play a vital role in the development of the aviation industry in India. According to the Center for Monitoring Indian Economy (CMIE), the growth in air passenger traffic in India is estimated to have fast-tracked to 12.6 per cent in 2014-15 from the 6 per cent growth recorded in 2013 – 14. New airlines like Tata Airlines and Singapore Airlines JV called Vistaara and Air Asia taking off in Indian skies in 2014, coupled with a strong rise in domestic passenger traffic due to hefty discounts on fares by domestic carriers like Spice Jet, Indigo, Go Airways and Jet Airways in the past one year boosted this growth. Domestic passenger traffic accounts for 70-75 per cent of the total air passenger traffic in India.

During 2015-16, Indian airports are expected to handle 207.2 million passengers, 8.9 per cent higher as compared to 2014-15. Majority of this traffic would be concentrated in Delhi, Mumbai, Hyderabad and Bengaluru. A total of 151.8 million domestic passengers are likely to travel from the Indian airports as compared to 139.1 million estimated for 2014-15. This translates to a rise of 9.2 per cent (CMIE, 2015). The air traffic canvas is however much broader. India has a population of 1.2 billion. On a daily basis only 0.01% (1 in 10,000) of the population uses an aircraft (MOCA, 2011). International visitors excluded the ratio would be even lower. This illustrates the enormous potential for air travel in a large and diverse country like India. The development in India is still at a comparatively early stage. While significant investments have been made and public private partnerships are proving successful, further investment is required in response to quickly rising demand for air travel and corresponding infrastructure on the ground and in the air. The modernized airports in Delhi and Mumbai only provide sufficient capacity for the next few years before further expansion or even a new airport is required. Greenfield airports hold enough capacity for the medium term future; however, the modernization of 35 smaller airports plus plans for more Greenfield airports will further stimulate air traffic growth quickly filling excess capacity at these airports.

While ACI predicts global air traffic to double within 15 to 20 years, traffic volumes will at least triple in India during the same period. The current plans for further modernization and expansion of the airport network in India are estimated at USD 10 billion. A similar or higher amount will be required to accommodate growth beyond 2015 (ACI, 2011). To secure financing and world class know-how, a first step was made by establishing public private partnerships for four Delhi, Mumbai, Hyderabad and Bangalore. However, to ensure the viability of the airport sector in the future more private sector involvement is essential. This article aims to primarily focus on the economic and social costs and benefits of PPP airport

infrastructure project in India, where the special case of Delhi Airport Brownfield project is discussed in the light of Cost Benefit Analysis.

2. REVIEW OF LITERATURE

a. Role of Infrastructure in Economic Growth

Infrastructure services can be described as being of 'strategic importance' (Kay, 1993). Infrastructure plays like pillar for an economy to be sustainable. Sound infrastructure drives national competitiveness. An infrastructure project can usually be classified as a form of public good, because it has both non – rivalry and non – excludability properties. Non – rivalry means the good can be used by another person at no additional or marginal cost; while non – excludability means it is not possible to exclude people from using the good even if they don't pay for it (Stiglitz, 2000). Recent trends in commercialization of infrastructure will be a shift from this model of non – rivalry and non – excludability. Infrastructure has some inherent characteristics like it entails a huge investment, large sunk cost and a long gestation period. So it is not possible for the government alone to bear the entire huge investment requirement for the infrastructure sector. The solution lies in privatization or the private participation in public infrastructure projects which is popularly termed as PPP.

The World Bank (1994) found evidence that the role of infrastructure in growth is substantial, and frequently greater than that of investment in other forms of capital. Spillovers arising from an infrastructure project are of a much larger order of magnitude than for many other activities (Threadgold, 1996). Aschauer (2001) pointed out that investment in public infrastructure has positive spillover effects on an economy's productivity and thus on economic growth. Also, Milbourne et al. (2001) found a positive effect on economic growth from public investment with particular evidence of gains from investment in transportation, communication and education. Recent studies confirm a statistically significant positive relationship between productivity and infrastructure and suggest that infrastructure may be a key determinant of comparative advantage between countries (Yeaple and Golub, 2002).

Infrastructure projects typically exhibit economies of scale, possibly leading to natural monopolies; they may be socially desirable but not privately profitable. To correct these failures governments may regulate private service providers or provide the services

themselves. These government failures may actually exceed the market failures, favoring private provision as argued by Winston (2006).

Infrastructure services, in general, are becoming more commercially oriented (Grimsey and Lewis, 2002). There has been the perception that a move from 'tax payer pays' to 'user pays' (i.e. from ability to pay to the benefit principle) is likely to be associated with a better economic use of the services (Musgrave, 1959).

Infrastructure is also expected to play a more important role in the catching-up process of developing and transition countries, both of which are supposedly facing underinvestment. (Estache et al., 2002; Hirschhausen, 2002).

b. Airport Infrastructure

Over the past decade, across much of the world, there has been extensive reform of airports. In several cases, airports have been fully or partly privatized, and in other cases, they have been restructured as corporations. Ownership structure has been changed with a view to making airports more commercially oriented. Airport privatization has been and still is, on the agenda of national air transport policies of many countries throughout the world. Privatization may take many different avenues, ranging from a minor divestiture of airport companies by public shareholders (for example in Germany) to a complete sell-off of (former) public airports to private investors (for example in Australia). Privatization can be restricted to the operation of public infrastructure facilities by a private firm (for example in Bolivia), or it can also involve privatizing the airport's infrastructure (for example in the UK). (Wolf, 2008)

c. Concepts of PPP

The term "public-private-partnership" was probably originated in the USA initially referring to joint public private sector funding for educational programmes. The scope of PPP was broadened in the 1950s to include funding for utilities, but came into wider use in the 1960s to refer to public-private joint ventures for urban renewal. In the provision of infrastructure, PPPs can be conceptualized as "project-based" or "contract-based" arrangement, which gained importance in the early nineties (Yescombe, 2007). Ministry of Finance, Government of India defines PPP as: "A partnership between a public sector entity (sponsoring authority) and a private sector (a legal entity in which 51% or more of equity is with the private partner/s) for the creation and/or management of infrastructure for public purpose for a specified period of time (concession period) on commercial terms and in which the private

partner has been procured through a transparent and open procurement system. (Department of Economic Affairs, Ministry of Finance, Government of India, 2007)”

d. Cost Benefit Analysis of Infrastructure Projects

Cost benefit analysis is concerned with the theory and application of criteria for appraising the desirability of investment decisions in the public sector, in terms of national objectives (Chawla, 1987). The fundamental economic problem facing most nations is the optimal allocation of scarce resources in competing projects. This involves making a rational choice between various alternative projects and selecting the best possible one according to the criterion of maximization of net societal benefit. Social Cost Benefit Analysis (SCBA) of projects should aim to establish two national objectives, increasing the total national income (growth objective) and improving the income distribution so as to make it more egalitarian (equity objective). The other objectives of SCBA are ensuring that a selected project subscribes to employment generation, self-reliance, balanced regional development, protection and improvement of environment.

Projects are to be evaluated by the extent to which they contribute to (benefits) or detracts from (costs) from the national objectives. If benefits exceed costs, the project is acceptable. The benefits are defined in terms of their national objectives, whereas the costs are opportunity cost, which is the benefit foregone by not using these resources in the next best investment decision available. The benefits foregone can be re-defined in terms of their impact on national objectives. In an ideal condition, where every information pertaining to competing alternative projects are available, the investments are usually made to the best possible projects.

3. DATA SET

For the purpose of the present study, DIAL has been chosen to represent CBA. DIAL has completed a large part of the capital expenditure earmarked for its first phase of airport expansion. Terminal T3 with annual passenger handling capacity of more than 30 million is already operational.

The present work is based on secondary data collected from Centre for Monitoring Indian Economy (CMIE), Airports Authority of India (AAI), Airports Economic Regulatory Authority

(AERA) and National Council for Applied Economic Research (NCAER). The dataset for analysis is collected for the period 2006 – 2012

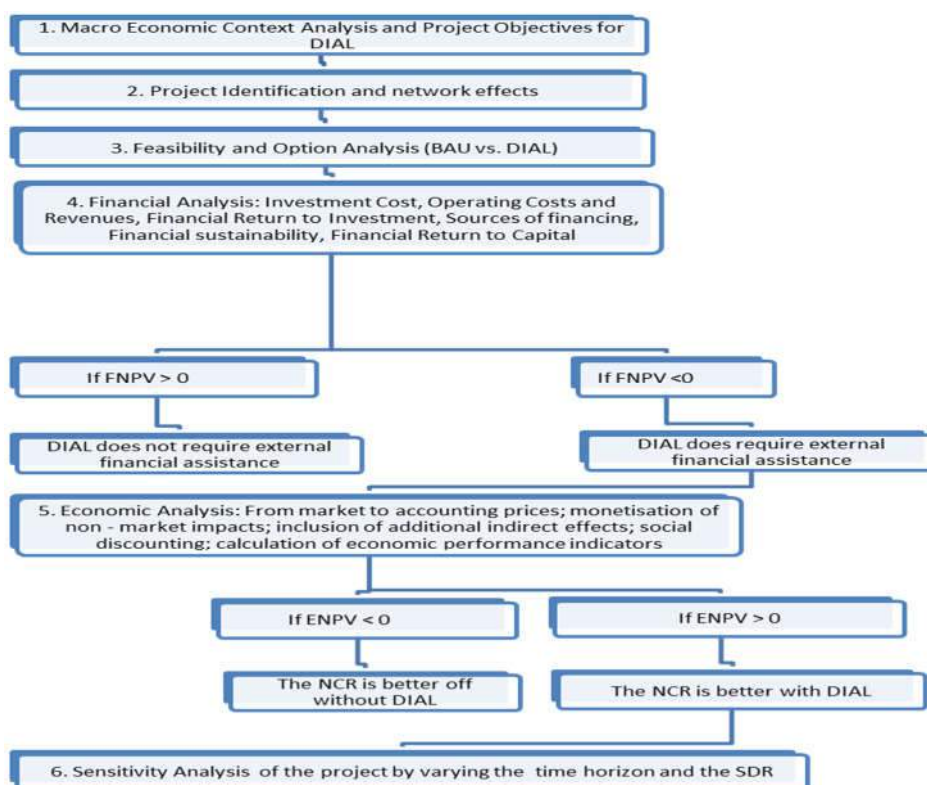
4. COST BENEFIT ANALYSIS OF DELHI AIRPORT PPP PROJECT

The article focuses on building a base of CBA for Delhi International Airport Limited (DIAL) as a case for Brownfield PPP Airport Project in India. It may be worthwhile to mention that according to OECD Manual (Little Mirrlees Approach, 1968), UNIDO Guidelines (1972), World Bank’s Guide to Practical Project Appraisal (1978), European Commission’s Guide to Cost Benefit Analysis (2008) and similar such works on project evaluation discussed in the literature review observed that CBA is primarily meant for ex-ante appraisal of projects. However, it is argued that the use of the approach may be encouraged equally for ex-post evaluation of projects like Delhi Airport, to analyze why a particular project succeeded or failed.

a. Schematic Representation of CBA

A schematic representation of Delhi Airport is shown below

Figure 1: The Six Steps of Cost Benefit Analysis for DIAL
(Source: Adapted from Guide to CBA, EU, 2008; NCR stands for National Capital Region, India)



b. Macro-economic context analysis and the project objectives

The ascent of the 21 Century witnessed unprecedented growth in the quantum of trade in India, which were associated with heightened business activities and passenger movement for domestic as well as International traffic. As the national capital, Delhi naturally became the first port of call for many India inbound passengers. The growth in air travel was further escalated by the arrival of many low cost airlines, which touched base with Delhi either as hub port or as a routing station. These lead to a spurt of aviation growth focused on the national capital region and with the passage of time, aircraft, passenger and cargo movements took an incline that prompted Ministry of Civil Aviation to draft a blue print for expansion of the terminal building, runways, apron space and other aeronautical facilities at the Airport. At the same time, investment in CNS, ATM and related technological backbone for airborne and ground surveillance of the aircrafts were also planned. This called for a planned investment in Delhi Airport and the government embarked upon a journey of public private partnership as a procurement mechanism to augment Delhi's airport infrastructure.

c. Project Objectives

The key objective of Delhi Airport in general and Terminal 3 in particular was to build a world class International airport and provide a gateway for passengers coming to India via Delhi. In particular, there are four specific objectives, associated with Delhi Airport project. They are:

Institutional objectives: reduction of congestion by eliminating capacity constraints through balancing airside and landside demand and capacity.

Air passenger objectives: the infrastructure augmentation creates travel time savings and travel cost savings for passengers which results in efficiency whereas the decongested DIAL air space promotes the LCCs, enabling the common man to become airborne, thus fulfilling the equity objective of the airport.

Social objectives: as an economic asset, DIAL strengthens the social welfare of the national capital region by generating positive spillover effects in the community.

Economic objectives: are associated with ensuring the economic gains of the Government in leasing the airport to a private operator and re-investing the revenue earned from DIAL by building airports in the economically unfavorable locations or modernization of existing AAI managed airports.

d. Identification of the project

The identification of an infrastructure project implies that the functions of the project should be clearly stated and it should be coherent with the objectives of the investment. Delhi International Airport Private Ltd. (DIAL) was formed with the objectives of operating, maintaining, developing, designing, constructing, upgrading, modernizing, financing and managing the Indira Gandhi International Airport, New Delhi. DIAL, the Integrated Brownfield Airport Project is comprised of three separate terminals - 1A (for domestic flights of state owned Air India, MDLR and Go Air), 1B (was used by other domestic airlines, now closed and demolished), the Domestic Arrival Terminal (1C) and the newly-constructed 1D (now used by all remaining domestic airlines). There is also a separate Technical Area for VVIP passengers. Additionally there is a separate terminal for Haj flights. Delhi Airport has two parallel runways and a near-parallel runway.

e. Feasibility and Option Analysis

The basis of any investment appraisal is to make a comparison between “with and without” the project. The core of benefit cost analysis is based upon the “with and without” approach and this in turn is grounded on the concept of opportunity cost. The best possible alternative solution on the basis of technical, regulatory and managerial constraints and demand opportunities, is the “do-something” alternative. This is the option which has been taken for the major brownfield project – DIAL.

f. Financial Analysis

The financial analysis is carried out through subsequent, interlinked accounts, referred to as the Integrated Documentation System (IDS) in the UNIDO Guide to Practical Project Appraisal, which is depicted in the figure in the following page.

In the financial analysis, it has been observed that though the net cash flow is still negative at 2012, but the rate of inflows has grown in leaps from 7% in 2010 – 2011 to 30% in 2011-2012. The greatly increasing returns trades off the negative imbalance in net cash flows. This is a strong indication that the project is financially viable; with the prospect of earning increasing returns on investment as the project matures. This satisfies the first test of the success of a project, i.e., financial sustainability.

The financial performance indicators are:

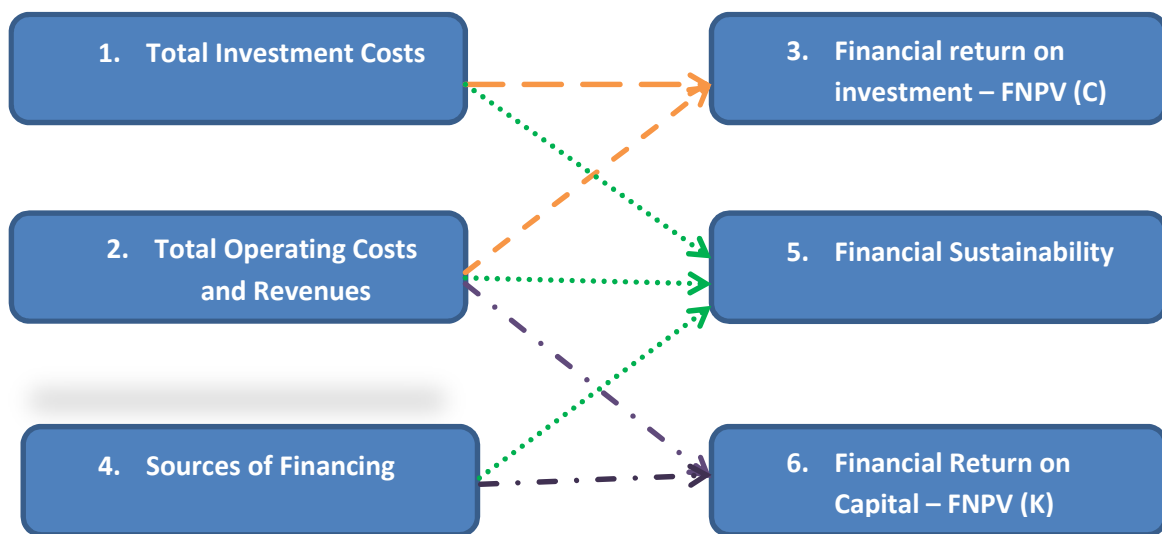
- Financial Net Present Value (investment) FNPV (C): **INR (15016.35) CRORES, OR,**

-2252452500.00 USD

- Financial Net Present value (capital) FNPV (K): **INR 1941.42 CRORES OR**

291213000.00 USD

Figure 2: Structure of Financial Analysis (Source: EC Guide to CBA, 2008)



g. Economic Analysis

In the cost benefit appraisal of DIAL, the financial analysis of the project is followed by economic analysis. The analysis draws its merit from the concepts of consumers' surplus and rents, the distinction between benefits and transfer payments, the concept of shadow pricing, external economies and diseconomies, the choice of investment criteria and the problems of uncertainty are adequately covered in the succeeding sections.

The economic analysis is distinctly different from the financial analysis with respect to benefits accrued as a result of the project. Whereas the latter is merely concerned with the owners or promoters of the project, economic analysis attempts to identify the project's impact on the society at large. The fundamental premise on which the economic analysis is grounded, is based on the use of accounting prices (shadow prices), centered on the social opportunity cost, instead of observed distorted prices. This happens because observed

prices of a project's inputs and outputs may not truly reflect the social opportunity cost (social value) like in case of imperfectly competitive markets. Financial data, though useful for project budgeting and financial control, may not be a good judge of welfare indicators of an economy.

To make a reasonably good Economic Analysis, it is equally important to consider the externalities that are not accounted for in the converted financial inputs and outputs. The sum total of the spillover effects as a result of the Delhi Airport megaproject is considered based on the direct, indirect and induced impact generated by airport construction and operational activities of DIAL. The qualitative aspects of these spillage effects have been attempted to capture under the umbrella of quantitative analysis.

Consumer Surplus

According to Alfred Marshall (1925), the consumer's surplus is the maximum sum of money the consumer would be willing to pay for a given amount of the good, less the amount he actually pays.

The consumers of an airport project are the airlines and the passengers. In these, airlines are the direct consumers in the sense that they interface with the operators on a daily basis in their transactions. The passengers are indirect consumers of airports; they patronize airlines flying in multitude directions and routes. The Consumer's Surplus of the DIAL project may be categorized in the following areas:

- (a) Consumer Surplus (airlines) due to save in travel time, thus opening up new routes apart from existing schedules
- (b) Consumer Surplus arising out of savings in Aircraft Operating Cost (AOC) in fuel expenses as a result of de-congested skies (less "go around" before receiving permission from ATNC to touch down)
- (c) Consumer Surplus (Air Passengers) as a result of more flights, increased frequency of departures between Delhi and other metros and lower airfare stemming from competitive airlines market.
- (d) Consumer Surplus (Air Passengers) as a result of saving in travel time.
- (e) Consumer Surplus (passengers) in time savings as a result of intermodal switching (road/rail to air) in short haul routes like Delhi-Jaipur, Delhi-Chandigarh, Delhi-

Gwalior, etc. Also, for the existing passengers in the same modes and routes, the road/rail corridor is now de-congested, so there is a lowering of the Vehicle Operating Cost (VOC) and savings in travel time too.

- (f) It may be mentioned here that the VOC of the passengers travelling to T3, DIAL may slightly increase due to increased distance travelled to access and egress the new link to T3, however, this cost is offset by the reduction in travel time, as a result of Delhi Metro Railway Corporation and Delhi Metro Airport Express (Reliance Metro Airport Express Line) where the normal 60-80 minutes off peak hours drive has been reduced to 18 minutes for INR 80=00 for a distance of 22 kilometers compared to normal taxi fare of INR 500=00 for the same distance at a much lesser comfort and convenience.

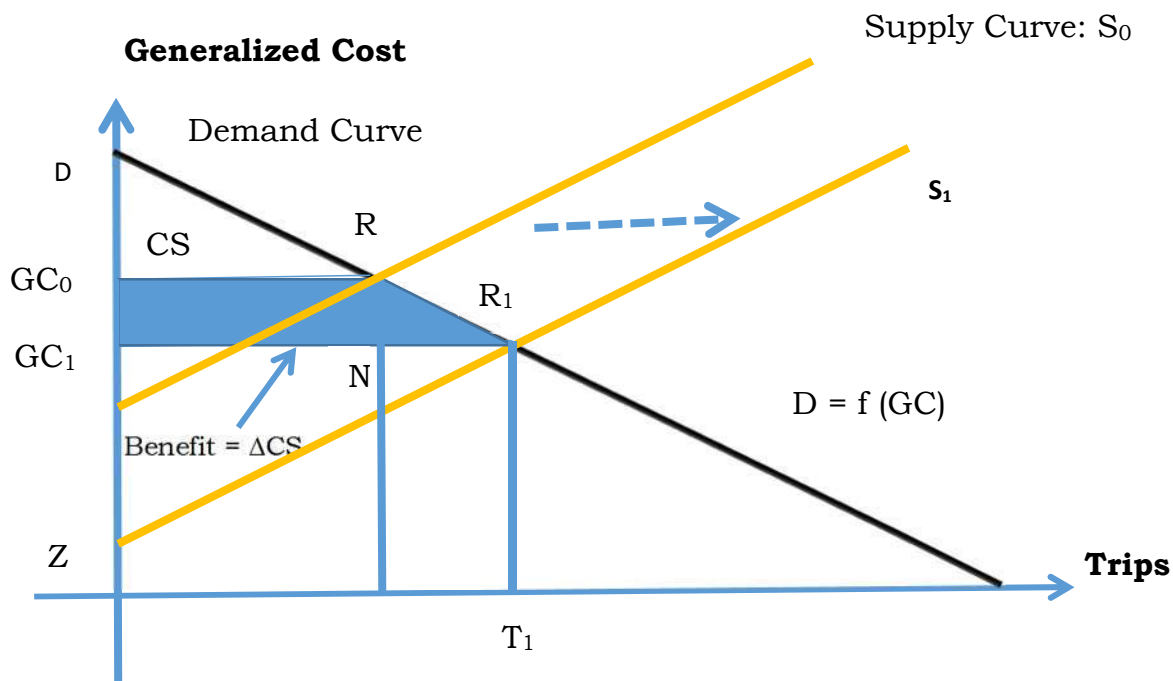
Producer Surplus

New International airlines are now arriving and departing IGI Airport as a result of capacity expansion and modernization of New Delhi Airport. They are also adding new routes connecting India to other places on the global map. This increases the net aeronautical revenue for DIAL and generates producer's surplus on three counts. New airlines or increased routes increase the revenue model for DIAL. Due to expansion of capacity, marked by opening of the new routes and new entrees, there is considerably more passenger traffic, which greatly augments the Passenger Service Fee (PSF) and the User Development Fee (UDF) collected from the passengers. Thirdly, the growth in International (as well as domestic) passengers fuels the retail and miscellaneous sales of passenger facilities at the airport, thus boosting the non-aeronautical revenue stream for the airport developers and operators. This is the aggregate Producer's Surplus generated from the operation of DIAL.

Government Surplus

Government's surplus from this Brownfield infrastructure initiative comes from multiple avenues. Having a share of 44%, as DIAL's revenue arises automatically Government's revenue also gets boost up. With the new terminal T3, additional flights and routes have opened at Delhi, bringing in additional passengers, thus having more tax revenues per passenger as well as from each airliner.

Figure 3: Consumer Surplus as a result of reduced Generalized Cost
(Adapted from Mishan, 1976)



The above figure clearly explains the concept of Consumer Surplus in the specific case of DIAL. As a result of development of Delhi Airport as a Brownfield Project, there occur considerable scale efficiencies, thus lowering of prices from OGC_0 to OGC_1 . The rectangle GC_0RNGC_1 is the resultant savings achieved by the existing airlines and its customers from the development of Delhi Airport, namely T3. Now let us consider the triangle RNR_1 . This part of the savings is brought about by the additional flights touching down and departing T3. These additional flights on new and existing routes and opening up new sectors for air travel further increases the competitiveness of airlines as compared to other modes of transportation like railways or roadways, thus substantially lowering down the price paid by the passengers toward the cost of air passage. This combined effect of cost saving (Consumer Surplus = Area of rectangle GC_0RNGC_1 + Area of triangle RNR_1 = Area of enclosed figure $GC_0RR_1NGC_1$) achieved by the airlines and passengers is expressed in the Generalized Cost Function.

Generalized Cost Function (GCF) is conveyed as the combination of the monetized and non-monetized cost associated with a particular journey. Algebraically, GCF is expressed as:

$$GCF = \alpha T + \beta L \dots (1)$$

Where α = value of time

T = average travel time

β = Vehicle Operating Cost (VOC)

L = travel distance

The triangle DRGC₀ represents the consumer surplus (CS₀, which is beneath the demand curve and above the generalized equilibrium cost) before the commencement of the project. The DR₁GC₁ is the new area (larger than the earlier one) for consumer surplus, brought about by implementation of the airport project. Therefore, the User Benefit = CS₁ – CS₀. We assume that with introduction of additional flights and new sectors and routes because of the new airport project, the supply curve will shift more toward the right (from S₀ to S₁) and hence the triangle GC₁R₁Z becomes the new producer surplus.

h. Results of CBA for DIAL

The Economic Performance Indicators of DIAL is given below.

- Economic Net Present Value (ENPV): INR 121,737.90 Crores (2006 – 2012)
- Economic Net Present Value (ENPV): INR 232800 Crores (2013 – 2017)
- B/C Ratio (Project Evaluation Phase: 2006 – 2012): 3.78
- B/C Ratio (Using discounted cash flow technique; 2013 – 2017): 8.15

The PPP of DIAL with the competition induced efficiency of the GMR led private partnership and the Government's effective monitoring and control has led to a synergy of relationships that ultimately gets reflected in the project evaluation and appraisal with regard to both the financial indicators and economic indicators. The performance indicators point to the fact that the project has been viable, both in the short-term as well as the future horizon of the lease period of 30 years till 2037. This work is a unique endeavor by itself, namely, the construction of finite elemental cost benefit analysis of an airport megaproject in India, which by all counts has been investigated for the first time in the area of airport infrastructure projects in India.

5. CONCLUSION

The article presents a comprehensive analysis of the benefits and costs associated with the construction of Terminal 3 at Delhi Airport project (DIAL). The benefits include not only the financial gains of the stakeholders in the system, but also the economic gains to the National Capital Region (NCR) as a result of the increase in social welfare created by the DIAL T3.

Asian Development Bank (2007) observed that “countries differ in economic structure, capital scarcity, stage of financial development, efficiency of financial intermediation, impediments faced in accessing the international capital market, and social time preference.” These differences result in varying SDRs and BCRs for airport infrastructure projects around the world. It may be worthwhile to examine the choice of social discount rates and the corresponding BCR for airport infrastructure projects across developed and developing economies to affirm the soundness of the results obtained in the CBA for Delhi Airport project.

The choice of the Social Discount Rate has significant impact on the outcome of BCR and Economic Net Present Value (ENPV). Economists across countries have applied a wide range of methodologies to get the SDR for a given infrastructure project. Prior to 1991, Australia used 8% SDR, and in recent times it follows the annually reviewed Social Opportunity Cost (SOC) Approach, which is less than 8%. As against this Canada uses a SDR of 7%, whereas in France it is 4% based on the Social Rate of Time Preference (SRTP) Approach. In the case of Italy it is 5% and Spain 6% based on SRTP Approach. Coming to Norway and UK it is still lower at 3.5% based on rate of government borrowing and the SRTP Approach. Compared to these US Office of Management and Budget follows a SDR of 7%. In the developing economies like Pakistan follows a 12% SDR based on SOC Approach, Philippines 15% based on SOC Approach, China 8% for Short and Medium Term Projects and less than 8% for Long Term Projects. In the present analysis, we have used a SDR of 10.81% using the SRTP Approach. There are significant variations in SDR policies in practice around the world based on the nature and the duration of the project, with developed countries applying lower rates (3–7%) than the developing countries surveyed (8–15%) and therefore our estimated value of 10.81% using SRTP Approach for a large scale and long term strategic infrastructure project like Delhi Airport that acts as major gateway, appears reasonable for a rapidly emerging economy like India.

The SDR affects the outcome of the project like changes in Benefit Cost Ratios (BCR) as economic performance indicators of Delhi Airport project. A variation in the discount rate can considerably change the BCR as observed in the sensitivity analysis for Delhi Airport project's economic performance. An examination of the project BCRs of the airport infrastructure sectors across countries reveals an interesting observation. The East West Gateway Council of Government estimated a BCR of 10.90 for St. Louis Regional Airport, USA, which is primarily used for air freights. Florida Department of Transportation (2009), estimated a BCR of 7.3 for South West Florida International Airport using NPV for a 20-year design life and a 7% discount rate. Graham (2013) of Imperial College, London mentions a BCR of about 5.6 for airports. A CBA was done for Rock County Airport in Southern Wisconsin by Wisconsin DOT to receive federal aviation funds from FAA for the airport expansion project. Technically it was a project appraisal which considered case of a runway expansion. The estimation of benefits and costs was undertaken using the Airport Benefit-Cost (ABC) software, developed for Wisconsin DOT by Economic Development Research Group with Cambridge Systematics; using the state of Wisconsin's officially accepted 7% discount rate. The sensitivity analysis of BCR varied between 3.23 – 5.27 when compared and contrasted against the set of alternatives for Rock County Airport. PricewaterhouseCoopers (PwC) estimated the project BCR for Sunshine Coast Airport (SCA), Australia to vary in the range of 3.52 – 6.24. Management Research Centre University of Waikato Management School (2008) obtained a BCR in the range of 2.15 – 3.85 for Waikato Regional Airport. The underlying observation for these variances reveal that for air freight focused airports, the BCR often assumes a double digit value and for passenger airports the BCR lies in the range of 2 – 5.6, which is specific to the macroeconomic context of the country, with due weightage to the nature of the project and its duration. These observations validate our BCR estimation of 3.78 for Delhi Airport and confirm the soundness of the estimate.

The financial and economic benefits have therefore been well justified in the results and highlights the worth of PPP in airport infrastructure projects in India.

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Expedia.co.in; Ezeego1.co.in; Ixigo.com; TravelMasti.com; Orbitz.com

A HIGH-FIDELITY ARTIFICIAL AIRPORT ENVIRONMENT FOR SESAR APOC VALIDATION EXPERIMENTS

Florian Piekert, Nils Carstengerdes, Sebastian Schier, Reiner Suikat¹ and Alan Marsden²

ABSTRACT

Europe's SESAR Program develops a wide range of solutions to increase the performance of the Air Traffic System. At airport level, the Airport Operations Center (APOC) is expected to provide the most benefit in adverse weather conditions, being the ultimate communication platform to pursue the Total Airport Management (TAM) Collaborative Decision Making Process. It will increase mutual and common situation awareness and allows the joint definition and implementation of the operational strategy.

The assessment of APOC benefits in a live airport environment is rather limited and requires implementation and "right" weather and traffic situations. This work argues for validation trials in high fidelity artificial airport environments as a more reliable and less costly alternative which allows comparison between operations before and after implementation of new solutions. Based on requirements provided by SESAR concept documentation and from live operations this work presents an approach for such a high fidelity artificial environment.

KEYWORDS

TAM; APOC; Validation; Human-in-the-Loop; Simulation Environment; SESAR

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1. INTRODUCTION

The SESAR (Single European Sky ATM Research) program is one of the most ambitious research and development projects ever launched by the European Community. The program is the technological and operational dimension of the Single European Sky (SES) initiative to meet future capacity and safety needs (European Commission, 2004, 2013; European Parliament & European Council, 2004), in compatibility to the US initiative NextGen (Brooker, 2008; Federal Aviation Authority & SESAR Joint Undertaking, 2014) and Japan's CARATS (Study Group for the Future Air Traffic Systems, 2010).

To coordinate and concentrate all relevant research and development efforts in the Community, the SESAR Joint Undertaking was founded by the European Commission and EUROCONTROL (European Council, 2007, 2008). Corresponding to the size and scale of the SESAR Program, a number of priority business needs (cf. SESAR Joint Undertaking, 2013, page 2) encompassing all of the ATM partners have been identified, referred to as 'SESAR Solutions'. These solutions are structured in a way as to ensure that their deployment will lead to benefits for all of the stakeholders across the ATM domain.

The validation of the different elements comprising each solution is structured around the so-called 'SESAR Release' process. Each Release comprises a number of validation exercises designed to prove the maturity of the individual building blocks of the overall SESAR concept and, as a result, their readiness for deployment.

Within the 'Airport Integration and Throughput' priority business area, a major work thread (Operational Focus Area – OFA 05.01.01) is focusing on the issue of Airport Operations Management (AOM) and among its research scope the development and validation of an Airport Operations Plan (AOP) and Airport Operations Center (APOC) for managing airport operations in nominal, adverse and/or exceptional operating conditions is addressed.

The SESAR AOM Concept (Bogers et al., 2015a, 2015b) builds upon the European Airport Collaborative Decision Making (A-CDM) concept (EUROCONTROL, 2013a). The concept will be scalable in order to permit its implementation across the broadest possible spectrum of Airport environments present in Europe and it is articulated around four services (Marsden, 2014). They are the *Steer Airport Performance*, *Monitor Airport Performance*, *Manage Airport Performance* and the *Perform Post-Operations Analysis* service.

The validation of these four services associated to the Airport Operations Management concept is being performed by the SESAR partners with a focus on so-called maturity levels V1 through to V3, following the standardized European Operational Concept Validation Methodology (E-OCVM; EUROCONTROL, 2010). The work to date has comprised the iterative

elaboration of the SESAR AOM concept by the definition of operational requirements captured in the form of an Operational Services and Environment Description (OSED; Bogers et al., 2015a, 2015b) and integrating specific operational processes such as the management of demand and capacity imbalances. This realization was subjected to V1 and V2 validation activities and the results have been used to further refine the OSED.

What still is missing is a benefit assessment of the concept and the associated prototypes within a dynamic and realistic environment.

2. LITERATURE REVIEW

Validation is employed in a wide range of disciplines, e.g. in statistics, medical products, car manufacturing industry and in air traffic management research (e.g. Carstengerdes, Jipp, Piekert, Reinholz, & Suikat, 2012). All validation endeavours have the common goal to provide a fit for purpose identification of differing complexity for the proposed aspect under consideration. In SESAR it is important to use validation as a means of quantifying the benefits or demonstration that the anticipated benefits have been achieved by the concept and prototypical implementation.

E-OCVM foresees eight phases, starting from V0 to V7. Whereas phase V0 and V1 of the E-OCVM Concept Lifecycle Model define the air traffic management needs, the scope of the concept under test and the possible operational and technical solutions, phase V2 addresses feasibility, acceptance and operability issues. The major advantage of the E-OCVM methodology lies in the opportunity of assessments and quick reactions to potential show-stoppers at early concept stages. With each phase the validation scope and the realism of the validation activities are evolving. The more mature a concept is, the more ecologically valid (Brewer, 2000) the validation activity has to become regarding the operational context.

The term "lifecycle" indicates that concept development and validation are tightly coupled in view of the fact that validation activities are supporting the refinement of the concept which – in turn – will be validated again until the transition criteria to the next validation phase are achieved. In the next phase, this process is starting again.

Coming from the V2 questions dealing with feasibility aspects, V3 is concerned with the pre-industrial development and integration. Validation activities in this phase are therefore related to the assessment of operational benefits of the concept under test. The concept and supporting enablers like prototypes, roles, procedures and responsibilities, and associated

human performance aspects are evaluated together in order to clearly identify costs and benefits associated with the proposed solution to the identified ATM need.

Finally, concepts should be stable after this phase and ready for a transition into an operational environment (V4: industrialization), followed by deployment (V5), operations (V6), and decommissioning (V7).

It should be clear from this description that every phase (V1 to V3) has its own set of appropriate validation techniques, tools and methods, starting with literature studies, model- and data based approaches, gaming or fast-time simulations and ending with real-time simulations, shadow-mode and even live trials.

The most straight-forward approach to assess the benefit of new procedures and technologies is the comparison of situations, where the application or implementation of these innovations has not yet occurred, with situations where the new procedures are applied or the technologies have been operationally implemented. Depending on the individual enhancement each procedure or technology is expected to provide, the induced effect may vary greatly and may even vary from situation to situation.

Regular operations, without external disturbances, appear to be well manageable and most probably can still benefit from innovations. But most of the potential of some innovative solutions in airport management was designed to manifest in situations that forces limitations onto the well-established operational processes. A major proportion of these bottleneck situations are caused by weather phenomena (EUROCONTROL, 2013b; Lau, Forster, Tafferner, Dzikus, & Gollnick, 2011; United States Department of Transportation / Bureau of Transportation Statistics, 2015), affecting various operating areas. Generally assumed, the intensity of the bottleneck situation is dependent on the severity of the weather phenomenon.

V3 validation can be supported by a wide range of techniques, with live trials being considered the culmination. The above indicated ideal solution environment apparently is an airport in live operations where, over an extended period of time, qualifying metrics have been measured prior and after APOC implementation and adjustment of procedures was completed. But considering the intended target situation, the crux is the availability of these situations when required. It appears unreasonable to start the implementation of innovations into a live environment and then wait for these situations to occur only to conduct benefit assessments as a decision support whether to implement these systems or not. Additionally, in cases where the implementation costs are high or have significant risks associated to them, the implementation in the live environment may be pursued only as a second step. In

those cases, applicable to the innovations addressed in this work, the first step is the benefit assessment in a live-like, but artificial environment that allows controlling of all parameters.

Consequently, the environment that qualifies for a V3 APOC validation has to offer a dynamic representation of the world typically encountered at an airport and the possibility of hosting the innovative prototype systems supporting the concept and operators.

These aspects can be expressed as requirements. The validation environment that consists of the artificial airport environment, including the baseline support systems, and the novel support systems that support the new AOM concept elements, need to cope with this set of requirements. Concerning the airport environment, the requirements in most cases are a reflection of the live operational environment transcribed into specific IT terms. The AOM concept covers requirements concerning its new conceptual functions and procedures. It does not directly provide requirements for validation environments, as the concept itself was created for a live operational environment. A thorough analysis of the concept's requirements has to be performed and the appropriate requirements have to be transferred into the individual exercises' validation plans (e.g. Carstengerdes et al., 2015). For example, such requirements can be grouped into requirements concerning the validation environment, operational procedures and functional aspects for the support systems. Examples are provided below.

Type	Example
Environment	"It is assumed that the airport simulated in the validation exercises is at least a primary node, i.e. a medium sized airport with a limited hub function and intercontinental P2P connections (e.g. Lyon Saint-Exupéry, Nice, Budapest, Warsaw, Athens etc.)" (Carstengerdes et al., 2015, p. 34).
Procedure	"It is assumed that the airport simulated in the reference scenario has implemented the A-CDM Information Sharing element of the A-CDM concept. In particular, it is assumed that this airport is equipped with an A-CDM Information Sharing Platform and similarly that the A-CDM concept elements of variable taxi-time and milestone monitoring are all implemented" (Carstengerdes et al., 2015, p. 31).
Procedure	"The APOC supervisor or responsible stakeholder (depending on the severity level A, B, C, D) shall update the overall impact message in the system (AOP)" (Bogers et al., 2015a, p. 235).
Functional	"Each warning / alert from airport performance monitoring shall lead to the instantiation of an overall impact message. This OIM will be indicated to the responsible stakeholder determined in advance" (Bogers et al., 2015a, p. 234).

Table 1: Examples for different types of requirements

Theoretically, every air transportation network and airport process and procedure can be modelled and then simulated with highest level of detail and degree of realism. Highly sophisticated models may, however, not always be required, or the real world data is not available in sufficient quality or quantity. A taxonomy of simulations and application of various modelling types and detail levels is provided in Haßa (2016) and further examples

are given in Odoni et al. (1997) and De Prins, Ledesma, Mulder, and van Paassen (2008). It is therefore evident, that an appropriate scaling of the process simulation that adheres to the requirements of V3 assessments has to occur.

Additionally, as explained above, exercises require specific weather information to unlock the potential of these innovations. This information has to be provided not only to the human operators (who will act as stakeholder representatives), but as well to the driving simulators and the APOC support systems. All will use this weather information in their area of work. The simulators will have to dynamically provide model driven reactions in the process chains and the APOC support systems will assist the operators in assessing the severity of the impact. The human operators who additionally judge by their experience what is presented to them will identify the implied consequences on airport operations. This approach will allow control of the most important experimental parameters. These focus around the timely distribution of weather or other disruptive events which are affecting the airport processes, and the air traffic demand and its density distribution (e.g. arrival and departure ratios).

In the remaining sections the above argumentation will be exemplified by an approach for conducting a V3 real-time Human-in-the-Loop (HitL) validation exercise (identified as SESAR EXE-06.03.01-VP-757). In this exercise it was necessary to not only identify the already documented requirements, but additionally to construct the necessary simulation requirements.

3. THEORETICAL CONTRIBUTION

The requirements build a framework of needs that has to be fulfilled by four pillars of this exercise. These are a) the industrial prototypes that provide the new functionality and procedure support, b) the physical environment where operators will be working jointly, c) the simulators that simulate reality and d) user interfaces as the means of interaction between operators and the support systems. These four pillars will be explained in more detail in the following sub sections.

4. THE INDUSTRIAL PROTOTYPES

INDRA is the industrial partner in this validation exercise and has developed the Systems Under Test (SUT) prototypes. Due to INDRA's business needs and intended target customers, their prototypes are designed to connect to operational airport systems or to

systems of the local air navigation service provider (ANSP). Therefore, the simulation environment has to provide similar interfaces and data of comparable quality. The SESAR Airport Operations Management concept (OFA 05.01.01 OSED; Bogers et al., 2015a, 2015b) envisages that with the deployment of APOC processes at an airport, A-CDM processes become established automatically, as these present the foundation of this collaborative airport management approach. Further, when the APOC concept and its support tools are deployed, it is assumed that airport data sharing will be conducted via System Wide Information Management (SWIM; Petrovsky et al., 2012).

The AINS prototype (developed within SESAR Work Package (WP) 12.06.09 – “Integration of CDM into SWIM”) is a SWIM gateway system, feeding the Airport Operations Plan (AOP) with local A-CDM information and providing information back into the SWIM. The ASDI prototype (SESAR WP 12.06.07 – “AMAN, SMAN and DMAN fully integrated into CDM processes”) presents the bridge to the local ANSP, thus providing ANSP related planning information to the AOP. The AOP prototype (SESAR WP 12.06.02) is implementing the Airport Operations Plan and adequate mechanisms and procedures to manage all aspects relevant for the concept. The majority of airport related data will be directly provided by the Airport Operational Data Base (AODB), which is a part of the A-CDM simulator, to the AOP, which acts as the data core of the APOC processes. The interfaces between the simulation environment and the prototypes are implemented following state-of-the-art techniques (e.g. web service mechanisms). Together with the APAMS prototype (SESAR WP 12.07.03 – “Airport Performance Assessment Monitoring System”), the AOP implements the *Steer Airport Performance*, *Monitor Airport Performance* and *Manage Airport Performance services* as outlined by the conceptual approach (Bogers et al., 2015a, 2015b).

5. THE AIRPORT CONTROL CENTER SIMULATOR

The ACCES (Spies et al., 2008; Suikat, Kaltenhäuser, Hampe, Timmermann, & Weber, 2010) is an infrastructure component of DLR’s Air Traffic Validation Center (Kaltenhäuser, 2015). It consists of a server room housing the computers running the simulation as well as the industrial prototypes and a large multi-purpose room that can accommodate operators for human-in-the-loop exercises, the validation supervisor, the simulation control team and exercise observer teams. An additional room to host operational level operator working positions is also provided adjacent. The main operator room provides flexibility for different validation setups, operator working positions can be freely rearranged on ground level as exercises require, e.g. to support research on the optimal seating arrangement to optimize

stakeholder communication. The simulation control team and the validation supervisor are located on an elevated platform hosting the simulation control system interfaces, opposite to an optional large video projection screen. The current arrangement of operator working and control team positions is depicted in the photograph below (figure 1), which includes a schematic 2D diagram of the overall arrangement. Currently, there are six operator working positions installed, in a hexagon arrangement. For positioning two operators in front of a single working position another chair can be added, the tables and available spacing provide enough room. Observers to exercises can be positioned either next to or behind the working positions, or on the simulation control team's platform.



Figure 1: ACCES Control Room Layout (long shot and 2D layout, operator positions in front)

6. THE SIMULATION ENVIRONMENT

The technical simulation system is based on a combination of simulators described by Spies et al. (2008), refined in Suikat and Deutschmann (2008) and further elaborated in Suikat (2012). The approach taken for this V3 assessment does not require all of those combined specialized simulators with their full functionality.

The central components to be used is an Airport Collaborative Decision Making (A-CDM) simulation (Schier, Timmermann, & Pett, 2016). This simulation models a flights' progress over time and sets the necessary event milestones required for the airport management. As for some phases of the flights a simple process model is not detailed enough, additional

simulation models were added to conduct a joint simulation and cover all aspects with sufficient detail level.

TAMODES (Kügler & Reichmuth, 2012), which features a complete turnaround process simulation, was redeveloped and its core turnaround simulator engine was integrated into the A-CDM simulation engine. The most important passenger process milestones (A-CDM milestone #11 "Boarding starts" and A-CDM Milestone #12 "Aircraft Ready") are thus provided by functionality within the A-CDM simulator, while a full passenger/landside simulation is not required.

The air traffic simulator NARSIM (developed by NLR; NARSIM, 2013) simulates aircraft movements in final approach, on runways, taxiways and the apron. Based on the total energy model and the base of aircraft data (Nuic, 2014) these phases are calculated in high accuracy and can therefore give a more realistic impression than the calculations of the A-CDM milestone simulation.

Support vehicles that are required for the turnaround processes are not addressed in detail in this exercise. The A-CDM simulator will use appropriate turnaround times matching to the simulated scenario airport.

The validation does not require a direct connection to the Network Manager (exchange of information with the Network Operations Plan, NOP); nevertheless there exists the need to obtain information from the NOP (e.g. A-CDM milestone #3 "Take off from outstation" or A-CDM milestone #4 "Local radar update", which can be understood as a Flight Update Message (FUM) and Slot Assignments). All of these will be created by the simulator, while Departure Planning Information (DPI) and Slot Requests will be submitted by the tools. DPIS are not relevant for the assessment. Further, it is assumed that the Network Manager will actively support solution implementation in bottleneck situations. This implies that the simulation will accept the requested slots as they are. Although this is a deviation from reality to some degree, the overall assessment does not suffer from this as this approach will be the same for both, the so-called reference and solution runs (which are described below in section 8).

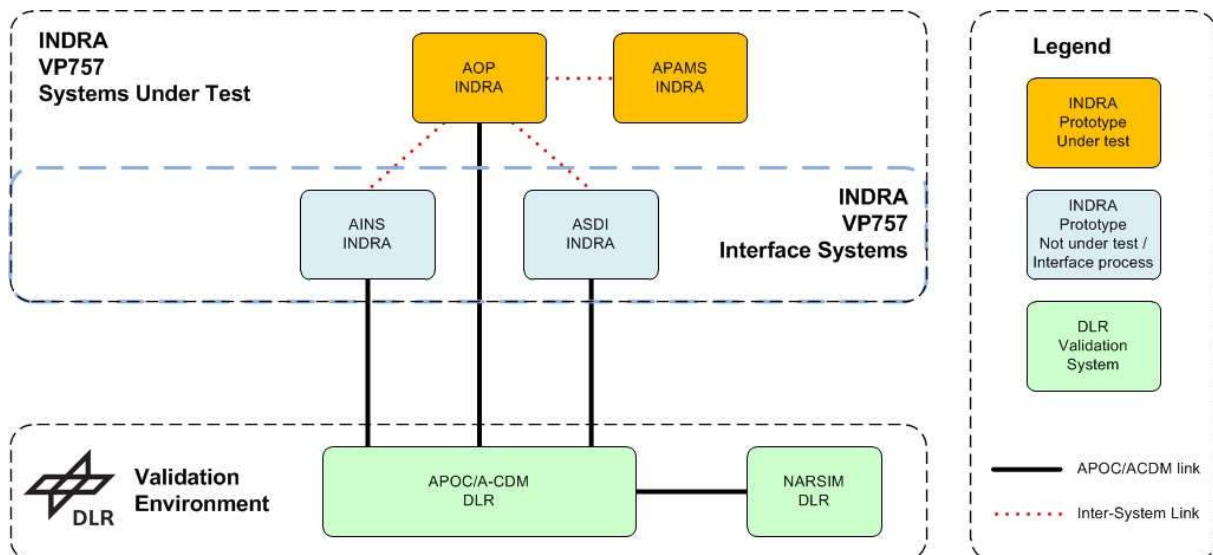


Figure 2: EXE-6.3.1-VP-757 Solution Situation Technical Setup of Prototypes and Simulators

Figure 2 depicts the technical system setup of EXE-6.3.1-VP-757. It shows various systems, DLR's validation environment featuring the combined simulators, INDRA's prototypes that represent the Systems Under Test and auxiliary support systems acting as interface systems. The solid lines depict the uni- and bi-directional connections between the simulators and INDRA's industrial prototypes used in the validation exercises, implementing the APOC/A-CDM link between the systems. The dotted lines represent the inter-prototype connection of INDRA's systems.

7. OPERATOR USER INTERFACES

AOP, APAMS and the A-CDM simulation provide Human Machine Interfaces (HMI) to the exercise operators. While the industrial solutions offer sophisticated functionality, the A-CDM HMI supplies the basic functionality that is required for these V3 exercises (Schier, Pett, Mohr, & Yeo, 2016). Assuming that the implementation of operational decisions is conducted on the operational level (e.g. via the airline Flight Operations or Hub Control Centre), the A-CDM HMI is used for these implementations (e.g. setting of the runway capacities by the local ANSP, adjustment of a TOBT (Target Off-Block Time), cancellation of a flight or a slot request) and for the actions of the airport actors.

The industrial HMIs are used to interact with the three above mentioned APOC services. When the stakeholders involved in the exercise agree on process planning aspects, these are stored in the AOP. Due to the bi-directional link between the AOP and the simulation environment, these new parameters are presented to the simulation. These then are used by

the simulation models to derive the implementation result, dynamically altering the future development of the traffic, metrics and the course of the exercise.

The simulation additionally provides a set of control HMIs to the technical supervisor and simulation control staff.

8. THE APPROACH TO APOC VALIDATION

The aforementioned APOC solution will be evaluated using the human-in-the-loop real time simulation technique in the above mentioned environment. The purpose of the proposed validation activity is to demonstrate that the developed SESAR APOC concept (including prototypes supporting the operators in performance monitoring, assessment and management as described above) leads to improved situation awareness and – owing to the collaborative approach to decision making – to a quicker recovery to normal operations and an improved overall airport performance (relating to different key performance indicators like departure and arrival delay, punctuality, usage of available apron and runway capacity). Especially, this should hold true for situations with adverse conditions where a highly collaborative environment will facilitate an improved decision making. Furthermore, the validation will assess if the APOC concept and environment provides an enriched data availability to generate post-operation analysis reports which can be used for the generation of solution support for the APOC operators in future adverse conditions.

Therefore, the key elements of the APOC concept for validation are:

- Situational Awareness of current and predicted airport performance through the AOP data content and alert messages,
- Overall Airport Performance Monitoring and Alerting,
- Deviation Impact Assessment,
- Collaborative Decision Making for performance optimization, and
- Enriched data availability for post-operations analyses.

9. APOC AVAILABILITY

The impact of the presence of an APOC (so-called “solution scenario”) will be validated against airport operations without APOC and support tools (so-called “reference scenario”). As explained above, A-CDM is considered as the current standard and state-of-the-art for airport management, and therefore considered as reference. Accordingly, the management

functionalities provided in the two scenarios differ from each other. In the reference scenario the operators will only be provided with their individual "local systems" which deliver input to and allow interaction with the A-CDM platform and consequently the AODB. The APOC and its associated support tools are not provided, consequently not allowing tool supported performance monitoring and no provision of performance alerts to all stakeholders at the same time and no facilitation of the collaborative decision making process.

Three different exercises with different impact severity levels and key drivers like the possibility to anticipate the constrained situation or the location of the disruption (airside or landside) have been chosen based on actual operational constraints, which are typical of airport operations. These scenarios have been successfully used in former OFA 05.01.01 validation trials (Goni Modrego et al., 2015; Marsden et al., 2014) and will be adapted regarding severity and possible course of action to fit to the validation questions at hand. As a result, six runs (three different exercises, each executed twice, once as reference and once as solution scenario) will be performed with operational experts.

To be more specific regarding the content of the three exercises, in validation exercise #1 an airport faces a constrained situation whereby an external disruption coupled with the execution of planned works on the apron will lead to significant ground congestion. Validation exercise #2 deals with a situation where the airport is faced with a heavy thunderstorm whilst a light thunderstorm was forecasted. This adverse condition affects the operation of all airport stakeholders. In validation exercise #3, a disruption in passenger processes will take place due to an incident at the security control. These three situations have to be resolved with (solution) and without (reference) the APOC and its industrial support tools.

Using this approach, the benefit of the APOC concept will be shown in different performance degraded situations with different impact on each stakeholder and with different management options to mitigate the situation. This and in conjunction with the realistic APOC simulation environment will result in a more accurate assessment of the overall benefit of the APOC as a platform to pursue and enable the Total Airport Management (TAM) CDM (Günther et al., 2006; Spies et al., 2008).

10. THE REFERENCE SETUP

Figure 2 and figure 3 depict the logical setup of stakeholders and operating work places for the reference and solution scenario approaches. In the reference setup, as figure 2 shows,

there are three airlines (Airspace User - AU) present, addressing different AU business models/mode of operations; hub and low cost operator and the third represents all others including cargo operations. Two representatives from the operation level share a work place for each AU, representing e.g. the functions of a "Strategic and CDM Manager" and "Slot Manager" (the function denominators may vary from AU to AU in reality). Together they decide and implement operational decisions on aircraft movements and problem solution strategies. These two are representatives of a typically larger operational group usually involved in the AUs' processes. The local ANSP has a single representative, combining the Airport Tower Supervisor role and incorporating the Clearance Delivery Controller operational level role in these exercises. No direct communication to controllers is required as this is simulated by the simulation environment and no additional back office support is required for the exercise. The Airport Operator again has two representatives; the Airport Operator and the Stand and Gate planning role. They are locally grouped with their two working positions. All stakeholder companies have access to the local A-CDM system (HMI) only, an HMI that they share between their representatives. The airport Stand Planner additionally has access to a Stand and Gate Management system (powered by the simulation environment). The two stakeholder representatives can directly communicate face to face. The inter-stakeholder communication is limited to the use of a messaging system or phone only. No direct face to face communication is foreseen, to reflect the reality at most airports nowadays (with the exception of airports already using a centralized multi-stakeholder facility).

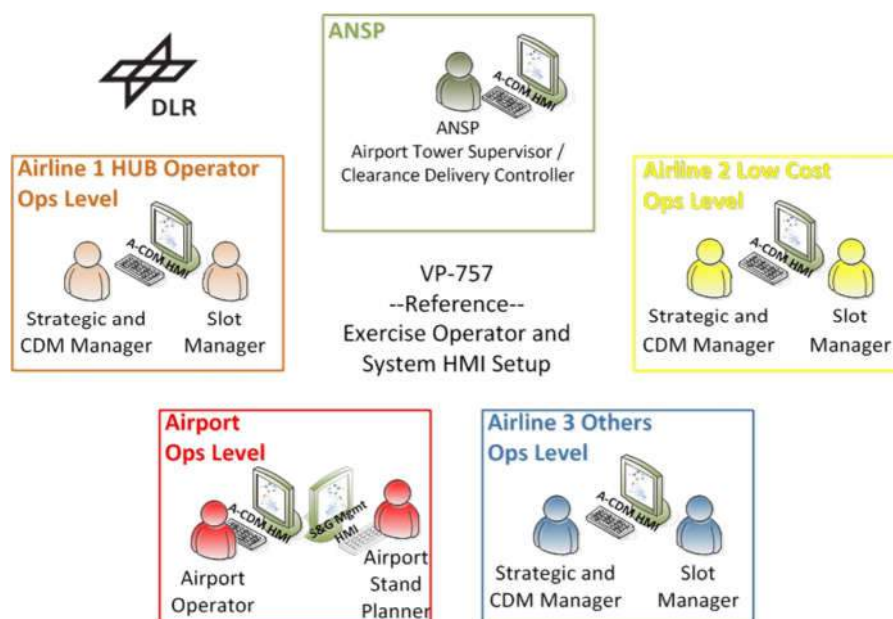


Figure 3: EXE-6.3.1-VP-757 Reference Situation Operators and HMIs

Due to the non-necessity of a direct link to the Network Manager (European Commission, 2004, 2005, 2010, 2011a, 2011b)/NOP, there is no Network Manager Representative (in reality this stakeholder may be represented by the Flow Manager Role at an airport) and no corresponding working position in either scenario setup. Since the three airspace user companies represent 100% of all traffic and aircraft handling decisions, the presence of a ground handler representative is omitted similarly.

11. THE SOLUTION SETUP

In contrast to the reference setup is the solution setup, which is depicted in figure 3. All management level representatives will be situated in a central APOC, the operational level representatives will be located outside the APOC, providing a degree of realism since the stakeholders' operation centres are not part of the APOC. The three Airspace Users each have a single management level representative and an associated working position in the APOC and another operational level representative in a back office environment (representing e.g. the Flight Dispatch or Hub Control Centre). Again, the operational level representatives will be responsible for the operational implementation of decisions for the airline. The local Air Navigation Service Provider (ANSP) will have the same representative as in the reference setup in the APOC, maybe not replacing the Tower Supervisor, but with an entirely new role defined. Again, there is no back office support for the local ANSP in this exercise setup. The Airport Operator will act as the APOC supervisor, being authorized to decide in decision making stalls and representing the goals of the airport. The supervisor is supported by an operational level representative outside the APOC, including the role of the Stand Planner as before.

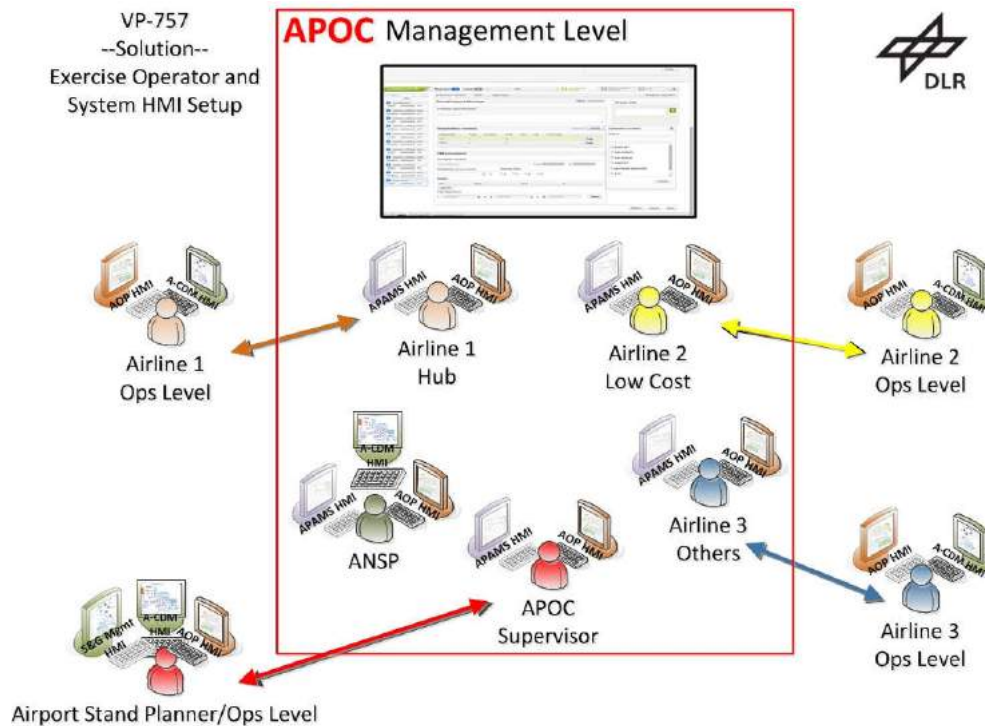


Figure 4: EXE-6.3.1-VP-757 Solution Situation Operators and HMIs

The APOC will provide a centralized video wall installation, where the APOC supervisor's APAMS HMI will be displayed. This video wall is expected to increase the situational awareness of the stakeholders' representatives and supports the efficiency of the decision making processes. The representatives in the APOC have access to HMIs of APAMS and the AOP, the local ANSP representative additionally has access to the local A-CDM HMI (since he still needs to implement his operational decisions for ease of simulation setup). The back office representatives have access to the AOP and A-CDM HMIs. The airlines' views are filtered though, to allow access to their own flights only while the airport back office sees the full picture for all flights. Additionally, the Stand and Gate Management System access lies with the airport back office representative. All operational level decisions and implementations are conducted by these representatives outside the APOC, while the management decisions are taken by the agents in the APOC. The agents can communicate with their back offices via phone or the messaging system. Inside the APOC all representatives have a direct face to face inter-stakeholder communication and may use the phone and the messaging system.

By implementing this setup it now is possible to conduct a V3 APOC assessment for the first time, providing a suitable dynamic environment for systems and operators, and fulfilling external and ecological validity criteria.

12.SUMMARY AND CONCLUSIONS

The next steps that will be taken on the way to the conclusion of this important validation goal include a variety of technical and support actions.

The industrial prototypes need to be integrated into the airport simulation environment after their development has concluded and the simulators have been enhanced to satisfy the interface requirements. Following this technical milestone, a thorough verification phase will be conducted, ensuring the reliability, consistency and interoperability of all technical components. This includes the execution of test runs with operators (not necessarily operational experts) to assess the correct operation of the system HMIs. These experiments will additionally be used to adjust prototype parameters where necessary and help to scope the specific scenario configuration that will then be used for the validation exercise runs.

Parallel to the technical actions, the preparation of the scenarios will be started, including the adaptation and definition of use cases based on the OSED that define the work flow of the operators in the APOC. The scenarios include definitions of events and the time of their occurrence, forming the storybook that will be used by the simulation control team to trigger those events as these would happen unforeseen on a real day of operations.

The test runs will be planned carefully, together with the real exercise schedule. Additional training test sessions with the operational expert personal will be conducted as part of the verification phase. This phase will be completed with the system acceptance test. The solution bundle referred to in this work is a part of the SESAR Release 5 cycle. Therefore, once the verification and preparatory actions have concluded, the "ready for validation" will be awarded through the SESAR System Engineering #2 (SE#2) Review.

Once the SE#2 is passed, the previously invited subject matter experts conduct the previously scheduled set of validation exercises, which are expected to be completed within a week's duration, running multiple exercises per day. During the execution of the exercises the relevant data from the systems, the simulators and the human interactions are captured and adequately processed. This data then will be analysed by the validation team responsible for the validation exercise. Under the consultation of the industrial and the operational SESAR partners, the data will be evaluated and assessed against the pre-defined validation

goals and corresponding success criteria, using the pre-defined metrics. A comprehensive validation report will finally conclude the validation.

With the successful completion of this validation activity, the SESAR APOC validation activities will be completed. The identified lessons learned and potential modifications derived from the assessment then will be used to provide input to a new edition 4 of the OSED and additionally may be included in the work program for SESAR 2020 (SESAR Joint Undertaking, 2014) which is expected to be launched at the end of 2016. By implementing the above mentioned requirements, the realistic and dynamic high-fidelity validation environment as described in this work offers the capabilities that are needed for this final SESAR APOC validation assessment. Furthermore, it closes the gap between pure laboratory experiments and live trials by offering flexibility concerning the required degree of fidelity and sophistication in order to deliver meaningful operational benefit assessments. The studies can be conducted in a scenario based approach using experimental designs, allowing control of confounding variables. The environment is ready to be used or can easily be adapted for future SESAR 2020 and Performance Based Airport Management (PBAM) APOC innovative research and validation assessments.

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SUPPORTING AIR TRANSPORT POLICIES USING BIG DATA ANALYTICS: A DESCRIPTIVE APPROACH BASED EMERGING TREND ANALYSIS

Hyun-jung Kim^a, Nam-ok Jo^b, Kyung-shik Shirf, Jin-seo Park^{d}, Ga-ram Sim^e and Je-chul Kim^f*

ABSTRACT

Qualitative research methods based on literature review or expert judgement have been used to find core issues, analyze emerging trends and discover promising areas for the future. Deriving results from large amounts of information under this approach is both costly and time consuming. Besides, there is a risk that the results may be influenced by the subjective opinion of experts. In order to make up for such weaknesses, the analysis paradigm for choosing future emerging trend is undergoing a shift toward implementing qualitative research methods along with quantitative research methods like text mining in a mutually complementary manner. The change used to implement recent studies is being witnessed in various areas such as the steel industry, the information and communications technology industry, the construction industry in architectural engineering and so on. This study focused on retrieving aviation-related core issues and the promising areas for the future from research papers pertaining to overall aviation areas through text mining method, which is one of the big data analysis techniques. This study has limitations in that its analysis for retrieving the aviation-related core issues and promising fields was restricted to research papers containing the keyword "aviation." However, it has significance in that it prepared a quantitative analysis model for continuously monitoring the derived core issues and emerging trends regarding the promising areas for the future in the aviation industry through the application of a big data-based descriptive approach.

KEYWORDS

Aviation; Big Data Analytics; Text Mining; Topic Analysis; Trend Analysis; Descriptive Approach

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1. INTRODUCTION

Recently, there has been a surge of interest in finding core issues and analyzing emerging trends for the future. This represents efforts to devise national strategies and policies based on the selection of promising areas that can create economic and social added value. The existing studies, including those dedicated to the discovery of future promising fields, have mostly been dependent on qualitative research methods such as literature review, expert judgement and the Delphi method. This approach involves the gaining and processing large amounts of information and the analyzing and reasoning results from them. Therefore, it takes a lot of time and effort to implement as a research methods for emerging trend analysis. Besides, there is a risk that the subjective opinions of experts might affect the results.

Efforts have been made to make up for the weaknesses of the conventional qualitative analysis approach designed to select key promising areas through discovery of future core issues and emerging trend analysis in various areas of academic research: the information and communications technology industry (Chung and Lee, 2012), the construction industry (Jeong and Kim, 2012; Korea Institute of science and technology Evaluation and Planning, 2010), the steel industry (Min et al., 2014), the public sector (Korea Agency for Infrastructure Technology Advancement, 2013; Korea Institute of S&T Evaluation and Planning, 2014). There needs to be a paradigm shift in toward implementing qualitative research methods along with quantitative research methods like text mining in a mutually complementary manner. The change is to ensure objective and practical emerging trend analysis results based on large amounts of data. However, even such studies have had shortcoming related to their dependence on simple keywords for analysis, which makes it difficult to derive meaning from data. Besides, no study has been carried out so far to develop core issues and analyze emerging trends in special domains like the aviation industry. Based on the issues, it identified aviation-related research trends and selected the promising areas for the future.

In this study, unstructured text data are quantitatively analyzed through text mining, which is a big data analytics technique. In this manner, the promising future areas for the air transport industry are selected based on objective data from aviation-related research papers. In order to compensate for the difficulties in grasping the meaning of single words in emerging trend analysis at keyword levels, this study will adopt topic analysis, which is a technique used to find out general themes latent in text document sets. The analysis will

lead to the extraction of topics, which represent keyword sets, thereby discovering core issues and conducting emerging trend analysis.

Research on core issue retrieval and emerging trend analysis for the aviation industry based on big data analysis is still in its incipient stages. So, the analysis targets for this study are restricted to data from aviation-related research papers. In the future, the scope is slated to expand to cover relevant domestic or international news articles and bidding information as well, thus increasing the reliability of analysis results.

On the basis of the topic analysis results, core issues for the aviation industry will be determined. Then, emerging trend analysis for the issues will be implemented by year in order to identify the changes they undergo in time series. Through these procedures, this study aims to prepare a system for developing key promising areas for the future aviation industry as well as for ensuring rapid response. Additionally, the promising areas selected based on the aforementioned results and the analysis of pertinent policy research reports will be compared with the areas in which the actual government investments are made. The results from this comparative analysis are expected to make useful reference materials for future policy development and budget establishment.

2. APPROACHES FOR EMERGING TREND ANALYSIS

The trend analysis is to understand the current phenomenon and further prospect and forecast the future emerging trends. Emerging trend is defined as "a topic area that is growing in interest and utility over time," (Kontostathis et al., 2004). Landford (1972) categorized three approaches for forecasting emerging technologies as intuitive approach, exploratory approach, and normative approach. Intuitive approach is to utilize expert's knowledge for forecasting the future about specific technologies. Experts prospect the future technologies based on specialized knowledge of expert or information previously provided to experts. This approach includes Delphi method, brain storming, cross-impact analysis, analogy, gap analysis, and monitoring. Exploratory approach is a technique for forecasting continual shifts in the future through trends represented during the period from the past to the present in the condition that is not directed to specific social demand. This approach assumes properties of technology or multiple determinants affecting technology development is changed by the time-series pattern, and analyzed using techniques such as trend extrapolation, growth curve, substitution curve, correlation, regression, and technometrics. Normative approach is to regulate the future technology shifts or the

demand for technology development, and then suggest optimal technological plan to satisfy the future demand. This approach contains relevance tree, scenario, morphology, mission-flow diagram, and simulations.

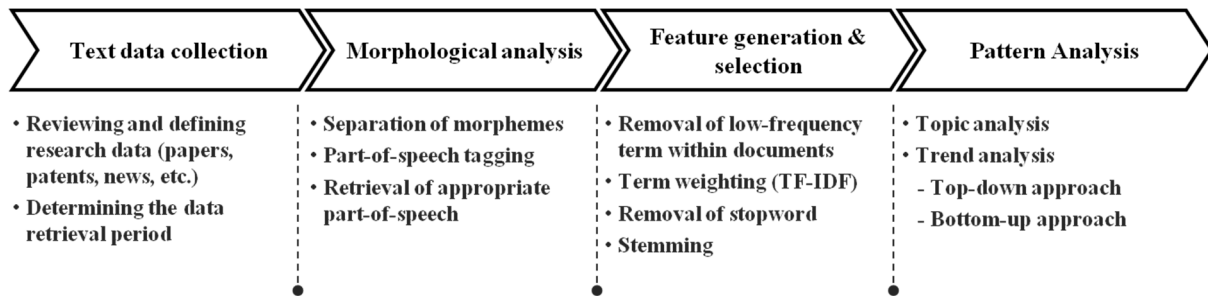
The existing studies have generally adopted qualitative research methods such as literature review, expert judgment such as the Delphi method among the various research methods for the selection of emerging issues based on trend analysis. This approach is contained to intuitive approach according to Landford (1972)'s study. Deriving results from large amounts of information under this approach is both time-consuming and costly, and it has weakness that may reflect subjective judgment. In this paper, we propose descriptive approach for analyzing changes of core issues and prospecting the promising areas in the future through trends analysis during the period from the past to the present. This approach mainly uses text mining techniques as an automatic data-driven approach. There has been no study that analyzes general trends using quantitative research methods such as text mining technique for the purpose of identifying core issues and prospecting the future promising areas of the aviation industry. This study is the first attempt to apply descriptive approach in the trend analysis for the aviation industry. The proposed approach extracts the latent themes of the aviation industry within document sets by using topic analysis, and analyzes changes of topics by year.

3. TEXT MINING

Text mining refers to a technique designed to obtain meaningful knowledge by deriving hidden patterns or relations from a large amount of unstructured text data comprised of natural language. This technique is based on the NLP (Natural Language Processing) technology that can understand languages spoken by humans. Text mining is considered as a part of the partial area of data mining, it differs from general data mining. Even though text mining is to search for meaning within unstructured text data, data mining is to a technique designed to discover patterns in structured data. While most of studies on knowledge discovery in data have focused on structure data, it is required for analyzing unstructured text data in that most of the available data is text data from various data sources according to the rapid of growth in the data available on the web (Feldman and Dagan, 1995). Text mining is used to extract meaningful information from vast amounts of text data, identify the association with other information such as structured data, and find out the categories corresponding to the text. It outperforms a simple information retrieval in terms of the scope of results that can be generated. The stages of performing text mining in

this study are illustrated in Figure 1.

Figure 1: Stages of Text Mining



3.1 Text Data Collection

The first stage is the process of collecting research data after selecting the sources. It is dedicated to collecting vast amounts of text data from a variety of sources such as office documents, email, news, blogs, and postings on social media. Data fit for analysis purpose should be selected.

3.2 Morphological Analysis

Morphological analysis is a stage when contents corresponding to terms, phrases and clauses are transformed into data forms suitable for language analysis processing. It is implemented through morpheme separation and part-of-speech tagging. Part-of-speech fit for research purpose should be extracted.

3.3 Feature Generation and Selection

After implementing morphological analysis, meaningful terms should be selected in order to make it possible to discover patterns hidden in text and analyze their trends. Term filtering involves the following procedures: removing low-frequency terms within documents, handling of stopwords, stemming, and assigning weights by term. First of all, terms are removed in case the number of documents containing them falls short of the minimum n . There are no established rules concerning this, so the minimum number should be determined through experiments. Terms difficult to understand, such as the definite article, as well as terms not used in the domain are processed as stopwords. In addition, terms with the same stem are processed as a single term in order to enhance the efficiency of text processing.

In order to store the processed text data as semantic information, term-specific weights are calculated by considering TF-IDF (Term Frequency-Inverse Document Frequency) which is widely used in the field of information retrieval, rather than just using term frequency (Salton & McGill, 1983). TF-IDF represents a value that can help determine the importance of a particular term in various document sets. TF is a value that reflects how often a particular term appears within a document. In general, the value increases proportionally to the importance of a term in a document. However, the frequent use of the term in a set of documents indicates that it is common. For this reason, not only term frequency but IDF (Inverse Document Frequency), which represents the reciprocal of DF (Document Frequency), is taken into consideration. IDF reflects how commonly a specific term appears within a set of documents. It is calculated by dividing the total number of documents by the number of documents containing the term, and then taking the logarithm of that quotient. The TF-IDF value is gained by multiplying the TF and IDF values, as shown in the following formula:

$$TF-IDF = TF \times \log(N/DF)$$

Where

TF = Frequency of a terms within a document

N = Total number of documents

DF = Number of documents containing the term

IDF = Reciprocal of DF

Through the task of text preprocessing such as morphological analysis and feature generation and selection, an unstructured document collection is converted into a structured term-document matrix.

3.4 Pattern Analysis

In the last stage, information is reproduced through document classification or clustering based on the finally selected semantic information. Once a set of unstructured text documents is transformed into a structured, analyzable form, documents are clustered. Clustering is carried out through text clustering or topic analysis, grouping documents in accordance with similar characteristics. Text clustering and topic analysis are techniques used to discover clusters or topics hidden in a text document set. They involve clustering of documents in accordance with similarity based on the association of terms. Association

between terms is calculated by co-occurrence frequency within a set of documents. Text clustering is conducted by using such schemes as the EM (Expectation-Maximization) algorithm and the HAC (Hierarchical Agglomerative Clustering) method. Topic analysis was first based on a technique called LSA (Latent Semantic Analysis) suggested by Deerwester et al. (1990). Later, Hofmann (1999) proposed PLSA (Probabilistic Latent Semantic Analysis) by introducing a probabilistic concept into LSA. Lately, LDA (Latent Dirichlet Allocation), a technique proposed by Blei et al. (2003), is being used widely in various areas.

Conventional text clustering is based on the assumption that individual documents correspond to one theme. Thus, it has limitation that it is difficult to derive overall themes from large amounts of text documents. In contrast, topic analysis is based on the assumption that an individual document can contain complex themes dealing with various topics. A cluster or topic is represented as a set of multiple keywords. The task on naming of each cluster or topic should be determined directly by the researcher.

4. MODEL DEVELOPMENT

4.1 Research Data

Various information sources that can be used for generating core issues and analyzing emerging trends for the aviation industry include academic papers, policy research reports, patents and news articles. This study focuses on collecting aviation-related data from the academic research papers in Korea. For the trend analysis in this study, a total of 4,104 academic papers and policy research reports containing the keyword "aviation" were selected from among those published in Korea since 2000. Analysis focused on the period from 2000 and to September 2014, during which the nation laid the groundwork for take-off of its aviation industry beginning with the opening of the Incheon International Airport. Also taken into consideration was the fact that domestic aviation research started in a full-fledged manner in 2000. Detailed contents of the target data are presented in Table 1.

Table 1: Research Data

Source	Retrieval period	Frequency
NDSL academic papers	2000.1 ~ 2014.9	2,780
KISS academic papers		1,214
PRISM research reports		110
Total		4,104

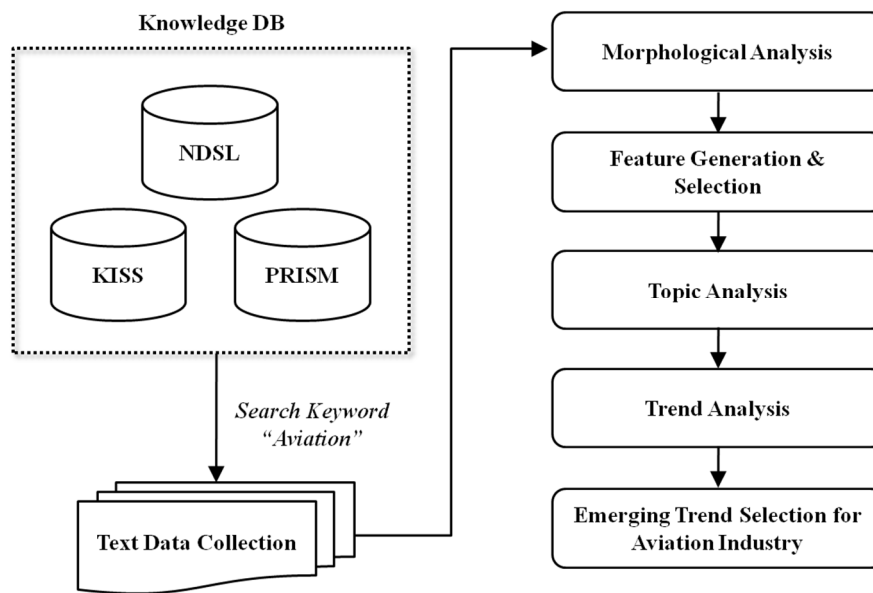
NDSL (National Digital Science Library) is a database that provides data on academic papers, patents, reports, trends, and factual information. As NDSL is focused on the science and technology fields, this study additionally used KISS (Korean Studies Information Service System), which is oriented toward social sciences. PRISM (Policy Research Information Service & Management) is a system designed to effectively manage the policy research tasks implemented by the central government agencies and share the policy research reports.

NDSL search led to the retrieval of 2,780 aviation-related papers, which had been published in 415 journals over a period of about 10 years. Large portions of the papers were found from the following journals: Journal of The Korean Society for Aeronautical & Space Sciences, Journal of the Korean Society for Aeronautical and Flight Operation, Journal of Surveying Geodesy Photogrammetry and Cartography, Aerospace Engineering and Technology, and The Korean Journal of Air & Space Law and Policy. Through KISS, 1,214 papers were discovered from 195 journals, which included prominent ones such as The Journal of the Korea Navigation Institute, Journal of the Aviation Management Society of Korea, Tourism Research, Journal of Tourism Management Research, Korean Journal of Hotel Administration, and International Journal of Tourism and Hospitality Research. Because NDSL and KISS databases were found to have the same document, only one of them was taken in order to avoid duplication. From PRISM, a total of 110 research reports were found in relation to aviation policies.

4.2 Experimental Design

Research on core issue generation and emerging trend analysis for the aviation industry is still in its early stages. Pilot experiment is conducted to build a framework based on descriptive approach for emerging trend analysis and examine the feasibility for the aviation domain application. Topic analysis, one of the text mining techniques, is employed as a way to retrieve the key issues affecting the aviation industry from academic research paper. The proposed research model and the analysis scope of this study are shown in Figure 2. Data-based model development based on descriptive approach for emerging trend analysis in the aviation industry is implemented through main two steps: text document collection and text mining based trend analysis.

Figure 2: Text Mining Based Trend Analysis



Text Data Collection

Various information sources that can be used for generating core issues and analyzing emerging trends for the aviation industry include academic papers, policy research reports, patents news articles, and bidding information. However, this study uses academic research papers and policy research reports. News articles data have copyright issue, and there also exist restrictions stemming from the difficulty of standardizing data crawled from a diversity of sources on the Web. Academic research paper data are relatively applicable to collect and analyze because they are composed of structured formats and items such as author, year of publication, abstract and keywords. In the case of policy research reports, data collection efforts faced limitations because of some organizations' practice of not disclosing the texts and due to the use of different items for mutually related information. In some cases, titles provided in summarized information by theme were used for data collection.

Research papers containing the term "aviation" in text data collection steps are retrieved through search of titles, abstracts and keywords. In general, the search keyword is selected from words specifically used in the pertinent domain, or chosen by experts. The keyword should be picked based on the relevance between research data and the purpose of the emerging trend analysis. This study is aimed at analyzing the overall aspects of emerging trends in the aviation sector, so the general term "aviation" was chosen as the search keyword. It will be necessary to prepare more sophisticated keywords when conducting

emerging trend analysis in the future targeting detailed areas within the aviation sector. Additionally, policy research reports are collected in order to compare the major issues dealt with in academic papers and policy research projects. The research reports are also analyzed to check whether proper investment is made in the core areas for the aviation industry.

Next is the process of clearly defining the scope of research data among a total of 4,104 academic papers and policy reports containing the keyword "aviation" selected for the emerging trend analysis in this study. Retrieved from search of NDSL, KISS, and PRISM databases are systematically organized and classified by year of publication, author, title, and organization in charge.

Text Mining-Based Trend Analysis

Based on the retrieved data, text mining, which is one of the big data analysis technique used to analyze the data in text form, is implemented through analyzing and processing technologies for the unstructured text data. Analysis targets are the theme of aviation-related academic papers and policy research reports. First of all, text preprocessing work, including morpheme analysis and feature selection, is implemented. This is followed by topic analysis to discover themes hidden in text document sets as well as trend analysis designed for time series review of the discovered topics. In topic analysis, documents are divided into groups based on similarity of themes. The similarity is determined by words' co-occurrence frequency within a document set. A topic is described as a set of one or more keywords, and topic analysis is based on the assumption that individual documents can handle not only single but multiple themes. Thus, topic analysis can be a useful tool for extracting general themes from large quantities of documents.

A topic extracted from a research paper can be understood as a set of keywords. The frequency of a particular topic's appearance within a document set reflects the level of interest in the concept the topic represents. Estimating the level of such interest makes it possible to analyze the trends regarding a particular concept. Eventually, it makes it possible to generate the core promising areas in the future for the aviation industry.

There are two approaches that can be used for trend analysis designed for time series review of the discovered topics. The first one is the top-down approach. In this method, the final topic is picked first, being followed by analysis of trends by year. After extracting a

topic from the entire data, frequency-based analysis is conducted by year based on the same topic. It can determine whether a topic is on the increase or decrease in terms of frequency. The second method is the bottom-up approach, which is to derive topics by era and analyze the trends. It makes it easy to grasp the topics that can be differentiated by era. However, it is difficult to examine the trends of topics taking place from the past up to the present. For this reason, this study adopts the top-down approach. By using this method, it implements trend analysis for the aviation industry, focusing on the identification of trends by year regarding the same topics.

This paper analyzes each topic's trends by using time series graphs showing yearly changes in the retrieved keywords and the discovered topics. The core issues and areas are generated through reflection of experts' opinions in addition to the keywords and the topics derived through topic analysis. This process is followed by the mapping of topics for each area. Finally, the topic trends are illustrated by using time series graphs by area. Through this process, topics showing growth trends are picked as the core promising areas for the aviation industry.

5. RESULTS AND ANALYSIS

A total of 261 keywords were retrieved as semantic information to be used for topic analysis from a total of 3,994 aviation-related academic research papers published between 2000 and 2014. The frequency and TF-IDF values of the retrieved keywords are exemplified in Table 2. We used TF-IDF values to weight terms for semantic information retrieval in the topic analysis.

Table 2: Frequency and TF-IDF of Derived Keyword Examples

No.	Keyword	Frequency	TF-IDF
1	Hub	76	7.534
2	Threat	82	7.317
3	Lidar	134	7.260
4	Job satisfaction	126	7.260
5	Disaster	86	7.260
6	Aviation safety	87	7.179
7	Airline service	74	7.179
8	Prevention	75	7.153
9	Cell	179	6.983
10	Low cost airline	160	6.960

On the basis of topic analysis results as well as experts' opinions in the aviation domain, the emerging topics were broadly classified into the following issue categories: aviation policy/air transport industry, airport, safety/security, and environment/technology. The topics and keywords corresponding to the core issue categories are presented in Table 3. Topic analysis led to the development of 23 topics, each of which was represented as a set of five keywords.

Table 3: Emerging Topics Derived for the Aviation Industry

Issue Categories	Topics	Keywords
1. Aviation policy/ Air transport industry	1.1 Aviation safety policy	Aviation, Safety, Accident, Aviation safety, Operation
	1.2 Airfare (low-cost carriers)	Carrier, Cost, Low cost airline, Operation, Value
	1.3 Distribution channels	Travel, Agency, Airline, Distribution, Channel
	1.4 Job satisfaction	Job, Satisfaction, Job satisfaction, Employee, Commitment
	1.5 Aviation agreements (baggage liability, etc.)	Law, Liability, Convention, State, Damage
	1.6 Flight attendant training/management	Flight, Attendant, Flight attendant, Commitment, Training
2. Airport	2.1 Airport service appraisal	Service, Quality, Passenger, Service quality, Satisfaction
	2.2 Aviation logistics	Airport, Cargo, Passenger, Facility, Logistics
	2.3 Airport hub strategy	Airport, Facility, Passenger, Security, Hub
	2.4 Noise control measures	Noise, Level, Airport, Measurement, Vibration
3. Safety/ Security	3.1 Air traffic control (collision prevention)	Control, Traffic, Controller, Response, Demand
	3.2 Air accident prevention	Accident, Passenger, Damage, Risk, Liability
4. Environment/ Technology	4.1 Eco-friendly high-efficiency fuel	Fuel, Cell, Power, Energy, Density
	4.2 Aircraft wing/shape design optimization	Aircraft, Operation, Wing, Landing, Stability
	4.3 Radar	Radar, Vehicle, Antenna, Traffic, Performance
	4.4 Sensor (error prevention)	Sensor, Error, Accuracy, Camera, Measurement
	4.5 Spatial resolution enhancement	Image, Camera, Resolution, Feature, Photo
	4.6 Unmanned aircraft	Vehicle, Path, Unmanned aerial vehicle,

		Aerial, Flight
4.7	Lidar	Building, Lidar data, Lidar, Surface, Height
4.8	Engine	Engine, Flow, Fuel, Performance, Temperature
4.9	Composite materials	Material, Property, Composite, Temperature, Strength
4.10	Digital map	Map, Digital map, Accuracy, Photo, Road
4.11	Aerial photo	Land, Photo, Aerial photograph, Management, Construction

The derived topics, which can be understood as keyword sets, were mapped onto the four core issue areas. There are six topics in the aviation/air transport industry category, four in the airport category, two in the safety/security category, and 11 in the environment/technology category. Among the derived topics, the following 10 were selected as the highest ranked ones in terms of frequency: aircraft wing/shape design optimization, air traffic control (collision prevention), radar, flight attendant training and management, sensor (error prevention), airport service appraisal, spatial resolution enhancement (geographical features), aviation logistics, aviation safety policy, air accident prevention, unmanned aircraft, radar, engine, composite materials, and airfare (low-cost carriers). These can be considered to be the core issues being studied in the aviation sector. The selected topics and frequency of each core issue category are summarized in Table 4.

Table 4: Core Emerging Topics of the Aviation Industry

Rank	Categories	Topics	Frequency
1	Environment/ Technology	Aircraft wing/shape design optimization	614
2	Safety/Security	Air traffic control (collision prevention)	466
3	Environment/ Technology	Radar	441
4	Aviation policy/ Air transport industry	Flight attendant training/management	436
5	Environment/ Technology	Sensor (error prevention)	425
6	Airport	Airport service appraisal	423
7	Environment/ Technology	Spatial resolution enhancement (geographic features)	389

8	Airport	Aviation logistics	388
9	Aviation policy/ Air transport industry	Aviation safety policy	387
10	Safety/Security	Air accident prevention	370

We additionally retrieved the keywords and core issue categories to discover the investment areas from the aviation-related policy research reports. Then, they were compared with the areas in which the actual government investments were being made. The 10 keywords derived from the policy research reports are safety management, noise control measures, space, small craft, aviation accidents, aviation demand, aircraft certification, service appraisal, air traffic control, and unmanned aircraft. The level of correspondence was 60% between the academic research areas and government investment fields as shown in Table 5. It is determined that the non-matched areas such as small aircraft, aviation demand, and aircraft certification will be studied in the academic field for the future. The results from this comparative analysis are also expected to make useful reference materials for future policy development and budget establishment.

Table 5: Correspondence between Core Emerging Topics and Issues in Aviation Policy Research

Rank	Categories	Keywords	Frequency	Correspondence
1	Safety/Security	Safety management	13	○
2	Airport	Noise control measures	6	○
3	Aviation policy/ Air transport industry	Space	5	
4	Environment/ Technology	Small aircraft	4	
5	Safety/Security	Aviation accidents	4	○
6	Aviation policy/ Air transport industry	Aviation demand	4	
7	Safety/Security	Aircraft certification	3	

8	Airport	Service appraisal	3	○
9	Safety/Security	Air traffic control	3	○
10	Environment/Technology	Unmanned aircraft	3	○

Trend analysis was conducted to identify the changes by era in the degree of interest in the finally chosen topics as well as to determine the promising fields for the future aviation industry. The data for 2014 were excluded from the trend analysis because they were available only for the first nine months. Finally, the topics corresponding to the core issues were analyzed through the top-down approach. First of all, topics are extracted from the entire data. Then, analysis is conducted to find out yearly changes in the degree of interest for the same topics. It represents a scheme to determine topics on the increase or decrease in terms of the level of interest. Frequency of a particular topic within a document set reflects the degree of interest in the concept represented by the topic. The annual degree of interest for an individual topic is calculated in the following manner:

$$\text{Degree of interest} = \text{Frequency of a pertinent topic} / \text{Total number of documents}$$

For trend analysis, the period from 2000 through 2013 was divided into three phases by reflecting relevant changes in the aviation industry. Then, time series patterns were analyzed for each topic. Phase 1 (2000~2003) was named the "period of stable growth and preparation for take-off," while Phase 2 (2004~2007) was called the "period of take-off and rapid change." Phase 3 (2008~present) was referred to as the "period of stability and second take-off."

Phase 1 saw the acceleration of the signing of aviation agreements as well as the introduction of international standards for aviation policies. In addition, efforts to secure aviation safety were intensified through the implementation of the confidential aviation incident reporting system, the aviation safety inspector system, the air operator certificate system, and the maintenance organization approval system. Following the 2001 opening of the Incheon International Airport, various standards were established, thus laying the groundwork for take-off the Korean aviation industry.

Phase 2 was a period when the hub strategy for Incheon International Airport was

implemented along with its second-phase construction project. An aviation safety management system was established to enhance the level of safety. In particular, low-cost carriers began to appear amid efforts to provide air services suitable for domestic situations. Their market participation was related to decreases in air demand caused by an economic slowdown and progress in the development of alternative modes of transport. Korea's first low-cost carrier was Hansung Airlines (presently T'way Air), which launched its flight services in August 2005. During the period of Phase 3, the 3rd-phase construction of Incheon International Airport began in a move to strengthen its competitiveness. The project is to be completed by the end of 2017. At present, two full-service carriers - Korean Air and Asiana Airlines - and five low-cost carriers are in operation in Korea. Other major developments included the preparation of autonomous air safety reporting regulations and the further easing of market entry restrictions for air transport operators. This was a period when the nation secured a basis for diversifying air transport businesses such as the operation of small aircraft.

The topics found to be on upward trends were picked as the core promising areas for the aviation industry. As demonstrated in Figures 3 to 6, researches pertaining to aviation were shown to be actively implemented during Phase 3, which were referred to as the stability period and the take-off period, respectively. The number in the following bar graphs was matched by the selected emerging topic in Table 3.

Figure 3: Trend Analysis for the Issue of Aviation Policy/Air Transport Industry

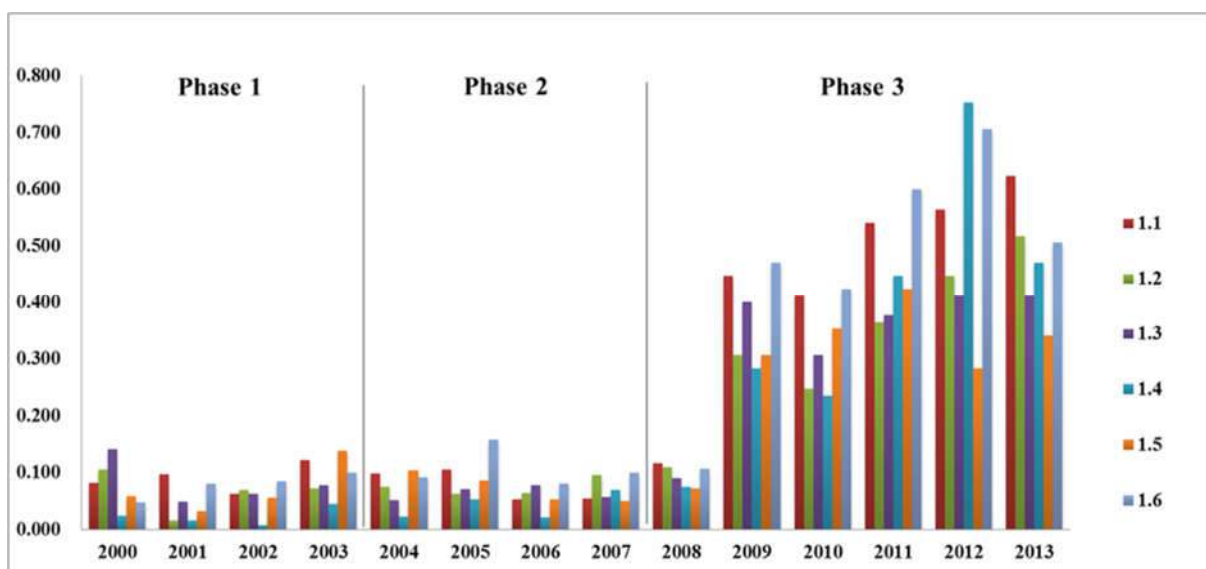


Figure 4: Trend Analysis for the Issue of Airport

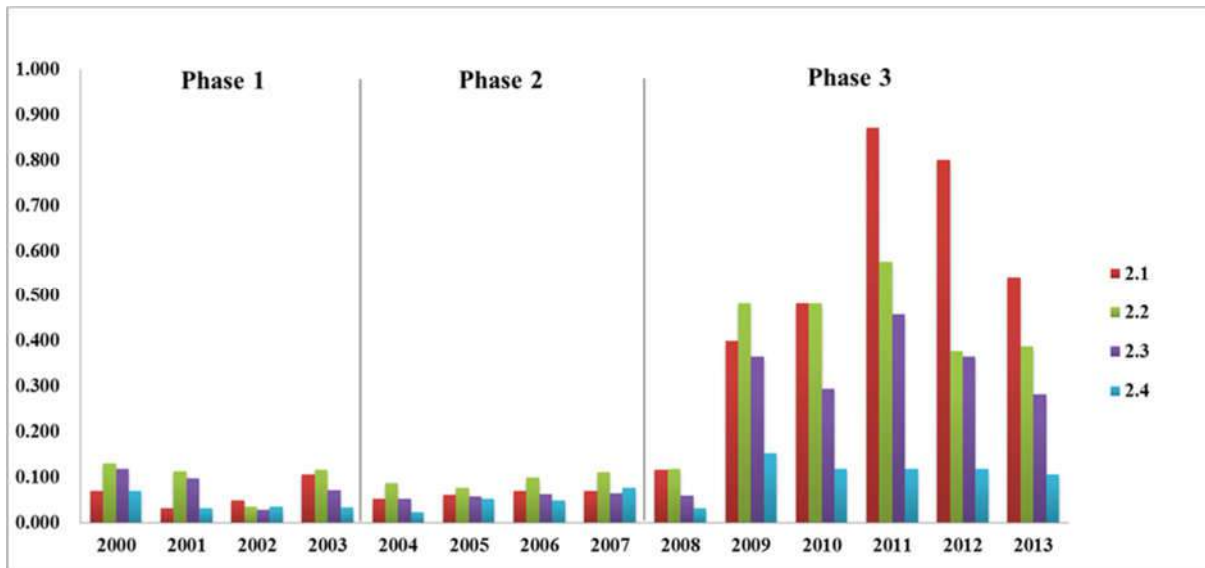
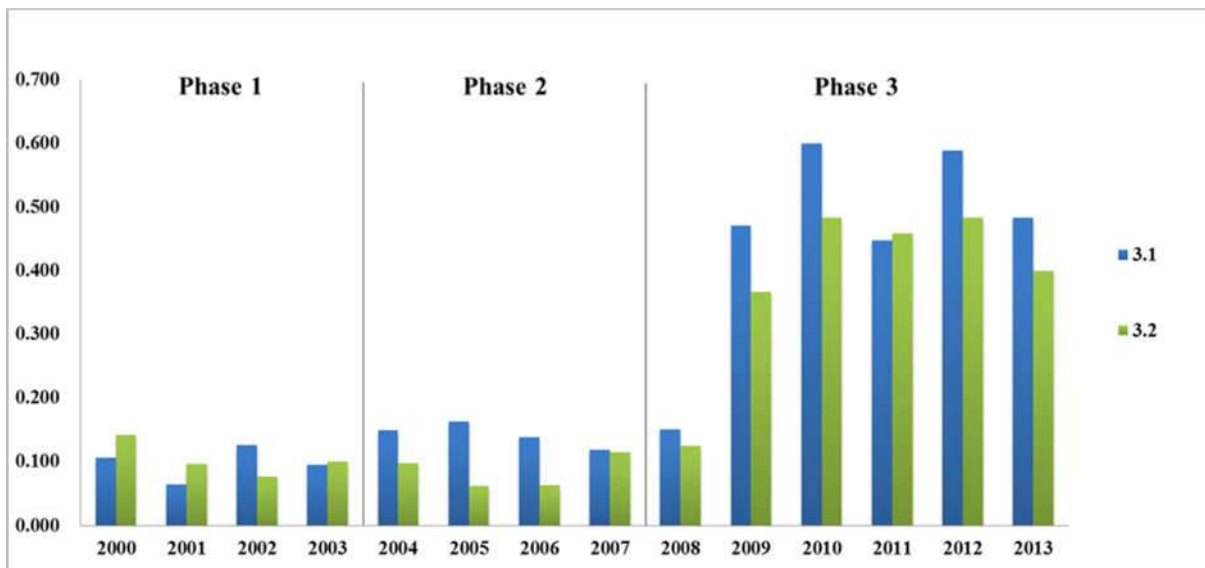


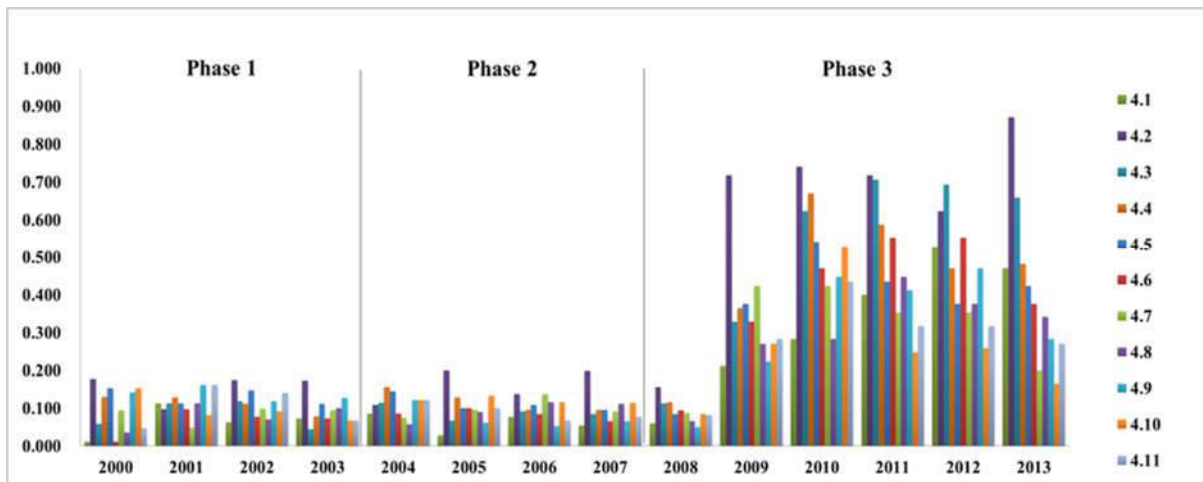
Figure 5: Trend Analysis for the Issue of Safety/Security



We categorized topics as three types through time-series pattern analysis: upward trends, downward trends, and types without upward or downward trends on the degree of interest for a topic. Types without specific patterns indicated that that it was consistently considered as important topics without trends or downward trends on the degree of interest for a topic. Topics with high degree of interest were selected as the future promising areas in the aviation industry by reflecting the number of three or more consecutive upward trends during the entire research period and the number of upward trends during phase 3,

considering that aviation-related studies were shown to be actively conducted in recent years.

Figure 6: Trend Analysis for the Issue of Environment/Technology



Topics such as aviation safety policy, airfare (low cost carriers), and eco-friendly high-efficiently fuel were found to be on upward trends. First, aviation safety policy, a topic that belongs to the issue category titled aviation policy/air transport industry, has drawn an increasing level of attention since the nation's aviation industry entered a period of stability and second take-off, as manifested in Figure 7. This was a period when international standards on aviation safety policy were introduced into the nation. In May 2008, Korea underwent a safety audit administered by the International Civil Aviation Organization (ICAO). Through the audit, Korea was certified to have implemented 98.89% of the relevant international aviation safety standards. Aviation accidents occur at lower frequency than those of other modes of transport such as trains, buses and ships. Once they occur, however, they cause large numbers of human casualties and serious damage to aircraft. Besides, aviation users become distrustful of the airlines involved. For these reasons, aviation safety policy is expected to keep attracting a high level of attention. There is a need to continuously improve the aviation safety system and to prevent accidents, flight delays and cancellations.

Second, airfare is a topic that belongs to the issue category of aviation policy/air transport industry. Particularly with regard to low-cost carriers, the airfare issue kept attracting a high level of interest beginning in 2009, as demonstrated in <Figure 8>. Low-cost carriers entered the aviation market as the nation was seeking a new air service system suitable for domestic conditions, following a drop in aviation demand caused by an economic slowdown and the development of alternative modes of transport. In August 2005, Hansung Airlines

(predecessor of T'way Air) began operations as the nation's first low-cost carrier. Four more budget carriers launched their commercial flights over the next several years: Jeju Air in June 2006, Jin Air in July 2008, Air Busan in October 2008, and Eastar Jet in January 2009. According to statistics compiled by the Ministry of Land, Infrastructure and Transport, the airline domestic market shares in the first quarter of 2014 reached 29.4% for Korean Air and 23.1% for Asiana Airlines. The share for low-cost carriers were 13.2% for Jeju Air, 11.9% for Air Busan, 7.9% for Eastar Jet, 7.3% for T'way Air, and 7.2% for Jin Air. Domestic low-cost carriers increased their flights and opened new routes. These activities led to a rise in the number of people using the budget airlines. As a result, the market shares of Korean Air and Asiana Airlines went down. The low-cost and full-service carriers are expected to compete fiercely over the market shares. Amid such a competitive atmosphere, the airfare issue will likely continue to attract a high level of attention.

Figure 7: Trend Analysis for Aviation Safety Policy

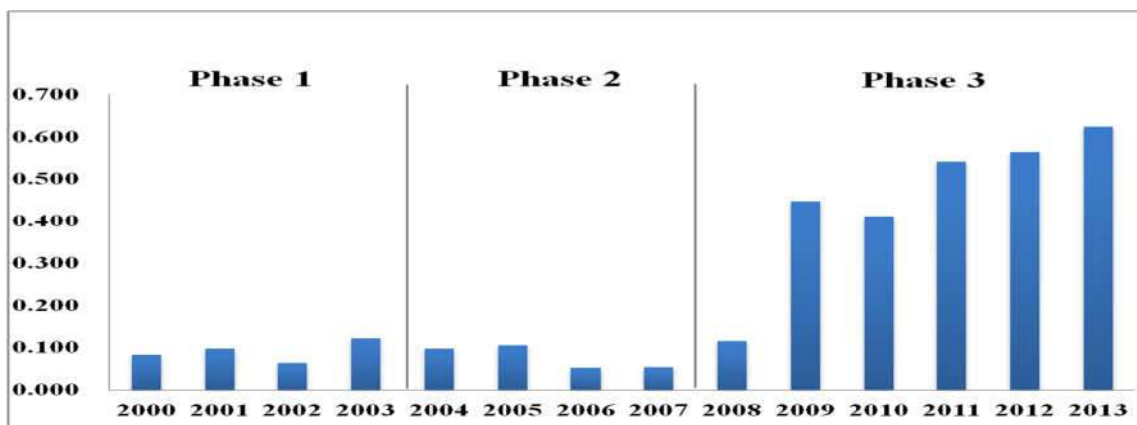
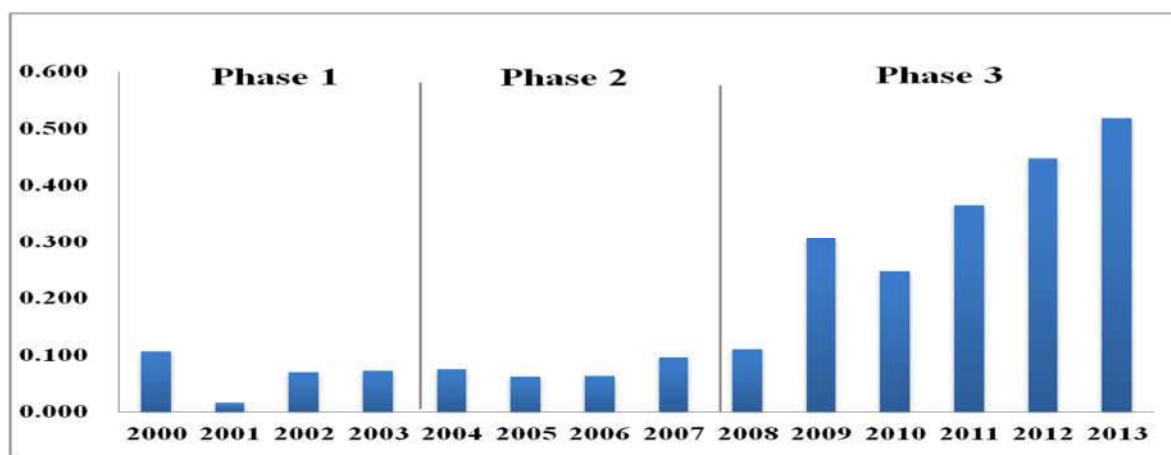
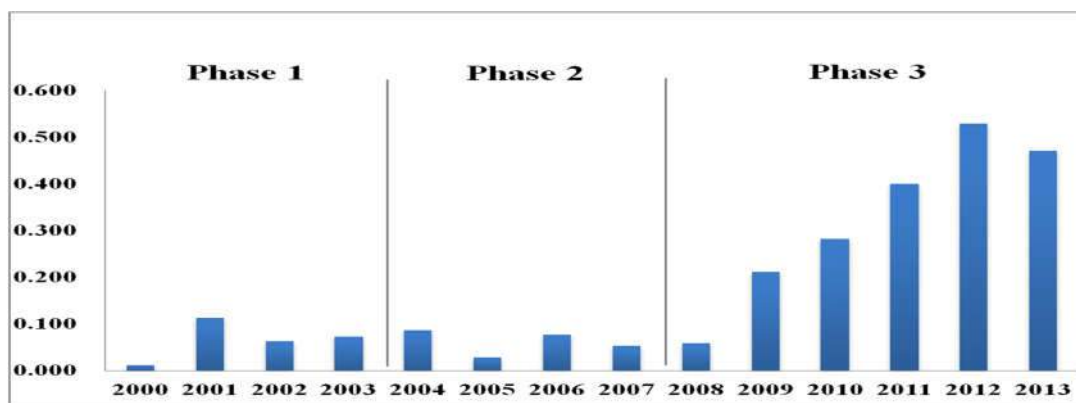


Figure 8: Trend Analysis for Airfare (Low-Cost Carriers)



Third, eco-friendly high-efficiency fuel is a topic that belongs to the environment/technology issue category. As shown in Figure 9, the level of interest in the topic has steadily increased since 2009, although it slightly went down in 2013. In relation to efforts to reduce greenhouse gas emissions from aircraft, the level of interest is particularly high for environment-friendly and high-efficiency fuels like hydrogen fuel cells, secondary batteries, and biofuels. In addition, a growing level of attention will likely be focused on matters related to greenization of the aviation industry, such as the use of composite materials, the use of fuel-efficient engines, and fuel conservation through shape design optimization.

Figure 9: Trend Analysis for Eco-Friendly High-Efficiency Fuel



Topics such as airport hub strategy, noise control measures, lidar, and aerial photos were found to be on downward trends. In contrast, the following are steadily regarded as important topics without specific patterns: circulation channel, job satisfaction, aviation agreement (baggage liability, carry-on baggage restrictions), flight attendant training and management, airport service appraisal, aviation logistics, air traffic control (collision prevention), air accident prevention, aircraft wing/shape design optimization, lidar, sensor (error prevention), spatial resolution enhancement (geographic features), unmanned aircraft, engine, composite materials, and digital map.

6. CONCLUSIONS

This study focused on deriving core issues for the air transport industry from aviation-related academic research papers by using a text mining method, a big data analysis technique, with a view to identifying the relevant trends and making predictions on promising areas for the aviation industry. It has limitations as its research for discovering the core issues and promising areas was restricted to academic research papers containing

the keyword "aviation." However, it has significance in that it has helped establish a quantitative research method for generating and steadily monitoring aviation-related core issues as well as for presenting directions of core promising areas in the future.

Research on extracting core issues and conducting emerging trend analysis for the aviation industry through the application of a big data-based descriptive approach is in its early stages. However, given the rapidly rising number of research papers, news and patents, it seems essential to prepare measures to cope with changes in relevant technologies and environments. In the future researches, efforts will be made to enhance the reliability of analysis results by selecting more detailed search keywords and expanding the scope of research sources to cover news articles, patents, and bidding information as well.

To increase the accuracy of the text mining based trend analysis results, in-depth studies will have to be carried out continuously on ensuring research data coding standardization and defining the pertinent standards as well as establishing an automation scheme for text representation. Such studies will help develop more objective analysis methods for discovering the core issues and promising areas pertaining to aviation, laying the groundwork for establishing mid- and long-term policies aimed at securing the competitiveness of the aviation industry. In addition, reflecting the opinion of domain experts will additionally be considered for capturing the correct meaning of topics through a set of keywords.

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* This work was translated into English from the original Korean study of Supporting Air Transport Policies Using Big Data Analysis published by the Korea Transport Institute in 2014.

INFLUENCE OF THE THREE LINKS AGREEMENT ON THE BEHAVIOR OF TAIWAN AIRPORTS: A TWO-STAGE DEA ANALYSIS

Lu Yang¹

ABSTRACT

Taiwan is a small island with a relatively large number of airports. These airports show great disparity in terms of passenger volume and cargo tonnage. This paper in the first part evaluates the efficiency and productivity of Taiwanese airports using a panel data set, to verify the ones with lower efficiency performances. DEA (Data Envelopment Analysis) and Malmquist index methods are applied. In the second stage the changes of these scores are analyzed in different regression methods to test the influence of the Three Link agreement between China and Taiwan. It reveals that airports in Taiwan with routes to China have lower efficiency scores but their productivity grows faster than that of the other airports. This paper also confirmed that airports on offshore islands have higher efficiency scores and productivity.

KEYWORDS

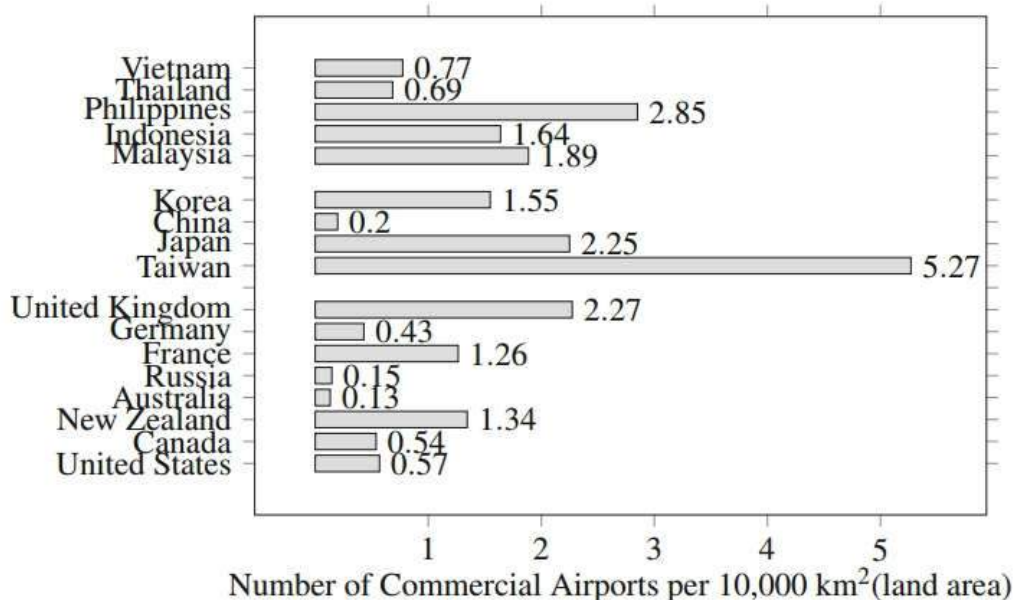
DEA; Malmquist index; Airport benchmarking

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1. INTRODUCTION

Taiwan is an island off the southeast coast of mainland China, facing the Pacific in the other side, consisting of a main Taiwan Island and several offshore islands. Taiwan has a natural advantage in international aeronautic transportation in the Asia-Pacific region: it is only 90 minutes away from Hong Kong and even less time to Shanghai by air. The flight time it costs from Taipei to Seoul and Tokyo are 140 minutes and 180 minutes respectively. Within 3 to 4 hours, one can reach Bangkok and Singapore from Taipei easily, enough for a one-day business trip. In its economic development history, there used to be a huge aviation demand that came along with the Taiwanese economic taking off during the 1970s, when more than one third of the civil aviation airports in Taiwan were built. Partly because of this convenient location between East Asia and Southeast Asia, also because of a great aviation demand in its economic development history, Taiwan has quite an extraordinarily high level of airport density. In Figure 1 we list the airport density of major countries/regions around the world. The information of commercial airports is collected from the official websites of each country's Civil Aviation Authority or the Department of Transportation. We can see that Taiwan ranks top in these selected countries/regions.

Figure 1: Worldwide Airport Density



However, the total aviation passenger number as well as cargo tonnage have been on the decline since the year 1997 (with some exception years), along with the decelerated economic growth. The trend of Taiwanese aviation demand in recent forty

years is shown in Figure 2. This decline continued in domestic flights when THSR² opened for service in 2007. However, as we can see in Figure 2, despite the fact that the domestic aviation demand decreased rapidly after around 1996, the international aviation passengers number kept growing.

More importantly, Taiwanese airports experienced a big change last decade, when the "Three Links" agreement was signed between mainland China and Taiwan. "Three Links" stands for direct postal service, direct transportation and direct trade between mainland China and Taiwan, which put an end to the history of no traffic relations between PRC China and ROC Taiwan since the end of the Chinese Civil War in 1949. The first chartered flight between mainland China and Taiwan appeared in 2003, when the flights had to make a transit in Hong Kong or Macau, and the airplane could only make one-way flight during traditional Chinese festival periods. After the huge earthquake in Sichuan, China in May 2008, humanity chartered flights were permitted for Taiwanese relief supplies³ and rescue teams⁴ to be sent directly to the disaster area. Two months later on July 4th 2008, first weekend regular chartered cross-strait flight made its debut without stopping by Hong Kong⁵, although a symbolic passing through the Hong Kong FIR (Flight Information Region) was still necessary. Finally, at the end of 2008, the regular daily flights across Taiwan Strait without detouring over Hong Kong came into reality⁶.

² Taiwan High Speed Rail. Currently runs from Taipei to Zuoying (Kaohsiung).

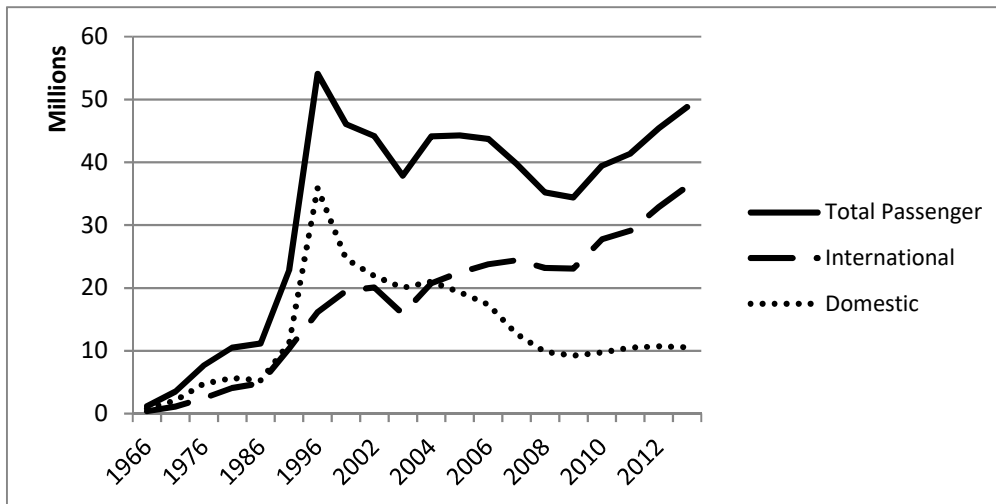
³ Chinese Airlines chartered cargo plane will make a direct flight to Sichuan in the afternoon to deliver relief supplies (in Chinese). RTHK. May 15, 2008. http://www.rthk.org.hk/rthk/news/expressnews/20080515/news_20080515_55_490111.htm

⁴ The Mainland agrees to receive 20 members of our Red Cross Society's relief team to join the relief effort --- due to arrive in Chengdu by charter plane in the afternoon of the 16th (in Chinese). The Red Cross Society of the Republic of China. May 15, 2008. <http://www.redcross.org.tw/RedCross/upload/main/00-2008hqrcyteam/970515.htm>

⁵ Taipei, Beijing reach historic pact. The China Post & agencies. June 13, 2008 <http://www.chinapost.com.tw/taiwan/china-taiwan-relations/2008/06/13/160749/Taipei-Beijing.htm>

⁶ Direct cross-strait links in place. The China Post. December 15, 2008 <http://www.chinapost.com.tw/taiwan/china-taiwan-relations/2008/12/15/187643/p2/Direct-cross-strait.htm>

Figure 2: Taiwan's Aviation Passenger⁷



It would be interesting to see how the policy change by the Three Links Agreements affects the efficiency and productivity of airports from both China and Taiwan. We focus on the behavior of Taiwanese airports in this paper. From Figure 2 the year 2009 appears to be a watershed: the growth of international aviation demand sped up and the domestic aviation demand stopped decreasing and increased slightly in recent years. As a whole the total aviation demand of Taiwan finished its 10 years decrease and returned to a strong increase ever since. Despite of the influence of the financial crisis of 2007-2008 and the bankrupt of Lehman Brothers, which pulled down the growth rate of Taiwan's GDP to around -5%⁸, along with the opening of THSR, both domestic and international passenger volume have better performance since 2009 than before. Our hypothesis in this paper is that the opening of direct China air route plays an important role. To evaluate the efficiency difference, we define efficiency by the DEA efficiency scores and productivity change by Malmquist index. DEA scores measure the relative ratio of (weighted) output to input of a specific DMU (Decision Making Unit) while Malmquist index evaluates the productivity change of one DMU between two time periods. The detail will be discussed in section 2.2, where the overall efficiency and productivity will be compared before and after the Three Link agreement. As it is widely discussed within Taiwan about whether small local airports should be open to direct China routes, our interest also lies in the possible gap between big airports like Taoyuan airport and small airports like Hengchun airports, after the Three Link agreement.

⁷ Data source: Traffic of Civil Aviation by Airports: <http://www.caa.gov.tw/en/content/index.asp?sno=362>

⁸ Taiwan GDP Growth Rate. <http://www.tradingeconomics.com/taiwan/gdp-growth>. Trading Economics

The remainder of this paper unfolds as follows. In the next section, we will introduce the development of DEA in airport benchmarking. In section 2, I will introduce the methodology applied in this study. In section 3 we are trying to measure (1) the efficiency of Taiwan airports; (2) the technical efficiency change (TEC) and the frontier shift (FS) of Taiwan airports over the years 2004 to 2011. Furthermore, we are going to analyze the impact of this policy change not only on the efficiency (DEA score) but also on the productivity change (Malmquist Index) of airports. A second stage panel data regression will be adopted to check the impact of endogenous factors of the airports, especially the effect of the Three Links Agreement between China and Taiwan. The results and conclusion, as well as policy suggestions, will constitute the last section.

2. LITERATURE REVIEW

The efficiency of airports has long been measured and evaluated in a wide variety of contexts. Among those methods DEA is one of the most widely used ones. In fact, in the appendices of Liebert and Niemeier's survey of empirical studies on the productivity and efficiency of airports (Liebert & Niemeier, 2013), only 4 studies employ price-based index approaches, 20 papers applied parametric approaches (SFA: Stochastic frontier analysis, is the main approach), while 37 papers use non-parametric approaches. Among those non-parametric papers 30 apply DEA purely and 6 compare DEA results to those of other methods. DEA method is chosen in many empirical studies because of its advantage in dealing with the naturally complex relation among multiple inputs and outputs of the DMUs, which is difficult to deal with other methodologies. In DEA models there is no assumption on a functional form for the DMUs and the production process is seen as being operated in a black box. For example, when measuring Taiwan's domestic airport efficiency, Yu (2004) applied DEA analysis with one undesirable output (airplane noise) and population of the prefecture where the airport locates is introduced as an environmental variable. The economical cost of the airplane noise or the mechanism it affects airports' operation is not necessary in DEA and the weight for each input or output is decided individually.

In the field of airport benchmarking, there is a significant amount of studies done by various researchers. Yoshida and Fujimoto (2004) calculated both the CRS and VRS efficiency scores of Japanese airports in year 2000. In the second stage they conducted a Tobit regression to test the connection between the efficiency scores and

two factors indicating the characteristics of each airport. Abbott and Wu (2002) analyzed both the total factor productivity (Malmquist Index) for twelve Australian airports and technical efficiency (DEA efficiency score) for Australian and international airports. Malmquist Index is decomposed into technical efficiency change and technological change, technical efficiency change is further decomposed into pure technical efficiency and scale efficiency. A second stage regression is also applied.

For the efficiency of Taiwan airports, the previous studies are quite limited. Some research compared the efficiency of global airports and TPE (Taoyuan International Airport) is included as one of the research objects. For example, Oum and Yu (2004) measured and compared the Variable Factor Productivities (VFP) of 76 major airports including TPE, utilizing the data from the 2003 ATRS global airport benchmarking report. VFP is chosen in this study because of the lack of information on the capital input of each airport and the distortion caused by government subsidy on airport capital expansion projects. TPE is also included in Yang's research (2010) on twelve international airports of the Asia-Pacific area from 1998 to 2006. DEA and SFA are both used in his study and the relations between the results of the two methods are discussed. Lin and Hong (2006) calculated the DEA efficiency score for twenty airports around the world by both CCR and BCC model. Besides the undesirable output study (Yu, 2004), Yu, Hsu, Chang, and Lee (2008) applied Malmquist-Luenberger productivity index and window approach to a panel data of four domestic airports of Taiwan, for a period from 1995 to 1999. Yu (2010) also conducted a cross section research on the fifteen domestic airports of Taiwan in the year 2006, using a slacks-based measure network DEA (SBM-NDEA) model.

In the Taiwan airport case, we not only want to obtain the efficiency scores for each airport, but also more importantly we are eager to identify the possible influence brought to the efficiency and productivity of Taiwanese airport by the Three Link agreement. At first, we would like to distinguish the performance of Taiwanese airports before and after the specific year when a China route was opened. If we want to know how the efficiency and productivity of DMUs changes during a specific time period, the Malmquist Index is a proper indicator which is calculated based on DEA efficiency scores of each year. Two stage Malmquist Index analyses are rarely seen in airport benchmarking. Fung, Wan, Hui, and Law (2008) evaluated the efficiency scores and Malmquist productivity for twenty-five Chinese airports during year 1995-2004. In the

second stage, however, they did not use a regression but only showed the ODF⁹ by groups to explain the relation between the airports' productivity and other factors such as the location or ownership of the airports. In this paper SBM DEA and Malmquist index model are applied for all the Taiwanese airports for a time span across the signing of Three Link agreement, also a second stage regression is run to verify the effect on efficiency and productivity of airports by China air routes or other characteristic factors.

3. DATA AND MODELS

Data

We collect the data of eighteen airports used in this study from the website of Civil Aeronautics Administration, Republic of China¹⁰. The biggest Taoyuan International Airport is operated by a state-owned cooperation. All the rest seventeen airports are administrated by the Civil Aeronautics Administration. It is a balanced panel data from year 2004 to year 2011. This is the longest time period given data availability and the fact that Hengchun Airport started its operation in the new terminal since Dec. 2003 and that Pingdong Airport finished its run in the year 2012. We have three variables each for input and output. The annual volume of Passenger, Cargo and Taking-off and landings are output variables. Terminal area, runway area and apron areas are input variables. Labor input is not included in this study because of data availability. This is not a big issue as we only focus on the capital input productivity.

There is a giant gap in the inputs and outputs among Taiwanese airports, while the changes along the eight years in each airport are not so significant. If we look at the input variables in the year 2011, we can find that the terminal area of Taoyuan International Airport accounts for nearly 80% of the total terminal area of the nineteen airports. Correspondingly, its apron area accounts for more than half of the total apron area. For runway area it is not so extreme but still Taoyuan runway accounts for 20% of the sum. The situation, as expected, is similar in the output section, where 42%, 60%, and 94% of the taking-off and landing, passenger volume and cargo volume are delivered by Taoyuan International Airport.

⁹ Output Distance Functions, the terminology they adapt for DEA efficiency score.

¹⁰ <http://www.caa.gov.tw/big5/content/index.asp?sno=186>

Taking a deeper glance at the output data, we could also find some interesting trends for different airports. For example, the passenger number of Taoyuan International Airport increases steadily until 2008, possibly due to the opening of THSR and the global recession resulted from the bankruptcy of Lehman Brothers. Both passenger volume and cargo volume recovered in 2010 though, when Taiwan economy expanded remarkably at a 23-year high of 10.8%¹¹.

For the second biggest Songshan Airport located within Taipei city which mainly operates domestic flights, the recovery in 2010 is not so strong as the previous one. The passenger number fluctuates around 4 million per year, no bigger than 2008 level. Kaohsiung Airport is the second biggest international airport in Taiwan, which has a decreasing passenger volume even before the crisis. However, the recovery since 2010 seems to be strong comparing to other airports. Passenger volume of Taichung Airport and Kinmen Airport grows rapidly despite of the crisis in 2008, passenger volume in Magong Airport recovers immediately since 2009. The four airports in main Taiwan island, namely Tainan, Taitung, Chiayi and Hualien, are examples of a rapidly decreasing passenger volume, the recoveries are slow and seem to be difficult for them. The trends of passenger volume for these typical airports are listed in Figure 3 and Figure 4.

Models

Assuming variable return to scales, which is realistic for the airport case, we chose an input-oriented model because our research focus is on the necessary infrastructure of airport in accordance with demand level. In other words, aviation demand is regarded as an exogenous variable here. We are trying to find out the most efficient allocation for the airport capital investment inputs, in order to give a reference to policy makers in making the right decisions.

The original input oriented model is a radial DEA model, where a proportional change of inputs and/or outputs is dealt with. There is another *non-radial* DEA model too. According to Cooper, Seiford, and Tone (2007), a non-radial input-oriented slacks-based model (SBM) deals better with input slacks (excesses). In the case of this paper, all the inputs for Taiwanese airports do not change in the same scale. For example, there exists a minimum requirement for the length and width of the airstrip even in an

¹¹ National Statistics, Republic of China (Taiwan)

airport with small passenger volume. On the other hand, we could increase the efficiency score by reducing the size of the terminal building. This kind of input slack would not affect the ordinary CCR efficiency score, though. So the Slack-Based Model (Tone, 2011) is applied to take into account all input slacks in DEA calculation.

Figure 3: Passenger Volume Trend for the Three Biggest Airports in Taiwan

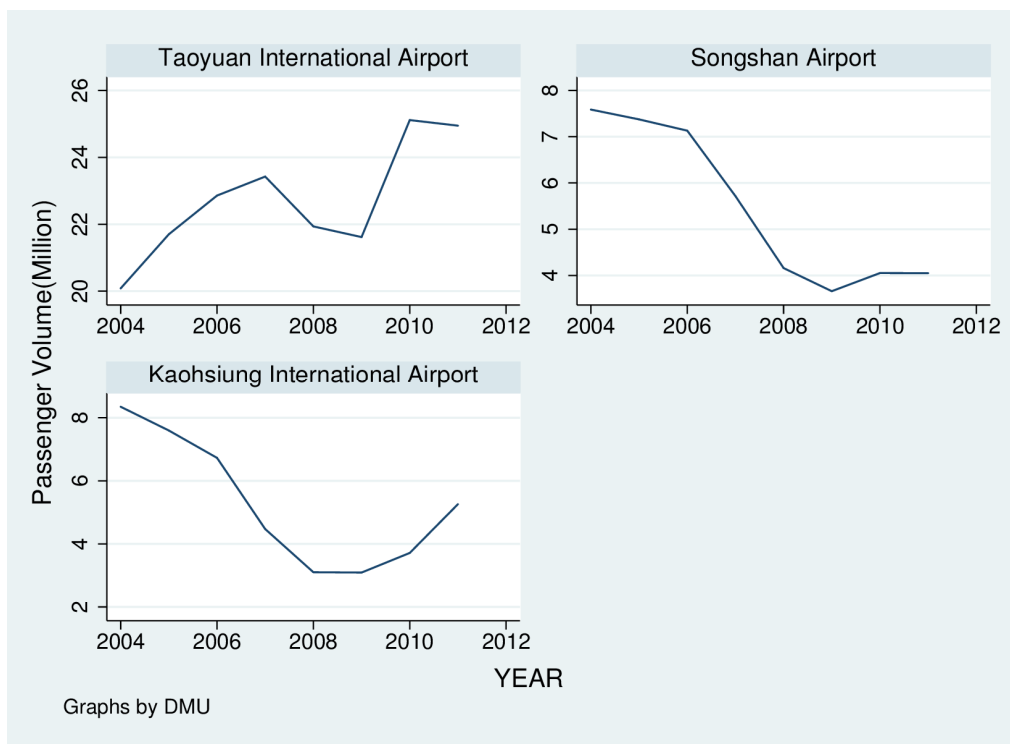
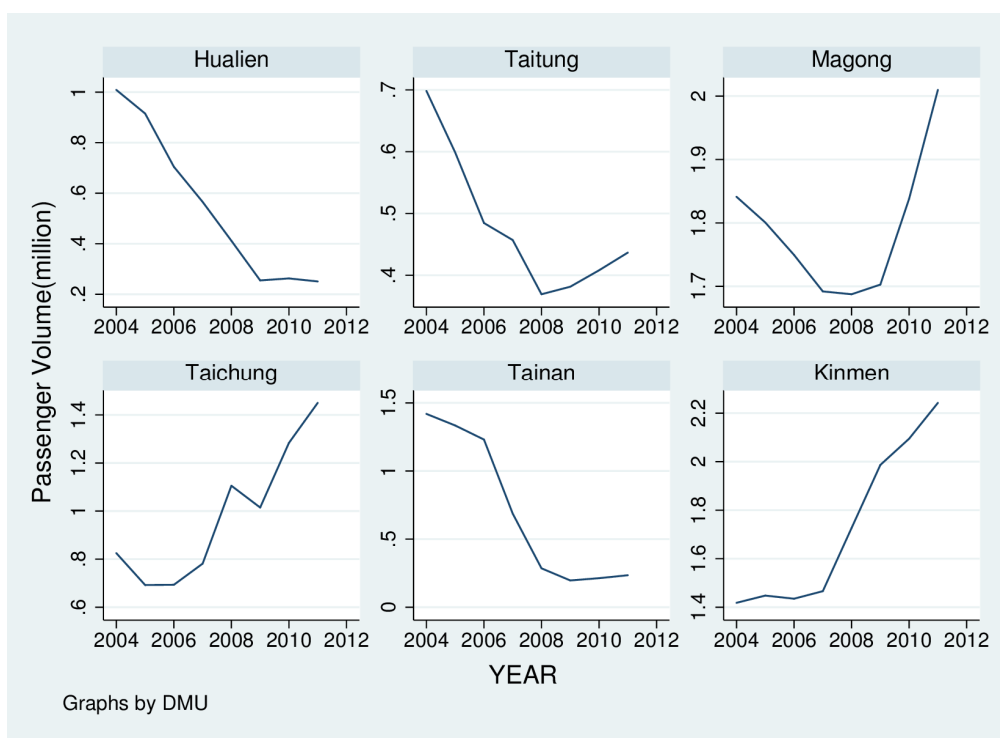


Figure 4: Passenger Volume Trend for some Typical Airports in Taiwan



Suppose there are n DMUs for which the efficiency score is calculated. For each DMU there are m inputs and s outputs. For a specific year, \mathbf{X} and \mathbf{Y} are the input and output matrices respectively. s_i^- is the slack of input i for DMU o and $\boldsymbol{\lambda}$ is a non-negative vector $\boldsymbol{\lambda} = (\lambda_1, \dots, \lambda_n)^T$. The efficiency value θ_o^t for DMU o at time t is obtained by solving the following problem:

$$\theta_o^t = \min_{\lambda, s^-} \left(1 - \frac{1}{m} \sum_{i=1}^m s_i^- / x_{io} \right) \quad (1)$$

Subject to

$$X_o = \mathbf{X}\boldsymbol{\lambda} + s^-$$

$$y_o \leq \mathbf{Y}\boldsymbol{\lambda}$$

$$e\boldsymbol{\lambda} = 1$$

$$\boldsymbol{\lambda} \geq 0, s^- \geq 0$$

As we are eager to know the historical trend of Taiwanese airports' performance and how it is affected by the China factor and other characteristic variables, we apply Malmquist index calculation afterward for the productivity measurement, based on the efficiency score result of non-radial input-oriented SBM model above. Malmquist input index is developed into a productivity measurement by Fare, Grosskopf, and Lovell (1994) from the original idea of Malmquist (1953).

$$M_o = \left[\frac{\theta_o^t(x_o^{t+1}, y_o^{t+1})}{\theta_o^t(x_o^t, y_o^t)} * \frac{\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1})}{\theta_o^{t+1}(x_o^t, y_o^t)} \right]^{\frac{1}{2}} \quad (2)$$

Here $\theta_o^t(x_o^t, y_o^t)$ calculates the above input-oriented VRS model (1), comparing the production of DMU o at time t to the productivity frontier at time t . $\theta_o^t(x_o^{t+1}, y_o^{t+1})$ calculates the input-oriented VRS envelopment model, comparing the production of DMU o at time $t+1$ to the productivity frontier at time t , respectively.

Additionally, Malmquist Index can be decomposed into two parts: catch-up and frontier-shift. Catch-up effect indicates the change in relative efficiency of a specific DMU from period t to period $t+1$; Frontier-shift effect indicates the change in the frontier technology around a specific DMU from period t to period $t+1$.

$$M_o = CU * FS \quad (3)$$

(4)

$$CU = \frac{\theta^{t+1}(x_0^{t+1}, y_0^{t+1})}{\theta^t(x_0^t, y_0^t)}$$

$$FS = \sqrt{\frac{\theta^t(x_0^t, y_0^t)}{\theta^{t+1}(x_0^t, y_0^t)} * \frac{\theta^t(x_0^{t+1}, y_0^{t+1})}{\theta^{t+1}(x_0^{t+1}, y_0^{t+1})}} \quad (5)$$

where CU stands for catch-up effect and FS stands for frontier-shift effect.

4. RESULTS

We use DEA-Solver (Version 10.0) to calculate the DEA efficiency score and Malmquist index. The results are listed in section 3.1 to 3.3. The second-stage regression results and test results in section 3.4 are obtained via Stata.

Input Oriented VRS SBM

Results of input-oriented VRS model are shown in Table 2. Those with full efficiency are shown with white cells and shaded cells indicate low efficiency.

Table 2: SBM-I-V Efficiency Score

DMU	2004	2005	2006	2007	2008	2009	2010	2011
Taoyuan	1	1	1	1	1	1	1	1
Kaohsiung	0.769353	0.804921	0.763018	0.875124	1	0.753767	0.714564	0.623997
Songshan	1	1	1	1	1	1	1	1
Hualien	0.58435	0.555488	0.479275	0.385938	0.283289	0.19006	0.189618	0.182221
Taitung	0.694452	0.714841	0.697383	0.540035	0.44977	0.534609	0.539313	0.535436
Magong	1	1	1	1	1	1	1	1
Taichung	1	0.73207	0.732061	0.634835	0.610309	0.560486	0.639007	0.691158
Tainan	0.799096	0.781894	0.730039	0.447778	0.247333	0.16782	0.163063	0.170801
Chiayi	1	1	1	1	0.389674	0.425881	0.398026	0.398361
Qimei	1	1	1	1	1	1	1	1
Wang'an	1	1	1	1	1	1	1	1
Lanyu	0.819752	0.988219	1	1	1	1	1	1
Lyudao	0.653847	0.671599	0.653019	0.677558	0.682305	0.651903	0.629085	0.676846
Kinmen	1	1	1	1	1	1	1	1
Beigan	1	1	1	0.584962	0.599952	0.642481	0.649289	0.663155
Pingtung	1	0.173222	0.151087	0.135798	0.124331	0.120765	0.122052	0.122052

Taoyuan, Songshan, Magong, Qimei, Wang'an and Kinmen are the 6 airports with full efficiency for the entire period. Except for the two capital airports (Taoyuan and Songshan Airports), the rest are all off-shore island airports. Kaohsiung, the second

biggest airport enjoys a full efficiency in year 2008 but faces decreasing efficiency behave since 2009. Hualien, Taitung, Tainan and Chiayi are the 4 airports confronted with a decreasing in efficiency since 2008. They are all small airports on the main Taiwan island. For the rest, there are no obvious shifts in efficiency. (Turning points for Beigan and Pingtung are due to a big construction and the following increase in input.)

Malmquist Indices

In Table 3 we see more light area (increasing productivity) on the right-hand side of year 2008 and more dark area (decreasing productivity) on the left-hand side. It shows more clearly that after 2009 almost every airport in Taiwan enjoys an increase in productivity, especially Kaohsiung, Songshan, Magong and Taichung airports, which all have direct flights to China.

Table 3: I-V Malmquist Index

Malmquist	04=>05	05=>06	06=>07	07=>08	08=>09	09=>10	10=>11
Taoyuan	0.970455	1	1	0.89846	1.020901	1.063923	1
Kaohsiung	0.966457	0.809812	0.799871	0.698511	0.740948	1.2323	0.996388
Songshan	0.552371	0.603279	0.490991	0.466601	0.835447	1.238678	1.361529
Hualien	0.8858	0.825454	0.804369	0.799473	0.701664	1.029555	0.960294
Taitung	0.949908	0.962843	0.787122	0.872472	1.136283	1.040366	1.02285
Magong	0.950492	1.010626	0.97148	0.979018	0.902955	1.274775	1.152318
Taichung	0.690981	0.960663	0.884156	1.043512	0.885757	1.220758	1.114377
Tainan	0.896155	0.909021	0.622626	0.572991	0.716769	1.00805	1.051322
Chiayi	0.865841	0.91396	0.5734	0.391761	1.06138	0.946415	1.019584
Qimei	1.073039	1.006904	0.994883	1.008695	1.014983	0.978614	0.99857
Wang'an	1.000527	1.044849	0.994917	1.000017	1.030529	0.97055	0.998791
Lanyu	1.101359	1.110826	0.997029	0.934062	1.243842	1.144537	1.000018
Lyudao	0.975225	1.019262	1.049688	0.997696	1.020449	0.948005	1.07085
Kinmen	1.071665	0.990474	1.148917	1.292277	1.0934	1.064796	1.048295
Beigan	0.730759	0.950789	0.477362	1.036779	1.062957	1.028248	1.016207
Pingtung	0.15486	0.887884	0.891436	0.92334	0.977228	0.999884	1
Nangan	0.845858	0.867175	0.921815	1.077861	0.984109	0.920374	1.098163
Hengchun	0.988481	0.997418	0.994539	0.998913	0.997499	1.000126	0.999767
Average	0.870568	0.937291	0.855811	0.888469	0.968172	1.061664	1.050518

Among these airports, a special example is Songshan Airport. Being the first airport in Taiwan and the only airport within Taipei city, Songshan Airport used to be the sky gateway into Taiwan until 1979 when Taoyuan International Airport¹² started operation as one of the "Ten Major Construction Projects" in Taiwan and at the same time

¹² Was named as Chiang Kai-shek International Airport from 1979 to 2006.

replaces Songshan Airport as the only international airport of Taipei. However, thanks to the "Three Link" agreement, Songshan Airport opened its international routes again to Hongqiao Airport of Shanghai in 2010. As part of Taiwanese President Ma Yin-jeou's "Golden Aviation Circle in Northeast Asia" campaign¹³, the flight services between Songshan Airport and Haneda Airport of Tokyo resumed operation in the same year. Moreover, in 2011 the flight service between Songshan Airport and Gimpo Airport of Seoul also started operation. As a result of the newly opened China routes and other northeastern Asian routes, Songshan Airport's decreasing trend due to the declining demand for domestic flights abated in 2009 and since 2010 Songshan Airport embraces strong increase ever since.

Decomposition of Malmquist index

Figure 5 illustrates the Catch-up Effect, Frontier-shift Effect as well as the Malmquist index of all the airports in the specific period. In the original Malmquist index graph, it looks more like chaos where the increasing trend is not so clear, although we can still tell that more values before the year 2008-2009 is below one while more values afterward is above one.

In the Frontier-shift Effect graph, we could understand this radical change more clearly: almost every DMU has a Frontier-shift Effect value less than one while most of them enjoy a value above one after 2008-2009 period. By contrast, the graph of Catch-up Effect shows a different trend. The values are dispersing before the year 2008-2009, where the smallest value is around 0.2 and the biggest value exceeds 1.2. After the year 2008-2009, however, the values are congregated with a distance around 0.2 between the biggest value and the smallest ones.

Second-Stage Regression

At this stage, we use regression models to verify the impact of several characteristic factors. At first, we run the following fixed effect, random effect to test the factors affecting airports' DEA efficiency scores:

$$DEA_{it} = X_{it}\beta + \alpha_i + U_{it} \quad (6)$$

¹³ Direct flights from Taipei's Songshan Airport to Seoul's Gimpo Airport to begin in March. Taiwan's president continues to carry out his "golden routes". CNN Travel 15 November 2011 <http://travel.cnn.com/seoul/visit/direct-flights-taipeis-songshan-airport-seouls-gimpo-airport-begin-march-487057>

The X_{it} here include the following dummy variables: CN indicates whether the airport operates a direct China route or not. OFF indicates whether the airport locates on an offshore island (1) or on the main Taiwan Island (0). INT shows at least one international route is connected to this airport and ML suggests whether the military force also uses this airport. The Mega and Mini variables are used to measure the passenger size of the airport.

Figure 5a: Progression of catch-up effect

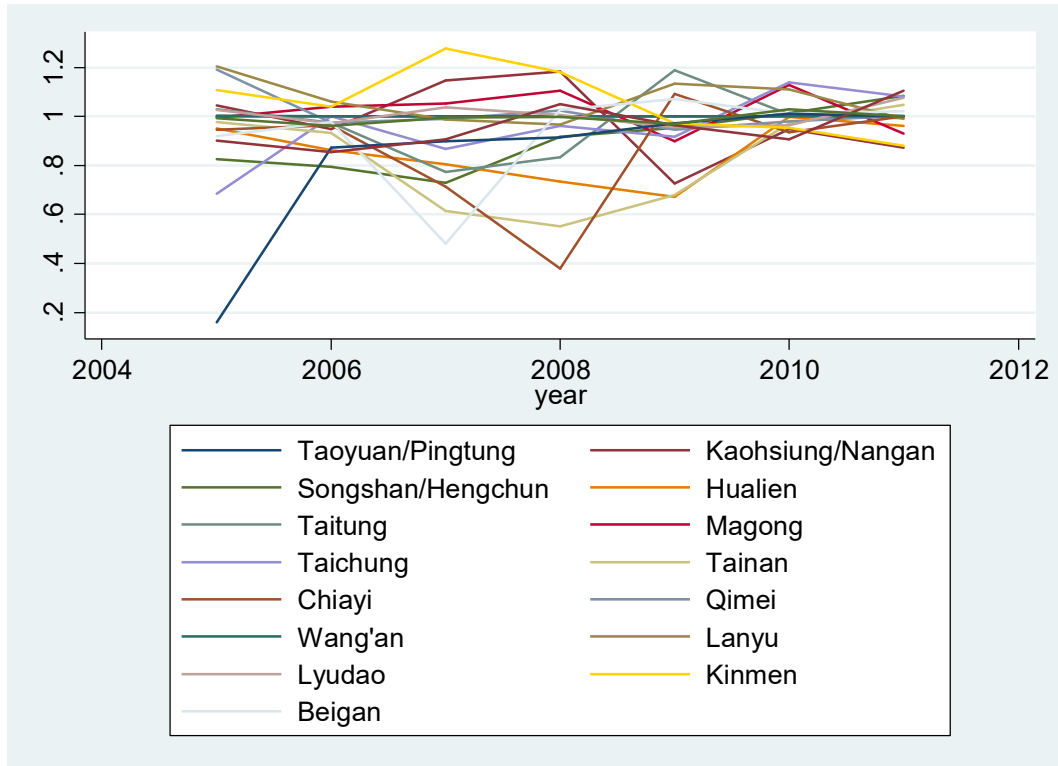
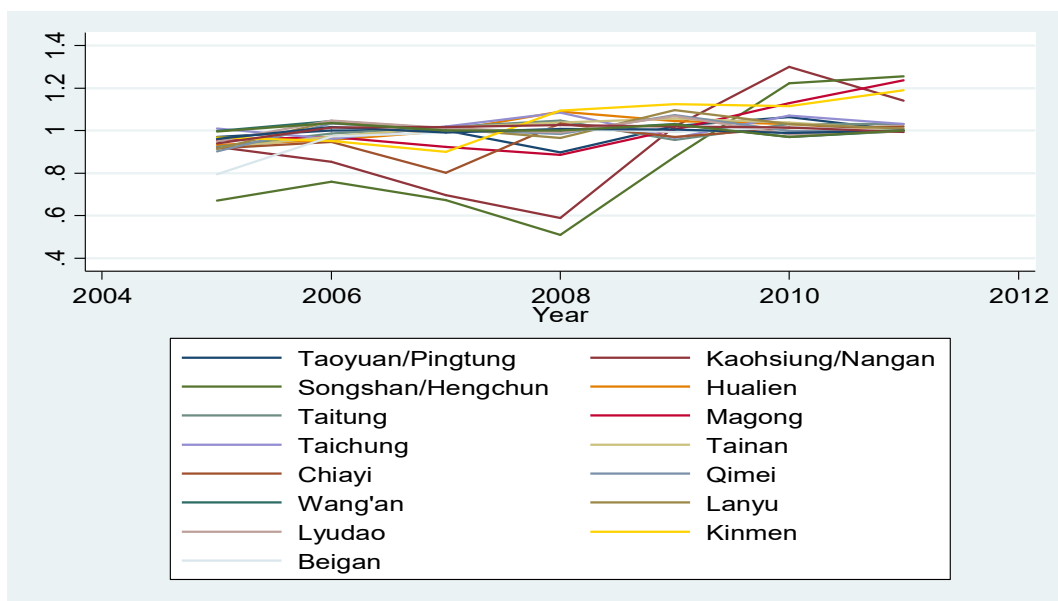


Figure 5b: Progression of frontier-shift effect



An airport is classified as “Mega” airport if the passenger volume exceeds 10 million and “Mini” airport if its passenger volume is less than one million. In a fixed effects model OFF, ML and Mega are excluded from X_{it} because these variables are time-invariant. Relatively, in a random effects model we could include all these variables with the assumption that α_i is not correlated with X_{it} . In the Hausman and Taylor model, however, the restriction of no correlation between α_i and X_{it} could be relaxed without losing those time-invariant regressors. Hausman Test is applied to verified which regressor is correlated with the individual effect α_i .

$$W = \frac{[\widehat{\beta}_{\{FE,k\}} - \widehat{\beta}_{\{RE,k\}}]}{[\text{se}(\widehat{\beta}_{\{FE,k\}})^2 - \text{se}(\widehat{\beta}_{\{RE,k\}})^2]^{\frac{1}{2}}} \quad (7)$$

The test results for CN, INT and Mini variables are 0.443, -1.175 and 1.529, which all have a p-value larger than 0.05. The Hausman Test for the overall model shows consistent result of a chi-squared value at 2.52 and a p value at 0.47. As a result, random effects model is preferred. We list both results in Table 4, with a pooled Simar & Wilson efficiency analysis model as a reference. In Table 4, we find negative relationship between the DEA efficiency score and the dummy variable CN. This might be an unexpected outcome before further exploring. Table 5 shows us the regression result for Malmquist index. At a significance level of 5%, the dummy variable CN has positive impact on the improving of productivity of Taiwanese airports. International route also brings positive effect to Malmquist index, with a larger coefficient and a bit higher significance. On the other side, in pooled OLS and random effect model offshore island airports show a strong positive gap with the airports on the main Taiwan island.

From the regression result of Malmquist index, the airports with a direct China route do increase faster than their counterparts. Why is the CN variable negatively related with the DEA score then? An overview of the data structure gives us a possible answer. Eight Taiwanese airports were opened from 2009 to Chinese routes. Taoyuan and Kaohsiung are permitted for regular flights while Songshan, Hualien, Taitung, Taichung, Kinmen and Magong are for chartered flights. Although capital airports Taoyuan and Songshan, along with offshore island airports Kinmen and Magong show full efficiency along this period, we should notice that smaller airports in Taiwan island like Hualien, Taitung and Taichung are also appointed to Chinese routes. Although they do show a

progress in their efficiency, as we observed in the Malmquist index, their absolute values of DEA efficiency scores are lower than their counterparts. In addition, Kaohsiung airport does not seem to be successful even after the agreement. As a result, we see the negative sign in the regression result of DEA efficiency score.

Table 4: Regression Results for DEA Efficiency Scores

	Pooled Simar & Wilson	Fixed Effect	Random Effect
CN	-0.1505** (0.054)	-0.0992* (0.016)	-0.101* (0.012)
OFF	0.3065*** (0.000)	0 (.)	0.320** (0.002)
INT	0.1827*** (0.051)	0.00644 (0.920)	0.0334 (0.575)
ML	-0.0099 (0.046)	0 (.)	0.0349 (0.737)
Mega	0 (.)	0 (.)	0.300 (0.171)
Mini	-0.2891*** (0.059)	-0.117 (0.175)	-0.193** (0.006)
Constant	0.6593*** (0.000)	0.840*** (0.000)	0.710*** (0.000)
Observations	126	126	126
Adjusted R^2	0.467	-0.114	
rho		0.709	0.585

p -values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Regression Results for Malmquist Index

	Pooled	Fixed Effect	Random Effect
CN	0.141*** (0.001)	0.142*** (0.001)	0.143*** (0.000)
OFF	0.195*** (0.000)	0 (.)	0.201*** (0.000)
INT	0.0959*	0.200**	0.112*

	(0.040)	(0.002)	(0.025)
ML	0.0259 (0.487)	0 (.)	0.0219 (0.635)
Mega	0.0716 (0.349)	0 (.)	0.0495 (0.607)
Mini	0.0411 (0.302)	-0.143 (0.102)	0.0277 (0.549)
Constant	0.765*** (0.000)	0.965*** (0.000)	0.770*** (0.000)
Observations	126	126	126
Adjusted R^2	0.227	0.080	
rho		0.585	0.0966

p -values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. CONCLUSIONS AND FOLLOWING WORK

According to the results of DEA efficiency scores and Malmquist index, along with the regression result for both of them, we try to shed a light on the effect of direct China routes on the efficiency of Taiwanese airports. As discussed in the previous chapter, China route variable is negatively related to DEA efficiency scores due to the selection of appointed airports. It is likely that economic benefit is not the only reason to open a specific airport. Otherwise, the best strategy would be opening only Taoyuan International Airport in order to support its target to become a hub airport in the Asia-Pacific region. The cross-strait relation, as well as the election and politics in Taiwan also played an important role here. On the other hand, the China route variable shows positive effect on Malmquist index. Those assigned airports may be less efficient in the beginning but they are growing faster than others are. After the Three Links agreement, the overall productivity of Taiwanese airports increases but the gap between big airports and small airports in the sense of efficiency also increases.

How to keep the growth of big international airports in the competition with other Asian airports, as well as how to deal with the inefficient small airports without prejudice against local residents are the two important topics facing Taiwan civil aviation authorities. Possible future research would be on: (1) Figure out the reason behind the negative relationship between Chinese routes and Taiwan airports efficiency. (2) Construct an applicable methodology of adopting Assurance Region model in calculating the Malmquist Index.

As a final remark, we point out that traditionally, Tobit regression was used due to the interval of the DEA scores being between zero and one. However, John McDonald argues that since DEA efficiency score is a fractional data instead of being generated by a censored process, Tobit model may not be appropriate. An ordinary least square is consistent in this situation (McDonald, 2009). Additionally, others argue that a fractional regression model is the best fit for analyzing DEA scores in the second stage (Ramalho, Ramalho, & Henriques, 2010). Verifying the result of this paper by using fractional regression model would also be a possible following work.

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PAKISTAN'S NATIONAL AVIATION POLICY (2015)
FLIGHT PATH, CROSS WINDS & OFF-COURSE

Wali Mughni¹

ABSTRACT

Pakistan is an emerging economy where the aviation policy, promulgated in April 2015, was designed to dramatically boost aviation activities, which in turn was expected to enhance the country's economy. Ownership and market access liberalization, stringent adherence to international standards, subsidies, taxes and duty exemptions/reduction, emphasis on education, investor friendly environment, greater safety and security assurance, and above all, travel and business friendly culture was the strategic direction that Pakistan's forward looking National Aviation Policy anticipated to achieve. Well after a year of promulgation, poor internal and external stakeholder buy-in of the policy continues to mar expectations of the industry's stability, growth and prosperity. This paper critically looks at stakeholder apprehensions and suggests possible remedial measures that may be adopted for a course correction.

KEYWORDS

Aviation policy; Pakistan; liberalization; stakeholder buy-in.

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1. INTRODUCTION

Pakistan's National Aviation Policy 2015 (NAP-2015), was formulated after 15 years. The policy marked an important milestone in Pakistan's aviation history, where Pakistan's Government along with all stakeholders, representing various segments of the aviation industry, collectively developed a comprehensive and forward looking document. The policy outline and key strategic aspects were also deliberated at length by industry experts and internationally acclaimed aviation policy consultants. While the key objective set forth for aviation division was to develop a safe, secure and efficient air transportation structure, the policy also extended its realm to create an environment to foster economic activity through dynamic and innovative strategic measures. This paper scrutinizes and analyzes overt as well as subtle responses of internal and external stakeholders with regards to policy buy-in. Notwithstanding extensive involvement of stakeholders prior to the formulation of the policy document, the policy once promulgated created dissents amongst many stakeholders. This resulted in widespread criticism of the policy; and the prevalent psyche of operators as well as regulators has de facto formed a barrier for new-entrants and induced greater hindrances for the incumbent operators. The desired cultural change in the existing environment did not come about as the policy failed to effectively bring in the expected values (by incorporating dynamic and bold strategic measures) that the policy hoped to inculcate. With known bugs and anomalies in the previous policy of year 2000, the 2015 policy aimed to rectify and debug weak-links in the system. The Nation Aviation Policy 2015 formulation was initiated with the realization that a non-user-friendly environment existed and that it was pervasively hampering growth and prosperity.

The paper scrutinizes and analyzes the policy's key features and the proposed changes that it aimed to bring about. The study recognizes the positive aspects and then reviews the extent of effective implementation, the degree of stakeholder buy-in and new operational glitches that emerged as a consequence of the new policy. Analyzing the ambiguities and areas that were not readily accepted (and not implemented or half-heartedly implemented), the study further evaluates possible reasons of resistance to change, ingrained cultural inertia and reconciliation with status quo as the preferred option. Concurrently, it was observed that amongst operators in particular there is widespread criticism about the policy that continues to foster an undesirable operational environment that is adversely impacting growth prognosis.

It was also observed that incumbent aviation businesses are eager to grow and expand as the market demand for aviation continues to grow at a fast pace. It is evident that there is a widening gap between supply and demand of various services within the aviation industry. Therefore, while many

entrepreneurs are enthused to expand their businesses, many are lined up to avail the business opportunities that exists within the aviation space. Notwithstanding the fact that the policy intended to bridge this gap, it unwittingly failed to achieve its major objective of facilitating growth. De facto, many aspects of the policy, the attitude of a number of regulators, and the socio-political environment, are an apparent deterrence to prosperity and growth and subtly but surely the overall milieu is perceived by many as a show-stopper. Such cognitive dissonance to invest or hold (wait and see) continues to bother both incumbent operators and prospective new businesses (market entrants) into the aviation domain.

2. METHODOLOGY

To better grasp the on-ground reality and deeper understanding of stakeholder issues, perceptions, popular understanding and common viewpoints about the policy, subjective data and relevant information was gathered through aviation industry grapevine. Prominent aspects were then identified, which were followed by surveys, targeting a diversified sample of stakeholders. Interviews were also conducted, with discussions and deliberations on applicable identified topics, and finally, detailed analysis was done using Q-methodology and factor analysis where applicable.

3. STUDY OBJECTIVE

Having realized the prevalent situation and understanding that the intent of the policy formulators was to achieve certain goals through policy implementation; and recognizing the evident diagnosis that the ensuing post policy results have fallen short of the expectations, this paper ventures to recommend and suggest a few remedial measures or corrective actions. To draw an analogy (in the aviation lingo), it may be described as 'a policy that did not fly the expected route', while the cross-winds (criticism and inadequate buy-in by the operators and regulators) continues to drift the industry towards the proverbial uncharted territory of possible downdrafts and wind shears ahead. Finally, moving forward, the paper recommends a course correction to regain the desired track, that the policy originally intended to fly (attain).

4. IMPLEMENTATION / POLICY BUY-IN: ON-COURSE & OFF-COURSE

Hitherto, the service provider function and regulatory function of both Pakistan Civil Aviation Authority (PCAA) and Airports Security Force (ASF) were under their own domains, and this conflict of interest resulted in obvious inefficiencies and latent irregularities. In other words, both ASF and PCAA were service providers and supposedly, regulators/auditors of themselves. Therefore, in order to ensure effectiveness and oversight of aviation safety and

security in particular, regulatory and service provider functions were made independent of each other with independent functions. According to the policy, Pakistan Civil Aviation Authority shall be the regulator and the Airports Security Force is mandated to be the service provider. Therefore, the inherent conflict of interest is resolved.

Similarly, Safety Investigation Board (SIB), which was under Director General PCAA, is now made independent and now reports to the Minister of Aviation to ensure that findings and safety recommendations of an investigation remain unbiased.

While the above two policy changes were accepted and implemented with zero or negligible resistance, few other aspects that may be considered as continuing bone of contention where reluctance to implementation in true letter and spirit has been observed to be evident. These are discussed in the succeeding paragraphs.

Over the years, protectionism and restrictive market access policy has suppressed the growth potential of the aviation sector in Pakistan. Therefore, transition to more liberal Air Service Agreements (ASAs), was stated in the policy, and it was expected that this would accord greater business freedom, higher levels of customer satisfaction and greater micro and macro-economic growth of the aviation domain (Dawna Rhoades, et al, 2015). As per policy, following the norms and conventions, Pakistan is expected to pursue bilateral open skies policy towards other countries based on the principle of reciprocity.

The proponents of the dissent of this aspect of policy (i.e. liberalization with regards to ASAs) was propagated from executive and managerial level individuals who hailed from the national air careers. Their point of view was projected in a manner that indicated a strong culture of protectionism, and propagating an argument that such a liberal approach was anti-patriotic and that national airline's interest would be compromised. Therefore, a large majority of individuals who subscribe to restrictive market access vehemently opposed the policy in favour of the protectionist approach in the larger interest of the national careers. To ascertain this approach a survey was carried out. The survey results on a Likert scale of 5 indicated a mean of 4.7 with all 20 sample subjects (heterogeneous aviation/airline professionals) specifying their opinion between 4 and 5 (out of 5) in favor of dissent to this aspect of policy.

Those policy changes, as stated in the NAP 2015, that appear to be attractive incentives but have not yielded any significant results, except a few half-hearted prospective investors, are discussed below:

Global trend in participative and cooperative business structures has given credence to the concept of Public-Private Partnership (PPP) models for operation and management of airports. While the private sector specializing in airport management enhances passengers' travel experience by investing in modernization of facilities; the Government is, as per policy, required to focus on the oversight of the operations and ensure accountability of the services, while the private party is expected to run the operations and provide services. PCAA shall (according to the policy guidelines) work with global airport management companies to find suitable PPP models to be followed for the operations and management of landside and terminal facilities of airports. Accordingly, this policy shall also be implemented for small, medium and large airports, with a view to exploit their commercial and tourism potential.

As per the policy, airport infrastructure was to be modernized to meet future needs of aircraft, passenger and cargo traffic. It included refurbishment of airport buildings and rehabilitation of airside infrastructure. Air cargo import and export would further strengthen the business community and help in promoting Pakistani products globally. According to the policy, two state-of-the-art cargo villages are to be established, one in the North and one in the South.

In spite of the incentives offered in the PPP model, companies have not yet come forth to avail the opportunity. It appears that either the policy (and the opportunity) has not been advertised, or not advertised enough, or the incentive package needs to be re-evaluated. In either case, more research needs to be done to identify the cause of poor response.

Aspects of the policy which are grossly misinterpreted are discussed below:

Another impediment in the growth of air travel and cargo was unjustified taxes and duties, which was hampering investment and not yielding any significant revenue for the Government. Rationalization of duties and taxes in the aviation sector shall now (according the stated policy) help attract more businesses, thus resulting in the growth of the industry and ensuing benefits to the end-users. In accordance with the policy, the taxes were supposed to have been restructured and simplified in line with the best international practices. Higher taxes and duties on aviation businesses negatively impact transportation activity in the country, which in turn, adversely impact Gross Domestic Product (GDP) and employment. Therefore, the policy strongly advocates that there should be no taxes and duties on investment in aviation sector.

The objective and the intent of this policy regarding tax breaks and exemption of CAA charges was to facilitate incumbent operators and to attract investors in various sectors of aviation business, including establishment of quality Maintenance, Repair & Overhaul (MRO) organizations.

Notwithstanding the above, the statement of the policy (para 4.8 [b]) guideline that "Import or lease (wet/damp/dry) of any General Aviation (GA) aircraft shall be tax and duty free", was misinterpreted and the commercial aircraft category selected was any aircraft that weighed above 15,000 kg was put under Pakistan Customs Tax Free regime. Those aircraft that were below this weight limit were not mentioned, and therefore, not included. Pakistan Customs allots Pakistan Customs Tariff codes (called PCT codes) and publishes all leviable duties and taxes against them. The PCT code allotted for exemption of duties and taxes is 8802.4000, which is for all categories of aircraft weighing above 15,000 kg. It is also worth noting that that EASA (European Aviation Safety Agency) refers to the Convention on International Civil Aviation, and quotes its Annex 8 (for Airworthiness of Aircraft), that specifies standards that fixed wing aircraft with maximum takeoff weight of greater than 5,700 kg must comply with. Furthermore, most General Aviation (GA) aircraft are below 5,700 kg MTOW (Maximum Takeoff Weight) category. Therefore, this misinterpretation appears to be arbitrary and not based on any weight category that could be confused or misinterpreted with. The only place where 15,000 kg (MTOW) category of aircraft appears is airport landing and parking fee structure of various airports across the globe. It can thus be assumed that 15,000 kg limit is not based upon any precedence or relevant logic.

Similarly, the policy envisaged reduction and/or removal of taxes and duties on GA aircraft, aircraft spares and material for maintenance of GA aircraft are also required to be given the same status. The policy did not get implemented in letter and spirit; additionally, it also introduced more complications in the process of import which should have been made simpler and user friendly. Thus, cumbersome and time consuming processes are negating the intent and purpose of the policy. Procedural complexities and misinterpretation in this area of operation is hurting the GA operations in particular and the aviation industry in general. This information was given by few senior GA operators and the case was further investigated and found to be absolutely true and valid.

The policy guideline to address the 100 LL (Low Lead) supply and distribution monopoly has also proven ineffective. No change to monopolistic fuel supplier for aviation fuel for GA operations i.e. 100 LL continues to plague GA operations, particularly the flight training

operation. Albeit it is very clearly and categorically mentioned in the policy that the monopoly of supplier and distributor of 100 LL aviation fuel shall be addressed so that cost of fuel is reduced (due fair competition), nothing concrete is visible to break the monopolistic powers of the supplier. It is known that fuel cost can be as high as 75% of the Variable Cost of GA operations. Therefore, to contain costs and offer flying training at an affordable price, it is incumbent on the Government to reduce the price of fuel. It can be done by incentivizing new entrants (suppliers of 100 LL) and breaking the monopolistic approach of a single supplier. Alternatively, a cost cap was also not enforced, that could have kept the cap (upper limit) to preclude exorbitant prices. Resultantly the GA operation continues to suffer, and the end result is that the training of pilots has become cost prohibitive to many prospects who can ill-afford the fees that the flight training schools are charging to sustain their operations.

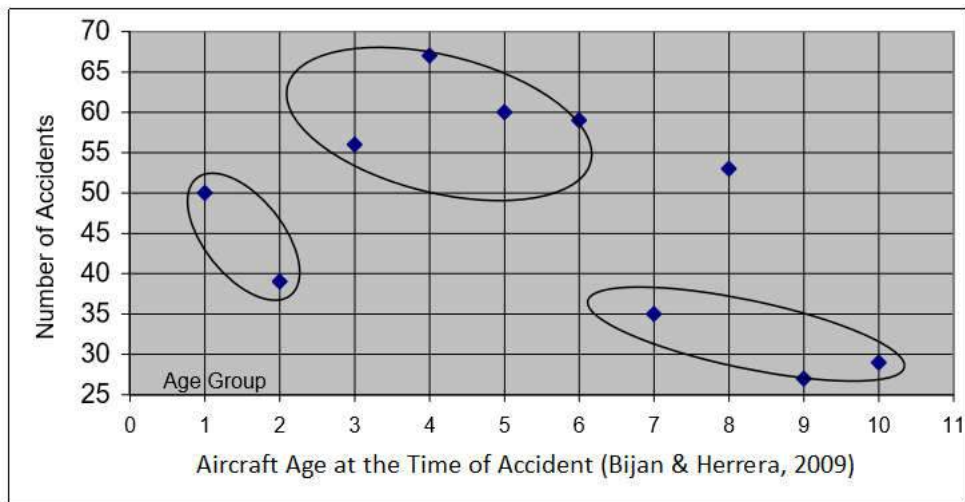
Recent air crashes and incidents have highlighted the need for stringent checks and procedures. In accordance with the new policy, PCAA is now reviewing such procedures and regulations for greater safety and efficiency of air transportation services. The policy also encourages induction and operation of more efficient aircraft by Pakistani operators. Such modern aircraft are safer and more fuel efficient. As a measure to ensure that only sound investors/operators venture in the aviation business, the paid-up capital requirement to obtain relevant licenses has been enhanced and the chronological age of aircraft for initial induction has been capped at 12 years.

The chronological age limitation to induct aircraft less than 12 years was introduced for the following reasons and logical assumptions:

- a) Twelve-year period was primarily based on two 'D' checks which are required to be completed on aircraft (which are generally approximated at 6 years' chronological age interval).
- b) Most newer aircraft (≤ 12 years' chronological age) are relatively more fuel efficient than their older counterparts.
- c) Most newer aircraft (≤ 12 years' chronological age) are relatively greener than older aircraft.
- d) Most newer aircraft (≤ 12 years' chronological age) have better navigation and safety equipment installed as compared with their older versions.
- e) The maintenance cost of newer aircraft (≤ 12 years' chronological age) is generally less than older counterparts.

- f) This also indicates that the aviation business entity that is buying or leasing the aircraft are financially stronger than those who look for relatively older and cheaper aircraft.
- g) While there are research studies that have indicated that there is no significant correlation between age of aircraft and fatal accidents up to 26 years of chronological age (Hansman 2012), there are a few studies that suggest that there is a positive correlation (Vasigh and Herrera, 2009) in their comprehensive study on "A Basic Analysis of Aging Aircraft, Region of The World, And Accidents." Interestingly, the rate of accidents and the probability of incidents, occurrences and accidents drop significantly just after 6 years (i.e. after 'D' Check, see Figure 1 below). The study was conducted on a global database of 549 aircraft accidents analyzed between 2000 and 2007.

Figure 1: Number of Accidents



- h) With reference to the study stated above, it appears that statistically and historically, the safest period in the life of an aircraft is just after 'D' Check. Thus, when the policy states less than 12 years it is assumed that businesses desirous of inducting aircraft for RPT (Regular Public Transport) operations would like to induct aircraft just after the first 'D' Check. Induction of such aircraft would have the highest probability of safety (least accident probability).

Table 1: Aircraft Accidents by Region

Aircraft Accidents by Region		
	Accidents	Probability
North America (NA)	121	25.42%
Latin America (LA)	60	12.61%
Europe (EU)	99	20.80%
Africa/Middle East (AF)	69	14.50%
Asia/Asia Pacific (AP)	127	26.68%
Total	476	100.00%

Source: Vasigh & Herrera 2009

- i) Another study (Vasigh & Herrera 2009, see Table 1 above) also clearly indicates that Pakistan falls in a region where the probability of accidents is one of the highest in world. Therefore, to mitigate other factors and reduce the probability of occurrence, all possible measures must be undertaken for ensuring greater safety. Therefore, it can be concluded that 12-year chronological age limitation for induction of aircraft is a positive step and must be taken in the right spirit.

Another concern sounded by most individuals is an objection to the enhanced paid-up capital limit. For domestic charter operations, the new policy requires that a company applying for the domestic charter license would be required to show a paid-up capital of Rs. 25 million. Although this seems like an excessive hike in the required amount (from previously 2 million to the new limit that is 12.5 times higher); it may be noted that the amount approximates only \$250,000. A company that desires to enter the aviation business offering charter services must at least be able to bear the monthly lease charges, maintenance charges and insurance charges and that may add up and exceed the paid-up capital stated in the policy. In the larger interest of the public that a new entrant wants to serve the market, it must have enough financial strength to sustain initial operations and bear losses as may be expected during the initial period after commencing operations.

Wet lease cost will be no less for aircraft typically deployed in an RPT operation. The required paid-up capital for RPT license is only \$5,000,000 (approx.) which for an operation with at least 3 aircraft (another policy requirement) would not be enough to cushion losses before break-even level is attained. Since the public is involved (as customers and clientele who may plan their business and travel requirements with the growth of the aviation services in the region, may be adversely affected if an airline closes down, bankrupts or simply performs inefficiently or compromises safety. It may be noted that there is a recent history of failures of new entrants because of lack of adequate financial strength, wherein the concerned entrepreneurs suffered losses while the general public was deprived of the services promised to them. Due to such repeated failures due to insufficient funding capability of the RPT operators, the aviation business environment has suffered in terms of consumer confidence, reputation and safety record. Therefore, it may be argued that it is reasonable to expect better performance by a more serious and financially sound new entrant in the aviation business. Thus the policy justifies the economic oversight as required by ICAO.

Scheduled routes to politically and socially deprived locations are now ear-marked to be served for those entrepreneurial business entities who want to avail the opportunity. According to

the policy, the operators are offered attractive incentives such as waived-off fees and other allied charges while operating to and from these locations. For such operations a new term was coined -- 'socio-political' routes. These routes are planned because political integration and social welfare was the primary objective of this operation and economic considerations were secondary.

Notwithstanding the incentives, there has been little or no response from the entrepreneurs to avail this business opportunity. The reason for such a lackluster response could be as follows:

- a) Lack of awareness about the opportunity, particularly for those who are capable of undertaking this venture.
- b) Not enough conducive environment for the entrepreneurs to venture in to such business.
- c) Non-business friendly attitude of the PCAA (Pakistan Civil Aviation Authority). This aspect is based on a few random interviews with entrepreneurs considering market entry in the aviation domain. A survey is underway to ascertain reasons with a greater degree of confidence.
- d) Perceived insecure environment (security concerns) in the remote areas where the identified airfields are located on the specified 'socio-political' routes.

The policy puts strong emphasis on up-gradation of air navigation infrastructure and effective utilization of satellite based technology to improve safety standards and future capacity needs of air traffic. However, except a few positive changes, not much improvement in the facilities is visible and it appears that the priorities are moving away from what was expected from the policy.

In order to capitalize the true potential of General Aviation (GA), apart from routine training of aviation personnel, other GA areas like aero-sports, tourism, agricultural pesticide and seeding sprays, cloud seeding, etc. would be encouraged and facilitated wherever considered possible and appropriate. Befitting incentives were to be offered for the growth of this sector. This seems to be an unattended and unaddressed area of the stipulated GA growth plans indicated in the policy.

Keeping in view the rapidly changing technology in the aviation industry, training and skill development of aviation personnel has also been given due importance in this policy, but no effort by the authorities to promote training and education is visible. This is a perception

shared by most incumbent aviation training and education institutes. This too is a survey based conclusion.

5. IMPEDIMENTS TO SUSTAINED GROWTH (DRAG)

Issues that are perceived as road blocks to good governance, development and sustained growth of the industry were identified and are summarized below:

There has been inadequate human resource development. The regulators as well as the service providers lack adequate formal training on international standards. The operators too short handed on qualified human resource with desired training, certifications and educational qualifications. Training and education in all segments of aviation industry must be given serious attention and priority. Formal training of technicians, education in aviation management for managers, international certifications for air traffic controllers, air transport & economic regulators, airspace and aerodrome safety regulators, airworthiness and flight standard inspectors are few of the areas that deserve attention. Emphasis on human resource development in finance and information technology is also lacking. Additionally, there seems to be a perpetual shortage of regulators, particularly flight standards and airworthiness regulators. This shortage adversely affects ramp inspections which the industry needs for efficient approvals and certification processes.

The policy emphasizes that there is a cultural change required in being customer-centric, safety and security-conscious and being positive in our attitude with high moral values and good work ethics for all PCAA personnel in particular and the aviation industry in general. This is a known weakness and concerted efforts need to be initiated to bring about a constructive change. Changing culture takes time and results will not be immediate, but we must initiate the efforts to make the desired change today. The future of Pakistan's aviation system depends on this change.

There is slow and inadequate infrastructure development (aerodrome facilities and navigation facilities on the airside). This aspect has been neglected in the past and is supposed to be addressed on priority. There are also huge gaps in communication and surveillance coverage in the western and northern part of Pakistan airspace due to limitations of conventional transmitters and sensors in hilly terrain. This could have been resolved long ago by application of satellite technology like CPDLC (Controller Pilot Data Link Communication), and ADS(C) [Automatic Dependent Surveillance (Contract)]. These technologies are ideally suited not only for the hilly terrain but are also cheaper alternates to conventional tools of

communication and surveillance necessary for air traffic control at long distances. Hence, action to aggressively address this issue is required as it relates to safety of air traffic transiting through Pakistan airspace.

The “procedures and regulations” are not user-friendly and act as a barrier to entry for new entrants in the industry. This aspect also needs to be addressed as soon as possible.

There is inadequate technology awareness, adoption and usage in all segments of the industry.

There is insufficient commercialization of non-aeronautical areas at the airports (e.g., real estate, car parking, food & beverages, retail stores, hotels, commercial plazas, etc.)

In the past, National Aviation Policy was also not implemented effectively. Therefore, National Aviation Policy-2015 implementation plan forms an integral component of the policy and timely implementation and follow up are structured in the system. Progress audit and remedial measures for non-performance is to be enforced. Steps to ensure implementation, stakeholder buy-in, and continual evaluation and assessment to see if the industry is moving on-track and on-schedule is important and critical to success.

6. RECOMMENDATIONS & CONCLUSION (COURSE CORRECTION CHECK-LIST)

It is conclusively determined that the buy-in of policy is equally important for successful implementation of the policy. In retrospect, it is agreed by most policy contributors (consultants, regulators and operators) that before the next policy is formally approved it is recommended that the policy’s various aspects may be circulated and formal and informal feedback must be taken and evaluated in a timely manner, and more seriously and comprehensively than it was done before. Furthermore, road shows, seminars and conferences may be conducted so as to inform and educate the stakeholders. Once the policy is formulated and approved, it must be implemented effectively. Periodically and in a systematic manner, the achievements must be measured, and time-lines considered, while never losing sight of the desired objectives of the policy.

The results of the policy must favorably impact local, regional and global business entities and passengers travelling within, as well as to-and-from Pakistan.

Incentivized involvement of foreign investors is a key component of the policy and incentive packages may be re-evaluated and tweaked (wherever necessary) to get better results. The

involvement of international reputable organizations and institutions is certainly expected to bring about greater collaboration, a favorable cultural mix and much needed enhanced confidence amongst all national and international participants. Economic well-being for all industry participants and stakeholders is a collateral advantage of the measures envisioned in the policy.

Periodic evaluations, change management and buy-in efforts through print, electronic and social media must also be exploited.

Reasons of resistance to change also need to be studied and evaluated. Deliberated corrective measures will have to be continually implemented and monitored to bring about a positive cultural change.

Table 2

Strategy to Cater for Resistance to Change		
Approach	Situation	Advantages
Education + Communication	Where there is lack of information or inaccurate information and analysis	Once persuaded, people will often help with the implementation of the change
Participation + Involvement	When a change in design is necessitated and there is considerable power to resist	People who participate will be committed to implement change and relevant information will be integrated in the change plan

Source: Harvard Business Review July-Aug 2008, Kotter & Schlesinger

“It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things.” Niccolò Machiavelli, *The Prince*.

As shown in Table 2 above, the strategy to cater for the resistance to change is primarily through apt education and effective communication. This strategy as elaborated and discussed by Kotter & Schlesinger’s article published in Harvard Business Review magazine (July 2008) is considered most suitable where there is a general lack of complete knowledge or inaccurate information about the subject at hand. Inaccurate analysis leads to false beliefs, and commonly accepted norms are difficult to change.

As aptly quoted by Kotter & Schlesinger: “It follows that an acceleration in the rate of change will result in an increasing need for reorganization. Reorganization is usually feared, because it means disturbance of the status quo, a threat to people’s vested interests in their

jobs, and an upset to established ways of doing things. For these reasons, needed reorganization is often deferred, with a resulting loss in effectiveness and an increase in costs.”

When a policy demands macro level change, macro level change management must follow. It is also pertinent to note the fact that an amenable relationship between the initiators and the people is mission critical for success. Equally important is a sincere effort, logical approach and a few dedicated professionals who may be taken on-board to make a team that disseminates and propagates the concepts that form the essential drivers to instill a change that is pervasive and progressive.

To get back to the desired track, all the above shall have to be considered. Albeit, time is of essence and it takes time to change, the effort must commence today to expect a positive change in the days and months to come.

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AN EVALUATION OF AIRPORT WAYFINDING AND SIGNAGE ON SENIOR DRIVER BEHAVIOUR AND SAFETY OF AIRPORT ROAD ACCESS DESIGN

Nur Khairiel Anuar, Romano Pagliari; Richard Moxon¹

ABSTRACT

The purpose of this study was to investigate the impact of different wayfinding provision on senior driving behaviour and road safety. A car driving simulator was used to model scenarios of differing wayfinding complexity and road design. Three scenario types were designed consisting of 3.8 miles of airport road. Wayfinding complexity varied due to differing levels of road-side furniture. Experienced car drivers were asked to drive simulated routes. Forty drivers in the age ranges: 50 to 54, 55 to 59 and those aged over 60 were selected to perform the study. Participants drove for approximately 20 minutes to complete the simulated driving. The driver performance was compared between age groups. Results were analysed by Mean, Standard Deviation and ANOVA Test, and discussed with reference to the use of the driving simulator. The ANOVA confirmed that age group has a correlation between road design complexity, driving behaviour and driving errors.

KEYWORDS

Airport; Senior driver; Driving behaviour; Road safety; Simulation

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1. INTRODUCTION

The importance, functions and design criteria of wayfinding and traffic signs are essential in designing a complete airport road access. Poor wayfinding provision discourages drivers and is not directed towards understanding the concepts or practice (Burns, 1998; Darken & Sibert, 1996; Montello & Sas, 2006) in airport areas. Previous literatures (Beijer, Smiley, & Eizenman, 2004; Burns, 1998; Charles & Haddad, 2007; Darken & Sibert, 1996; Findlay & Southwell, 2004; Fuller, 2002; J. R. Harding et al., 2011; J. Harding, 2012; Raubal & Egenhofer, 1998; Raubal & Worboys, 1999; Raubal, 2001; Smiley, Houghton, & Philp, 2004) discussed wayfinding and signage as a supporting role of the urban landscape and architecture. The design of signage, wayfinding, roads and the facilities provided for airport building is very important to all travellers, as airports contribute to high growth economies and affect the environment and quality of life.

The debate concerning visual effects caused by the proliferation of signs and wayfinding along roads has led to considerable discussion by transport planners. This is a major problem which threatens to become greater as more and more elements are added to roadside landscapes; much of the road furniture is not there to help with road safety and it is understandable and right that transport authorities consider this one of their main priorities (Transport Scotland, 2006). Ineffective signage around airport areas distracts from wayfinding. Harding (2012) stated that many airports have not established the concept of 'simple, functional and less is more' for airport signage systems. He suggests a simple wayfinding and sign message could help reduce the overall cost of poor signage systems which make them less attractive and competitive than neighbourhood airports (Alhussein, 2011; J. R. Harding et al., 2011). In many cases, drivers experience most difficulty in understanding the complete wayfinding process, resulting in distraction while driving (Bhise & Rockwell, 1973; May, Ross, & Bayer, 2005) in airport areas. This distraction (e.g. too much advertising signage) increases drivers' confusion and road accidents (Mitchell, 2010; Wener & Kaminoff, 1983) in airport road access.

Senior drivers and airport road access design has been discussed in section 2 and 3. The methodology of this paper was explained in section 4, followed by results in section 5 and discussion in section 6. Conclusion, limitation and future research of this study has been described in section 7, 8 and 9, respectively.

2. SENIOR DRIVERS AND AIRPORT ROAD ACCESS

There are challenges in defining when an individual becomes an elderly or senior citizen. Most developed countries set the age of senior citizen at 65 years old, but in other regions such as Africa, the “senior” threshold is much lower at 50 years (WHO, 2016). Orimo et al. (2006) stated that with recent technology in the medical and health science industry, the average lifespan has increased rapidly, thus, such a definition of elderly to simply include all persons over 65 years might be no longer appropriate for this era with a life expectancy of 80 years. WHO (2016) agreed that a definition of senior is arbitrary and introduces additional problems of data comparability across nations. For example, the MDS Project² collaborators agreed at the 200 Harare MDS Workshop to use the chronological age of 60 years as a guide for the working definition of “old”; however, this definition was revisited (i.e. “older” was set at the age of 50 years) due to it not taking into account the real situation of older persons in developing countries. In addition, British Senior Insurance³, the minimum age range of senior citizen has been set to 50 years old in order to have the Lifetime Payment Guarantee policy.

WHO (2011) reported that the number of people aged 65 and over is projected to grow from an estimated 524 million in 2010 to nearly 1.5 billion in 2050, with most of the increase in developing countries. Driving represents the most significant mode of transportation for senior drivers in terms of mode share and distance travelled (O’Hern & Oxley, 2015). With an increasing ageing population throughout much of the developed world combined with increasing life expectancies, it is necessary to understand travel behaviour, mobility and safety implications of active transport used (i.e. the private car) on airport road access (Budd, Ison, & Ryley, 2011; Chang, 2013; Tam, Lam, & Lo, 2008) by senior drivers. Understanding senior drivers’ mobility and accessibility needs was crucial to ensure that a specific requirement of road access systems is fully provided (Alsnih & Hensher, 2003). The output of this research could be significantly beneficial to airport management, road sign design professionals and airport users, including senior drivers, in the future.

Senior drivers are a large and increasing proportion of the population (National Institute on Aging et al., 2011; RoSPA, 2010). In 2014, 21,490 casualties were reported as being senior drivers in the UK (Department for Transport, 2015a, 2015c). Senior drivers are commonly

² The workshop was convened on behalf of the World Health Organization’s Minimum Data Set (MDS) Project on Ageing and Older Adults in sub-Saharan Africa, by South African MDS Project collaborators Monica Ferreira (Institute of Ageing in Africa, University of Cape Town) and Craig Schwabe (Geographic Information Systems Centre (GIS), Human Sciences Research Council).

³ <https://www.britishseniors.co.uk/over-50-insurance/>

involved in road accidents often because of misjudged speed or distance of other vehicles or failing to see a hazard (Department for Transport, 2015b; RoSPA, 2010).

Senior drivers are likely to drive to the airport due to carrying extra luggage and preferring more time spent in the vehicle (Ashford, Mumayiz, & Wright, 2011; Chang, 2013). DfT (2015d) reported that private car is the preferred transportation mode to reach the airport; i.e. Manchester Airport (57 per cent), London Luton Airport (54 per cent), and Gatwick Airport (43 per cent). Public transport is the second preferred transportation mode at Stansted Airport (39 per cent) and London Heathrow International Airport (29 per cent). With a current ageing population throughout much of the developed world, there is an imminent need to understand the current transportation requirements (Alsnih & Hensher, 2003; O'Hern & Oxley, 2015) of senior drivers, and to ensure sustained safe mobility and comfort on airport road access (Chang, 2013; Chebli & Mahmassani, 2002; O'Hern & Oxley, 2015). The results confirmed that the wayfinding has importance for the promotion of road safety.

The research focuses on the senior drivers as this segment of the travel market is becoming increasingly important in many countries. Many airports report that the proportion of elderly passengers using their facilities has increased and is predicted to rise further in the years ahead. An improvement on airport road access wayfinding, road safety and comfort for senior drivers should be considered by airport management, road sign design professionals and road authorities.

3. DRIVING BEHAVIOUR AND ROAD SAFETY OF SENIOR DRIVERS

Underlying health conditions, and some types of medication taken to treat those problems, are common factors in accidents involving senior drivers. Indeed, a proportion of senior driver fatalities occur when a senior driver dies of natural causes while driving, and so their vehicle immediately crashes. Senior drivers are commonly involved in collisions at junctions, because of misjudging the speed or distance of other vehicles or failing to see a hazard (Devlin & McGillivray, 2016). They are likely to drive slowly and in some circumstances they probably stop driving completely, particularly when approaching junctions. Although this may appear to be safe behavioural adaptation, their speed reduction can occur without consideration of traffic regulations. However, not all senior drivers do this, and there is little guidance for drivers about it. A major deterrent to self-regulation or stopping driving is the lack, or perceived lack, of viable alternatives to the car.

Elander et al. (1993) stated that the relationship between drivers' skills, behaviour and accident involvement is complex. Safe driving is clearly a complex skill in which various cognitive processes such as perception, attention and motor control are involved (Jamson & Merat, 2005). Elander, Jamson and Merat found that the association between drivers' skills and crash involvement were related through the changes in the way drivers are trained and tested.

Senior drivers' behaviour and safety are connected to the driving abilities and willingness to take risks on the road. The contrast between the safety performances expected of road transport and the management of all other risks is stark, not least when compared with other transport modes (e.g. rail and sea) in terms of fatality and the total of all casualty categories (Department for Transport, 2015c; Evans, 2003; Gayle, 2014). Senior drivers felt that their driving experience skills and driving abilities may not be as good as they once were, which in turn, means that they started to have difficulties in assessing complex problems or high-speed traffic situations and required additional information process time to make a decision (Hassan, King, & Watt, 2015; IAM, 2010). Driving behaviour that led to risk of road accidents (i.e. failing to look properly, poor turn manoeuvre, speeding, aggressive driving, overtaking and tailgating the car in front, failing to stop for traffic lights, and unable to process information on signs) has appeared as a critical factor of distinguishing crashes involving senior drivers (Department for Transport, 2015c; Elander et al., 1993; Godley, Triggs, & Fildes, 2004; Mårdh, 2016; Oltedal & Rundmo, 2006; RoSPA, 2010), which are caused by poor wayfinding on current road designs.

Reported statistics indicate that the risk of an accident increases after the age of 60 up to 70, and they are no more likely to cause a crash than to be the victim of another road user's mistake. However, drivers over 70 are more likely to be at fault when they crash. CrashMap (2015) reported the high road accidents rate on airport road access; i.e. London Heathrow Airport (LHR) had the highest reported casualties (129 casualties), followed by Gatwick Airport (43 casualties), Edinburgh Airport (39 casualties), Glasgow Airport (26 casualties), Manchester Airport (19 casualties) and London Luton Airport (15 casualties) in 2014.

Road safety plays a fundamental role by decreasing the risk of being involved in an accident. Engineering measures such as a road design can prevent accidents and injuries to senior road users (RoSPA, 2010). RoSPA suggested that due to a higher number of accidents at junctions were involving senior drivers, road planners should redesign areas in which high crash rates are reported. An important aspect of senior drivers' safety is being able to

accurately identify which drivers are significantly more likely to be involved in crashes, and ultimately to help them give up driving and adapt to life without a car.

4. METHODOLOGY

Driving scenarios were scripted within a general-purpose "world" provided by a simulator that included a dual carriageway, with buildings, static objects, pedestrian walk-ways and vegetation. Driving simulation is field experimentation using a model building technique to determine the effects of changes and computer-based simulations (Sekaran, 2003). It was developed to test drivers' performance on a virtual environment of airport road access wayfinding design. Drivers and architectural clues (e.g. signs, maps and buildings) were included in the driving wayfinding simulation (Raubal, 2001). A causal and effect analysis was performed with the control of the researcher in the experimental simulation (Beins & McCarthy, 2012; Sekaran, 2003) which validated selected research variables of the intended study. As stated by Raubal and Egenhofer (1998), the combination of drivers' choice (decision) and clues (i.e. sign message) in a real world can be measured through virtual simulation.

This research set the minimum age of 50 years as a "senior", and selected 40 senior drivers aged 50 years and above as a sample of the population. The definition of "senior" being aged 50 years and above was set to allow an accepted minimum "older" age (i.e. based on the MDS Workshop case) globally (Kowal, Rao, & Mathers, 2003). This research, hopefully, could be extended to be applied to other countries for airport road access wayfinding improvements.

a. Scenario Specifics

The simulated driving was scripted using a Scenario Definition Language (SDL) provided by the STISIM Drive Software Version 2. The authoring software was used to add the necessary objects (e.g. direction and advertisement signs, bollards and pedestrians) and auditory cues which provided the driver with instructions (e.g. "That is the end of the simulation"). Scenarios were scripted within a general purpose of the simulator that was a mixture of dual carriageway, buildings, static objects, pedestrian pavement and vegetation.

Three scenario types were designed to provide a variety of driving scenarios and complexity of the road designs to the airport. The complexity of wayfinding varied to assess the safe driving behaviour on alternative airport road access design. Drivers' decisions and judgement are extremely important while driving especially when they have to make a rapid

decision or whilst making decisions under pressure at decision points (Casutt, Martin, Keller, & Jäncke, 2014; Hassan et al., 2015). Drivers need to demonstrate visual scanning of the driving environment. They also must be able to make a quick scan of the signage information. Drivers often will face degrees of pressure and anxiety on journeys to airports in order to ensure that flights are not missed.

Table 1 shows the total number of signs and road furniture in the driving simulation scenarios. We established three scenarios representing different degrees of airport road design complexity.

Table 1: Total number of signs and road furniture in the driving simulation scenarios

Road furniture type	Simulation 1 (S1)	Simulation 2 (S2)	Simulation 3 (S3)	Total
Directional sign	129	145	160	434
Regulatory sign	8	8	8	24
Warning sign	36	36	36	108
Advert	8	21	28	57
Bollard	68	68	68	204
Traffic light	2	2	2	6
Pelican beacon	2	2	2	6
Street light	45	45	45	135
Pedestrian	218	326	513	1057
Intersection	11	11	11	33
Building	90	101	111	302
Vehicle	199	199	199	597
Roundabout	3	3	3	9
Bus stop	2	2	2	6
Total	821	969	1188	2978

Scenario 1 or 'Less Complex' scenario was designed to be as less busy as possible to test the effect of road design on drivers' wayfinding to the airport. Drivers' behaviour and safety during navigation were also tested. The signage placement and road furniture were included to assess drivers' adaption to the actual airport road design with accurate wayfinding (including signage) provided. Scenario 2 or 'Complex' scenario was designed as a busy road and more complex in terms of road access design and wayfinding (including signage). Curved roads and warning signage were included in order to measure the impact of airport

road design on drivers' safety and driving behaviour. Multiple signage types (e.g. diamond and rectangle signs) in the simulation design were considered. Scenario 3 or 'More Complex' scenario was designed as a busiest airport road with different types of direction and warning signs (e.g. diamond and rectangle signs), advertisement signs and complexity of airport road design provided with accurate wayfinding systems (including signage).

b. Procedure

The simulation participants were selected based on convenient sampling and participation in this study was completely voluntary. Convenience sampling is a non-random (nonprobability) sampling technique that involves using whatever participants can conveniently be studied. It is most often used during experiment-based research and is the best way of obtaining basic information in the most efficient way (Sekaran, 2003). Thus, convenient sampling is the most appropriate sampling design for this paper because the collection of information is collated from the population of participants who are conveniently available to provide it.

40 experienced car drivers holding a valid driving license volunteered to take part in the study. The age of drivers ranged from 50 to over 60 with a sample mean age of 59 years. Complete instructions were given before the simulation started. Drivers were instructed to drive to the airport with the aid of wayfinding and signage in the driving scenario. The simulation test was 3.8 miles long for each scenario and took approximately 20 - 30 minutes to complete all three simulations. Participants decided which route to use based on the provided signage and wayfinding systems. The scenario was tested randomly.

c. Data Analysis

The mean and standard deviation were used in this research as they are the most common descriptive statistics, and a very useful tool of statistical rules, in normal distribution (Beins & McCarthy, 2012; Robson & McCartan, 2016; Sekaran, 2003). Beins and McCarthy (2012) stated that ANOVA compares group means to assess the reliability of different means. In this research, ANOVA was used to measure the most prevalent importance of driving behaviour, road safety and the complexity of road design. The ANOVA test measures the differences of the independent variable (e.g. drivers' age group) and the dependent variables (e.g. risk of collision and centreline crossings). The level of significance ($p < 0.05$) was set in this study while 95% confidence level was selected as a conventionally accepted level (Sekaran, 2003).

5. RESULTS

a. Hypotheses

Table 2 shows the mapping of research hypotheses, research variables and analysis techniques in the airport road access wayfinding research.

Table 2: Research Hypotheses, Research Variables and Analysis Technique

Hypotheses	Study Variables	Analysis Techniques
H ₀ : Low adverse impact of airport road access complexity design on driving behaviour and road safety.	Factors that contribute to safe driving behaviour and road safety (IV)	Frequency analysis (Mean and standard deviation)
H ₁ : High adverse impact of airport road access complexity design on driving behaviour and road safety.	Airport road access wayfinding (DV)	ANOVA Test

b. Drivers' Age and Gender

There were a total of 40 respondents who volunteered to participate in this research as a convenience sampling design was applied. Table 3 shows the age group of senior drivers who volunteered as participants in this research.

Table 3: Range of drivers' ages

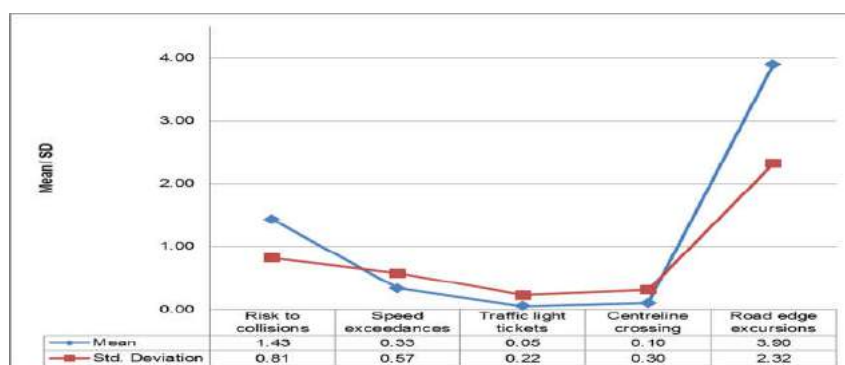
	Minimum	Maximum	Mean	Standard Deviation
Age	50	71	58.60	5.31

The minimum and maximum age of the senior drivers are 50 and 71 years old, respectively. Mean and standard deviation of age range was computed as 58.60 and 5.31, respectively. The mean and SD results revealed that most of the participants were aged in the range of 53 to 63 years. In total, 24 male drivers (60 per cent) and 16 female drivers (40 per cent) successfully completed the driving simulation test. The selection of senior drivers' gender was based on convenience sampling and volunteered feedback during invitation timeframe (e.g. 6 months).

c. Key Factors Influence Senior Driving Behaviour

Figures 1, 2 and 3 show mean and standard deviation computed for senior drivers' age mistakes based on 'Less Complex', 'Complex' and 'More Complex' road design, respectively. The results show that there is a low impact between road design complexity and driving errors. The results also revealed that the road edge excursions was the most mistakes and 'disobeyed' red traffic lights was the lowest mistakes made by senior drivers in all simulated driving scenarios. Senior drivers preferred to drive near to the road edges (or road shoulders), 'too carefully' at the junctions and roundabouts and surprisingly drove too fast in sections of the road that had lower speed limits. This pattern showed that senior drivers are less safe and are exposed to incidents on the road. In the 'Less Complex' wayfinding design (Figure 1), senior drivers were likely to cross the road edge (mean=3.90, SD=2.32), be exposed to the risk of collisions due to driving too close to a vehicle in front (mean=1.43, SD=0.81), exceeding the speed limit (mean=0.33, SD=0.57), cross the centreline (mean=0.10, SD=0.30) and were less aware of red traffic lights (mean=0.05, SD=0.22).

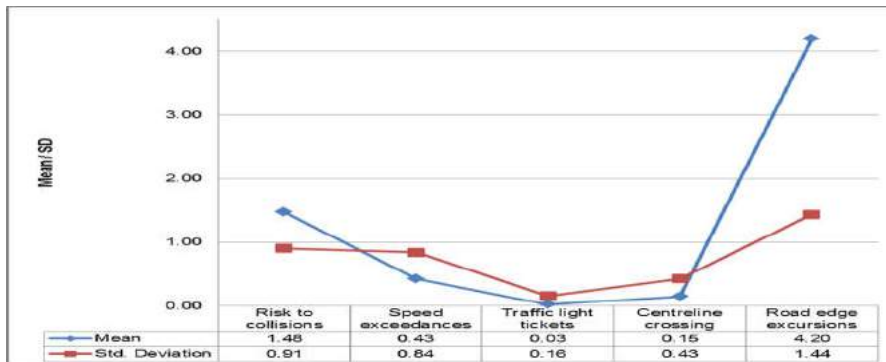
Figure 1: Mean and SD of drivers' age based on 'Less Complex' Scenario



Senior drivers' mistakes during the driving simulation test were recorded. In the 'Complex' wayfinding design (Figure 2), senior drivers were likely to speed and exceed the standard speed limit (mean=0.43, SD=0.84). They preferred to drive close to the kerb, which resulted in road edge excursions (mean=4.20, SD=4.44).

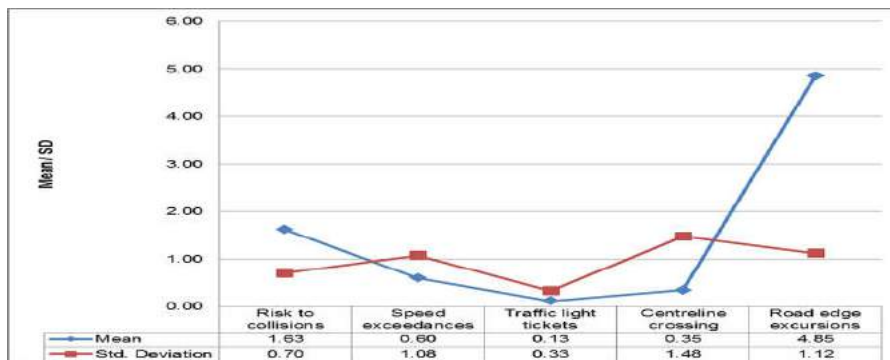
However, they were likely to cross the centreline of the road lane (mean=0.15, SD=0.43) when attempting to turn at the next junctions. Tailgating as one of the major contributors to the road accidents could raise the risk of collision (mean=1.48, SD=0.91). Traffic light ticket (mean=0.03, SD=0.16) rates were low in the 'Complex' scenario, perhaps because of their experience from the previous simulated driving test.

Figure 2: Mean and SD of drivers' age based on 'Complex' Scenario



Drivers made more errors in the 'More Complex' wayfinding design (Figure 3); road edge excursions (mean=4.85, SD=1.12), risk to collisions (mean=1.63, SD=0.70), speeding (mean=0.60, SD=1.08), crossing the centreline (mean=0.35, SD=1.48), and less aware of red traffic lights (mean=0.13, SD=0.33) while performing navigation in this scenario. These five mistakes are the major factors influencing senior driving behaviour and safety on airport road access wayfinding design.

Figure 3: Mean and SD of drivers' age based on 'More Complex' Scenario



d. The Impact of Airport Road Access Complexity on Driving Behaviour and Road Safety

Table 4 shows the ANOVA test results of the research parameters.

Table 4. Summary of Senior Drivers' Mistakes in Simulated Driving

Driver's Mistake	Simulation 1		Simulation 2		Simulation 3	
	F	p-value	F	p-value	F	p-value
Risk to collisions	0.928	0.405	0.727	0.490	0.158	0.855
Speed exceedances	0.216	0.807	0.523	0.597	1.725	0.192
Traffic light tickets	0.849	0.436	1.177	0.319	0.720	0.493
Centreline crossings	0.742	0.483	0.146	0.865	0.826	0.446
Road edge excursions	0.564	0.574	1.262	0.295	1.228	0.305

i. Risk of collisions

The ANOVA result of risk to collisions shows that there was low statistically significant difference between risk of collisions and senior drivers' age group. It shows that senior drivers had no difficulties to reach the airport in Simulation 1 (F=0.93, p=0.41), Simulation 2 (F=0.73, p=0.49) and Simulation 3 (F=0.16, p=0.86). Therefore, there is low statistical impact to airport road access wayfinding designs on road safety. Based on Table 4, the highest possibility of senior drivers being exposed to a road accident was in the 'More Complex' (mean=1.63, SD= 0.70), followed by 'Complex' (mean=1.48, SD=0.91) and 'Less Complex' (mean=1.43, SD=0.81) scenarios. Senior drivers were observed to drive near to the road edges (especially at the roundabouts), had difficulties in making a fast decision at the decision point (e.g. junctions and approaching signs), and failed to respond to speed limit signs at low speed limit roads. These factors were contributory factors that lead to road collisions.

ii. Speed exceedances

The ANOVA result shows low significant impact between speed exceedances and age group of senior drivers; Simulation 1 (F=0.22, p=0.81), Simulation 2 (F=0.52, p=0.60), and Simulation 3 (F=1.73, p=0.19). The results in Table 4 revealed that airport road access wayfinding design has low link to senior driving behaviour and safety. Drivers preferred to speed in the 'More Complex' (mean=0.60, SD=1.08) airport road access wayfinding design compared to the other scenarios. Variable speed limit signs were considered in the "More Complex" scenario; however, the results confirmed that the complexity of the airport road access wayfinding design less affect senior drivers' behaviour. Surprisingly, research results revealed that the speeding was controllable in the 'Less Complex' scenario (mean=0.33, SD=0.57). The 'less busy' and 'cosy' environment led senior drivers to the comfort driving

without thinking of other tasks. Observation confirmed that senior drivers felt it to be comfortable and easy to navigate to the airport. DfT (2015c) and Oxley et al. (2006) reported that exceeding the speed limit and driving too fast are contributory factors to the accidents and casualties statistics. Exceeding the speed limit was reported in around 16 per cent of fatal accidents in 2014, whereas 8 per cent of fatal accidents were caused by driving too fast. A similar pattern was seen for reported road fatalities where exceeding the speed limit contributed to 17 per cent of fatalities and driving too fast contributed to 8 per cent of fatalities. The road statistics also revealed that 7 per cent of serious accidents and seriously injured casualties were allocated to the categories of exceeding the speed limit and travelling too fast.

iii. Traffic light tickets

The ANOVA result shows the airport road access wayfinding design has low significant impact on driving behaviour and road safety in terms of traffic light awareness. Senior drivers were less aware of red traffic lights in all scenarios; Simulation 1 ($F=0.85$, $p=0.44$), Simulation 2 ($F=1.18$, $p=0.32$) and Simulation 3 ($F=0.72$, $p=0.49$). Statistical results revealed that senior drivers are more likely to fail to stop at red traffic lights in the 'More Complex' scenario (mean=0.13, SD=0.33) compared to the 'Complex' (mean=0.03, SD=0.16) and 'Less Complex' (mean=0.05, SD=0.22) scenarios.

iv. Centreline crossings

The ANOVA result shows the senior drivers' age had low impact on road centreline crossing in all scenarios. Drivers are likely to cross the centreline more often in the 'More Complex' road design ($F=0.83$, $p=0.45$) compared to the 'Less Complex' and 'Complex' roads designs ($F=0.74$, $p=0.48$; $F=0.15$, $p=0.87$), respectively. The ANOVA results revealed that the complexity of road design affected senior driving behaviour. The complexity of the 'More Complex' scenario led senior drivers to cross road centrelines more often (mean=0.35, SD=1.48) compared to the 'Less Complex' (mean=0.10, SD=0.30) and 'Complex' (mean=0.15, SD=0.43) ones. Poor turn manoeuvre at roundabouts and junctions were main factors of unsafe driving behaviour. DfT (2015b) confirmed that poor turn manoeuvre led drivers to road accidents.

v. Road edge excursions

Table 4 shows there is a low significant impact between the senior drivers' age group and road edge excursions; Simulation 1 ($F=0.56$, $p=0.57$), Simulation 2 ($F=1.26$, $p=0.30$), and

Simulation 3 ($F=1.23$, $p=0.31$). The ANOVA test revealed that senior drivers crossed the road edge more frequently in the 'More Complex' scenario (mean=4.85, SD=1.12) compared with the 'Less Complex' (mean=3.90, SD=2.32) and 'Complex' (mean=4.20, SD=1.44) scenarios. As similar to centreline crossings, poor turn manoeuvre affected senior drivers' safety which could lead to the risk of collisions. Senior drivers being likely to drive close to the kerb (e.g. to get a close view of traffic signs' information) was the reason for the highest mean value. Based on Table 4, the alternative hypothesis has been rejected and at the same time the null hypothesis was accepted at a significant alpha of 0.05. The hypothesis states that there is a low impact between driving behaviour, and road safety on airport road access wayfinding design.

6. DISCUSSION

The paper suggests that driving simulation is useful for testing drivers' wayfinding ability in a virtual environment. The study investigated the impact of different wayfinding and signage provisions on driving behaviour in three groups aged 50 and over. ANOVA results showed that drivers' particular age group had a low impact between driving behaviour and road safety on airport road access wayfinding design. There are several contributory factors that may influence safe driving behaviour. To emphasize the driving simulation results, the preferred key factors leading to road accidents have been considered as shown in Table 5.

DfT (2015c) reported that road accidents involving fatalities of senior drivers have only fallen by 15 per cent from the years 2005 to 2009. However, road accidents that involved serious injuries rose 10 per cent over the same period. DfT reported that in the year 2000, people aged 60 or over accounted for about 20.8 per cent of Great Britain's population. By 2013, this had risen to 23 per cent, just over a 10 per cent increase. As the number of people in the senior age group increases, a higher number of road accidents involving senior drivers would be expected. In addition, as people get older their health condition becomes more infirm (Cuenen et al., 2016; National Institute on Aging et al., 2011). Thus, it could lead to problems such as poorer depth perception and an increase in mistakes in both cognitive and physical behaviour (Department for Transport, 2015c; Marin-Lamellet & Hausteine, 2015; National Institute on Aging et al., 2011; Oxley et al., 2006; RoSPA, 2010). These factors affected senior drivers' ability to focus on the road while driving to the airport.

Table 5: Mapping of contributory factors influence safe driving behaviour

Contributory Factors	Risk to collisions	Speed exceedances	Traffic light tickets	Centreline crossings	Road edge excursions
Failed to look properly	X	X	X	X	X
Poor turn or manoeuvre	X			X	X
Failed to judge other drivers' path or speed	X	X			
Following too close	X				
Disobeyed 'Give Way' or 'Stop' sign or markings	X	X	X	X	X
Loss of control	X			X	X
Travelling too fast	X	X	X	X	X
Swerved	X			X	X
Exceeding speed limit	X	X	X		
Aggressive driving	X	X	X	X	X

There are three major of driving simulation that affects the ease of driving orientation and wayfinding designs to the airport. Firstly, the sign design of driving scenario's should be distinctive and different (J. R. Harding et al., 2011). Airport 'directional arrow' sign should be bigger, bold text, different colour and symbol than other signs. The airport landside signs should be identical in term of size, colour and style to be compared with current motorway signs. The senior drivers could differentiate and signifies the airport signs while they are performing wayfinding. Therefore, it is very important that airport signs adhere to copy, styles and sizes, consistent terminology and symbols and uniform colours of basic guiding principles standard functions (AASHTO, 2010; J. R. Harding et al., 2011; Smiley et al., 2004). Message content should be easily understood by airport travellers. For instance, first time travellers require different information rather than frequent flyers. Secondly, some attributes in driving simulation can be seen from various viewpoints. For example, the 'Less Complex' scenario was developed with 'comfort' driving environment which allows drivers to view the routes and landmarks more easily and distinctively compared than other scenarios. Adding more to that, in some attributes of simulated driving such as 'More Complex' scenario, senior drivers require sign direction to be displayed as far as possible to the airport (AASHTO, 2010). Thirdly, as age increases, it is certain that general health and fitness will begin to deteriorate which leads to road accident risks. The senior drivers felt that their

driving experience skills and driving abilities may not be as good as they once were (RoSPA, 2010). As a result, senior driver control their driving experience and develop a more defensive and cautious driving behaviour as they grow older. The senior drivers are commonly involved in collisions often because they misjudge the speed or distance of other vehicles or fail to see a hazard (Chevalier et al., 2016; Cuenen et al., 2016; Devlin & McGillivray, 2016; National Institute on Aging et al., 2011). From the driving simulation results, it shows that the 'more complex' of road design makes wayfinding more difficult. For instance, the senior drivers made more errors in the 'more complex' scenario which led to risk of collisions, exceeding the speed limit, centreline crossings, and road edge excursions. Senior drivers are more likely to have more driving errors which leads to road accidents.

7. CONCLUSION

In conclusion, the study revealed that senior drivers' attention and ability to process signage and wayfinding information is limited. These limitations can create difficulties because driving requires the division of attention between control tasks, guidance tasks and navigational tasks. Drivers' attention can be switched rapidly from one wayfinding information source to another. This means that drivers only attend well to one source at a time. For instance, while driving to the airport, drivers can only extract a small proportion of the available information from the road scene (i.e. airport directional signs). Thus, to interpret a limited information processing capacity while driving, drivers can only determine acceptable information loads that they can manage (Mårdh, 2016). When drivers' acceptable incoming information load is exceeded, they tend to neglect other information based on level of importance (i.e. if driver was looking for the word 'airport' on the sign, they tend to neglect the speed limit signs). As with decision making of any sort, error is possible during this process (Casutt et al., 2014). Drivers were less focused on information that turns out to be important, while less important information was retained. In addition to information processing limitations, drivers' attention is not fully within their conscious control. For drivers with some degree of experience, driving is a highly-automated task. Driving can be performed while the driver is engaged in thinking about other matters. Most drivers, especially a frequent traveller to the airport or one familiar with the airport route, have experienced the phenomenon of becoming aware that they have not been paying attention during the last few miles of driving (e.g. airport staff). The less demanding the driving task, the more likely it is that the drivers' attention to the airport wayfinding and signage will wander, either through internal preoccupation or through engaging in non-driving tasks. Factors such as complexity of road design and environment or increased traffic congestion

could also contribute to distracted driver's ability to keep track of wayfinding. Inattention may result in unintentional movements out of the lane, exceeding the speed limit (Chevalier et al., 2016) and failure to detect a vehicle on a conflicting path at an intersection (Dukic & Broberg, 2012; Mårdh, 2016; Oxley et al., 2006) that exposed drivers to the risk of collisions and reduced road safety.

8. LIMITATION

Driving simulators have a few disadvantages. For instance, simulator sickness (a type of motion sickness) is experienced by senior drivers whilst "driving" in the simulator room; it may include dizziness, headache, nausea and vomiting (Mourant & Thattacherry, 2000). Apparently, a senior driver would be compromised when experiencing these symptoms and it may not be appropriate for all drivers to be involved in a simulated driving experience. Gruening et al. (1998) claimed that the information gained through driving simulations may be misleading if the simulator does not provide an appropriate analogue to the simulated scenario, and that high reliability driving simulations are sometimes far more expensive than vehicle testing.

9. FUTURE RESEARCH

This research addressed the gaps in the literature on the airport road access wayfinding and the relationship between senior driving behaviour and road safety on airport road access wayfinding design. A driving simulator has been used as a tool to measure the relationship between these variables. In this section, further directions for future research are suggested. Firstly, Satellite Navigation (Sat Nav) was suggested to assess its impact on senior driving behaviour towards airport road access wayfinding. However, the Sat Nav was not built-in in the STISIM driving simulator Version 2. The idea of the insertion of Sat Nav as a tool to aid senior drivers to perform airport wayfinding hopefully would extend the current research, with additional variables on the impact of airport road access design using a simulated driving scenario. Secondly, senior drivers aged 50 years and over were chosen to participate in this research. Results from the simulated driving test were analysed and findings were measured only focusing on senior drivers attributes. It is suggested that this research could be extended to the younger drivers and with a consideration of gender to assess any effects on driving behaviour and road safety on the complexity of road design.

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THE CUSTOMERS' EXPECTATIONS AS A GUIDE TO SERVICE INNOVATION IN THE AIRLINE INDUSTRY

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ABSTRACT

According to the strategic innovation paradigm, service companies have their innovative efforts guided by market needs, so customer demand is crucial to successful innovation. However, the service literature about air transportation has been focusing on the evaluation of service quality delivered instead of the identification of market demands. This study applied the Hierarchical Model of air transportation service quality evaluation adapted to identify customer' expectations in a Brazilian domestic airport. The results indicate that customers have higher expectations regarding airline employees' conduct and expertise, which suggests areas where investments should be prioritized in order to optimize efforts on service innovation.

KEYWORDS

customers' expectation; innovation; service quality; air transport; airlines; services.

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1. INTRODUCTION

Providing high quality services is crucial for airline companies to increase profitability and market share (Wu & Cheng, 2013). In spite of that, some reports such as the Air Travel Consumer Report e JD Power Airline Satisfaction Study show that customers are not completely satisfied with the service provided by airlines (Waguespack & Rhoades, 2014). According to the authors, the disquality rates are calculated with data from the percentage of late flights, total number of customer complaints, total number of involuntary denied boardings, total number of mishandled baggage reports and cancellations.

Attempting to offer better services to customers and increase profitability, airlines innovate in services. Some examples of air transport service innovation developed in the past years that are becoming mass services are: on line check-in, self-check-in kiosks, web-booking with up sell offer, one-way ticket pricing, limousine service, empty middle seat, mobile phone usage onboard, live TV/radio, onboard bar and lie-flat seat (Rothkopf & Wald, 2011). Those innovations are incremental and create ancillary revenues (O'Connel & Warnock-Smith, 2013). However, the fees for these services, which apparently increase profits, are one of the main complaints of airline customers (Waguespack& Rhoades, 2014).

Therefore, airlines must understand their customers' expectations to improve service superiority and market performance, creating value (Carbonell, 2009). In that sense, customer interaction can provide a more accurate understanding of customer's wants and needs and prevent against the development of bad and undesired services that will not be accepted in the market (Alam & Perry, 2002).

The strategic innovation paradigm states that innovations are market-driven, meaning that the market situation is an important factor for determining the innovation's success (Sundbo, 1997). Market orientation requires learning about customers' needs, competition, environmental forces and customer involvement aims to facilitate the process of sensing the market (Matthing, Sanden & Edvardsson, 2004). Additionally, the literature on airline services has prioritized service quality issues in spite of customers' expectations.

This paper aims to identify customers' expectations, answering what clients want from air transport innovation and indicating innovation priorities for the companies. For that matter, the Hierarchical Model of air transportation was adapted and applied, because it is a multi-dimensional instrument with four primary dimensions and eleven sub-dimensions, which help elaborate management strategies and tactics and improving performance (Wu & Cheng,

2013). The adaptation process included using the techniques from Analytic Hierarchy Process (AHP) to provide decisions that are more objective from customers (Saaty, 2008) and understand the true level of importance of each dimensions.

2. AIRLINE SERVICE QUALITY

Quality is a manifold concept and is related to satisfying the needs of the stakeholders of the organization, including customers, owners and staff (Edvardsson & Olsson, 1996). It is usually defined as a form of evaluation of a product or service, a condition of global judgment, while satisfaction is related to a specific transaction. As satisfaction episodes accumulate over time, the customer develops a perception of service quality (Parasuraman, Zeithaml & Berry, 1988).

Service quality is the most important matter in obtaining service sector competitive advantage and financial success (Parasuraman, Zeithaml & Berry, 1988). Customers are the final evaluators of service quality and if they are unhappy, they will share their dissatisfaction with people they know (Cheung & To, 2011). Therefore, many studies have tried to investigate the service quality attributes in the airline industry.

The quality dimensions studied are usually tangibles, responsiveness, reliability, empathy, safety (Pakdil & Aydin, 2007; Chou et al, 2011; Mitra, 2014), cabin service (Liou et al., 2011; Wong & Chung, 2007), flight patterns, image, availability (Pakdil & Aydin, 2007), and communications (Hussain et al., 2014). Table 1 summarizes service quality research and its main results.

Table 1: Service Quality Research

Source	Method	Respondents	Main results
Basfirinci and Mitra (2014)	SERVQUAL and Kano Model	238 respondents (126 from Turkey and 112 from USA).	For US airlines and Turkish airlines, quality delivered is below customers' expectations; cultural differences influence customers' expectations and perceptions of service quality affecting satisfaction.
Chou et al. (2011)	Fuzzy weighed SERVQUAL	329 passengers from an international airline that flies from International Airport of Kaohsiung in Taiwan.	Passengers consider reliability and assurance dimension and safety-related services items as top priorities.
Hussain et al. (2014)	SERVQUAL	253 respondents from Dubai International Airport.	Superior service quality, perceived value and corporate image create passenger satisfaction and lead to brand loyalty.
Laming and Mason (2014)	Survey (Airs@t survey)	18,567 passengers from 15 airlines (five based in Asia, seven in Europe and three in the Middle East).	Satisfaction is derived specially from cabin features, crew and pilot performance, and in-flight food and drink and these items create customer loyalty.
Liou et al. (2011)	Modified VIKOR	5598 passengers from UNI Air, TransAsia Airways, Mandarin Airlines and Daily Air.	Cabin services are considered the most important dimension of service quality; the services with higher satisfaction levels are reservation, ticketing, check-in and boarding processes. The lower satisfaction levels refer to baggage claim and handling delays.
Pakdil and Aydin (2007)	Weighed SERVQUAL	320 passengers from an airline in Istanbul Ataturk International Airport.	Passengers' past experience is the most important reason in choosing an airline; passengers' education levels affect their expectations and perceptions; the "responsiveness" dimension is the most important and "availability" is the least.
Wong and Chung (2007)	SERVQUAL and C5.0 decision tree	812 passengers from a Taiwanese Airline.	Passengers like responsive, reliable and assured air transport service.

The Hierarchical Model proposes that service quality consists of four primary dimensions composed by sub-dimensions. The first dimension is interaction quality. It refers to the personal interface between service providers and customers during service delivery and its sub-dimensions are conduct, expertise and problem solving. The second dimension is physical environment quality, referring to the physical characteristics of the service production process and its sub-dimensions are cleanliness, comfort and tangibles. The third dimension, outcome quality, focuses on what customers obtain from the service and its sub-dimensions are valence and waiting time. The fourth dimension, access quality, refers to the ease and speed with which people reach the desired location and its sub-dimensions are information and convenience (Wu & Cheng, 2013).

The dimensions should be considered when developing management strategies, while the sub-dimensions can be analyzed when formulating daily management tactics. The combinations of those areas compose the general perception of airline service quality (Wu & Cheng, 2013).

3. SERVICE INNOVATION AND CUSTOMER' EXPECTATIONS

Many quality problems are caused by drawbacks in the development of new services. When developing a new service, the right quality must be built from the beginning, planning the development of services which customers see as appealing (Edvardsson & Olsson, 1996). The new service development process comprises four stages: idea generation, idea transformation, development and implementation. When developing a new service it is crucial to learn from and with customers, because they are a "potential goldmine" and help create value (Edvardsson et al., 2012). To deeply understand clients' needs and wants it is necessary to involve them in the new service developing process (Gustafsson, Ekdahl & Edvardsson, 1999).

Customers might get involved with the service depending on how important and meaningful that service is for them. The more involved a customer is with a service, the more customers' expectations will influence the evaluation of service performance. Therefore, companies should stimulate and try to increase customer involvement in order to obtain better ideas for new service development and achieve higher satisfaction levels (Cheung & To, 2011).

When developing new air transport services, involving customers helps tailoring the service and create unique experiences that enhance loyalty. The higher the degree of co-creation, the higher the financial (profits) and non-financial (loyalty and satisfaction) levels of the company. The value is created not only in the delivery of the service itself, but also in the development process, because the customer feels special and useful for the company (Grissemann & Stokburger-Sauer, 2012).

The idea generation phase is the most important stage in the development of new services, because it helps develop services that match customer's needs, especially if clients are involved in the process. In this phase, clients can contribute as they state needs, problems and solutions, criticize existing services, help identify gaps in the market and can provide a wish list of the services wanted (Alam & Perry, 2002). In the idea generation phase, companies should identify customers' expectations and design services that serve them (Edvardsson & Olsson, 1996).

As quality is a comparison of how the customers feel the service and how should be the perception of the service offered, as more companies know about customers' expectations, more quality it can provide by trying to achieve that expectation (Parasuraman, Zeithaml & Berry, 1988).

The customer' expectations are what clients want or wish for, what they think the company should provide them and not only what the company would provide (Parasuraman, Zeithaml & Berry, 1988; Zeithaml, 1993; Edvardsson & Olsson, 1996). They are previous beliefs that are used as standards or references to judge the service that is provided, determining customers' satisfaction and service performance. Two clients can have different expectations about the same service. That is why organizations in the same business can have completely different service levels and still maintain customers satisfied (Zeithaml, 1993).

Expectation construct is fundamental in determining the quality evaluations. Perceived service quality is the difference between customers' perceptions and desires. The desired service is the one the client hopes to get, that will attend all of his needs and surprise him. It mixes what services can be and should be. As customers know that it is not always possible, they can have a lower level of expectation that is still acceptable, called the adequate service level which customers will accept (Parasuraman; Zeithaml; Berry, 1988).

Expectations can be influenced by the company's image and reputation, the clients' previous experience with the company, marketing campaigns (Edvardsson; Olsson, 1996), personal needs, situational factors, past experience, word of mouth communication, advertising, personal selling, perceived alternative services and service promises (Parasuraman; Zeithaml; Berry, 1988).

4. METHODOLOGY

The research was conducted in a Brazilian domestic airport located in São Paulo (CGH) in January, 2015. This airport was chosen because it is one of the most important and busy airports in the country, with more than 200 thousand landings and takeoffs per year and around 20 million passengers in 2015, being behind in Brazil only of the Guarulhos Airport (GRU), with approximately 300 thousand annual landings and takeoffs and more than 38 million passengers in the same year (DECEA, 2016; INFRAERO, 2016). The convenience sampling technique was used for data collection. One hundred and twenty-two passengers that were waiting to board their flights answered the questionnaire in the airport lounge. Twenty-two of these questionnaires were incomplete and thus excluded from data analysis, resulting one hundred valid questionnaires. It is believed that this amount of interviewees, even if small, can be used as an initial reference for the study of the subject in this paper.

The Hierarchical Model for air transportation was adapted in order to measure expectations instead of service quality. The dimensions conduct, expertise, problem-solving, cleanliness, comfort, tangibles, safety & security, valence, waiting time, information and convenience of the Hierarchical Model were compared against each other in pairs, using the Analytic Hierarchy Process method (AHP) to provide more objective assessments from customers (Saaty, 2008) and understand each true level of importance of dimensions regarding customers' expectations. An example of this method is shown in Table 2.

Table 2: Some of the questions applied using the AHP method

In your opinion, this item below is...	More important	Equally important	Less important	...than this item?
Employees' conduct ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Employees' expertise
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Employees' ability to solve problems
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Aircraft' cleanliness...

The AHP method used with passengers by the Table 2 was applied by means of a questionnaire. The questionnaire was constructed with questions designed to assess customers' expectations through AHP, through the comparative analysis of the level of importance between the variables by the passengers, and questions that aimed to define passengers' demographic characteristics.

The questions that sought to assess customers' expectations compared two dimensions at a time in order to determine whether the respondent held higher expectations for a certain dimension or if he/she had equal expectations for both. If certain dimension was considered more important than the other one it was being compared to, the more important dimension should score 3 points and the less important dimension should score 1 point in the data analysis. If the importance weights were the same, both should score 2 points. Since eleven dimensions were analyzed in pairs, it was needed fifty-five comparisons in order to evaluate all of the possible relationships between pairs of variables.

5. RESULTS

The passengers' demographic characteristics answered are summarized in Table 3. As shown in Table 3, out of the one hundred respondents, 67% were males and 33% were females. Regarding respondents' ages, 61% are from 21 to 40 years old, and 88% of respondents have at least higher education and the majority of passengers - 63% of them were on a business trip. 40% of respondents use air transportation from 3 to 6 times a year, while the second biggest group uses it 11 times or more per year (30%).

Table 3: Sample Characteristics

Measure	Option	Frequency	%
Gender	Male	67	67%
	Female	33	33%
Age	20 years old or younger	11	11%
	21-30	34	34%
	31-40	27	27%
	41-50	17	17%
	51-60	8	8%
	60 years old or older	3	3%

Measure	Option	Frequency	%
Education	Elementary school or below	0	0%
	High school	12	12%
	Higher education	53	53%
	Post graduate	35	35%
Trip purpose	Leisure/Tourism	31	31%
	Business	63	63%
	Others	6	6%
Annual frequency of air travel in the last 12 months	2 or less	16	16%
	3-6	40	40%
	7-10	14	14%
	11 or more	30	30%

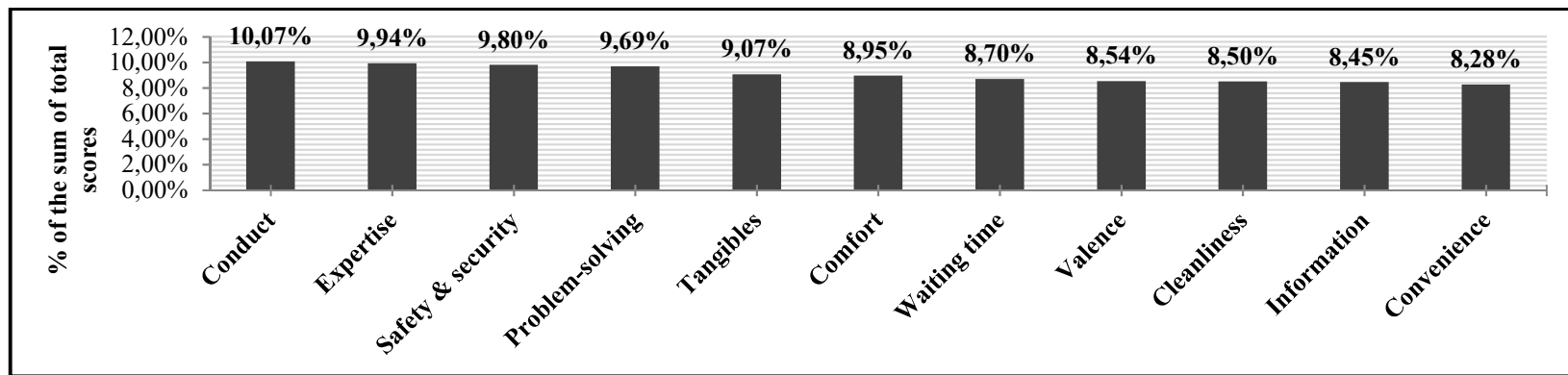
To classify the dimensions analyzed according to customers' expectations, it is used a total score for each variable. The total scores are composed by the sum of all individual scores a dimension received by respondents in the questionnaire. Table 4 presents the AHP matrix as well as the total scores each dimension received, in which the higher the total score a dimension received, the higher customers have high expectations for this dimension. Fig. 1 orderly classifies the dimensions importance in terms of customers' expectations by using the percentage of the sum of all total scores a dimension has.

Thereby, Figure 1 shows that, among all dimensions of service quality inherent to the Hierarchical Model of air transportation service quality, customers have higher expectations regarding airline's conduct and expertise.

Table 4: AHP matrix

Dimensions	Conduct	Expertise	Problem-solving	Cleanliness	Comfort	Tangibles	Safety & security	Valence	Waiting time	Information	Convenience	Total scores
Conduct	-	223	229	237	218	227	220	220	211	218	213	2216
Expertise	177	-	236	225	222	223	227	220	223	213	220	2186
Problem-solving	171	164	-	239	232	210	225	222	223	228	218	2132
Cleanliness	163	175	161	-	204	203	184	203	186	193	199	1871
Comfort	182	178	168	196	-	203	190	223	209	209	212	1970
Tangibles	173	177	190	197	197	-	212	219	208	216	207	1996
Safety & security	180	173	175	216	210	188	-	262	250	255	248	2157
Valence	180	180	178	197	177	181	138	-	217	214	217	1879
Waiting time	189	177	177	214	191	192	150	183	-	221	219	1913
Information	182	187	172	207	191	184	145	186	179	-	226	1859
Convenience	187	180	182	201	188	193	152	183	181	174	-	1821

Figure 1: Customers' expectations classification



The conduct dimension in the Hierarchical Model of air transportation service quality comprises the airline employees' willingness to help customers, the airline employees' friendly behavior and their understanding of customer needs, the sense of trust passed on by their behavior and the quality of service provided by them, the sense that customers can rely on airline employees to take actions in order to satisfy customers' needs.

Regarding the items that form the conduct dimension, all of them are related to airline employees' behavior, thus indicating an area of extreme importance for airlines to have good performance and also to seek ways of generating innovation in order to increase the level of service offered, since this is the dimension customers have higher expectations about.

The second dimension to which customers have more expectations about is the expertise dimension, which is formed by three items: the conscience of employees that customers depend on their professional knowledge to have their needs satisfied, the confidence that customers can count on the airline employees knowing their jobs and responsibilities and, finally, the airline employees' competence. Similarly to the conduct dimension, the expertise dimension also is completely related to the airlines' employees, reinforcing the critical importance of the airlines' employees to the quality of service received by customers in the airline industry.

6. CONCLUSIONS

The purpose of creating new services is to enhance profitability as the company retain clients and obtain new ones as they became loyal and satisfied (Gustafsson; Ekdahl; Edvardsson, 1999). This paper aimed to answer the question: what do clients want? Considering the customers' high expectations related to conduct and expertise, companies should innovate primarily in those two dimensions in order to meet customers' expectations, thus delivering a higher quality of service, and optimize efforts on service innovation.

This findings of this research should assist airlines' managers as it highlights the importance of human resources in the airline industry, thus indicating that managerial actions regarding human resources management, such as having good recruiting and selection processes, as well as offering adequate training in order to raise employees' expertise concerning their functions, could help airline companies to elevate their quality of service delivered and consequently strengthen their position against competitors.

As limitations of the study, we point the convenience sample, as the research was conducted in a Brazilian airport and the sample size was relatively small (one hundred valid answers). Even so, the research has important implications for both theory and practice as little effort has been made to understand what customers want regarding airline services. Future research should continue on this path, in order to help increase customers' satisfaction and airlines' profitability.

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Beta Anomaly and Comparative Analysis of Beta Arbitrage Strategies

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Abstract

Over a long period of time, stocks with low beta have consistently outperformed their high beta counterparts across developed and emerging markets alike. We explore the presence of low beta anomaly and its robustness after controlling for size, value and momentum factors in the Indian stock markets. We have chosen the universe of past and present constituent stocks of the Nifty 500 index in our study for the period 2001 to 2014. We study relative risk-adjusted performance and portfolio characteristics of three different zero-cost, long-short beta arbitrage strategies including beta neutral and negative net beta version of strategies. We find all the beta arbitrage

strategies deliver superior risk adjusted performance in the Indian markets, though of different magnitude, with a clear tilt away from the value factor and towards the momentum factor. However, we don't find any tilt towards size factor. Our study provides the framework for choosing an implementable beta arbitrage strategy consistent with the investor's investment objective.

JEL classification: G11, G12, G14, G15

Keywords: *market efficiency, betting against beta, low risk anomaly, volatility effect*

1. Introduction

An investment strategy based on investing in a portfolio that consists of low risk, stable stocks that consistently outperforms a matching portfolio of high risk, volatile stocks as well as market portfolio on risk adjusted basis. This phenomenon is widely known as risk anomaly or volatility puzzle.

In this study, we explore the presence of low beta anomaly and its robustness, after controlling for size, value and momentum factors, in the Indian stock markets. We have chosen the past and present constituent stocks of the Nifty 500 index for our study over a period 2001 to 2014.

We answer the following questions with respect to the Indian equity markets:

1. Does beta anomaly exist after removing small and illiquid stocks from the universe?
2. Does beta anomaly remain robust after controlling for size, value and momentum factors?
3. What are the alternative ways of implementing beta arbitrage strategies and how to compare different beta arbitrage strategies?

We establish the following: (a) Beta anomaly is robust even after eliminating small and illiquid stocks from the universe. (b) Beta anomaly is robust after controlling for size, value and momentum factors, and is not proxy for any other factors. (c) We compare relative attractiveness of alternative beta arbitrage strategies and we find that all beta arbitrage strategies deliver different magnitudes of superior risk-adjusted performance in Indian markets with a clear tilt away from the value factor and towards the momentum factor. We don't find any tilt towards size factor. (d) While all strategies offer superior risk-adjusted performance, they have very different ex-post beta and therefore, choice of strategy is a function of the investment objective.

This study highlights key differences in characteristics

of alternative beta arbitrage strategies and it provides a simple framework for choosing an implementable beta arbitrage strategy consistent with the investment objective.

Risk anomaly is one of the strongest anomalies. It has remained largely unexplored by researchers and under-exploited by practitioners till the dawn of the twenty first century. This anomaly is against the very spirit of a strictly positive relationship between risk and return depicted by classical asset pricing theories like the capital asset pricing model (CAPM). According to CAPM, systematic risk as measured by beta is the sole driver of the expected return. In the CAPM world, market portfolio is the portfolio with the highest Sharpe ratio, which implies excess return per unit of risk. Rational investors must hold a combination of market portfolio and long/short position in risk-free asset to meet their unique risk preferences. Risk-averse investors de-lever their holding in the market portfolio by investing a fraction of their capital in the market portfolio and remaining capital in risk-free assets. On the contrary, investors with a higher risk appetite use leverage - by borrowing money to increase expected returns on the market portfolio. In the imperfect real world outside the CAPM framework, various categories of investors including retail investors, mutual funds and pension funds may not have unconstrained access to leverage. Such investors tend to exhibit preference for high beta security in anticipation to earn higher expected returns compared to the market portfolio.

Early evidence of low risk anomaly and flatter security market line for US stocks can be traced back to the early 1970s. Black (1972) and Black, Jensen and Scholes (1972) first highlight that the security market line is much flatter than predicted by CAPM, because of the borrowing restrictions resulting in low beta stocks having a positive and higher alpha. Haugen and Heins (1975) were among the first to show that stocks

with low volatility of historical returns tend to outperform those with higher volatility. However, during hay days of market efficiency and CAPM, these results were dubbed as a data mining exercise or an aberration.

Subsequently after a long gap, research on risk anomaly has picked up and since the beginning of the twenty first century, many researchers have explored low risk anomaly using various approaches. Studies differ mainly on two counts - choice of risk measure and method of portfolio construction approach. While popular risk measures include idiosyncratic volatility, standard deviation and beta, two popular portfolio construction approaches are portfolio construction based on ranking stocks using a risk measure and constructing a minimum variance portfolio using modern portfolio theory Markowitz (1952) framework. More recent literature is focused on finding rational and behavioral explanations to explain the risk anomaly or to explain it away. Ang, Hodrick, Xing and Zhang ((2006), (2009)) use idiosyncratic volatility calculated as standard deviation of residuals of daily stock returns regressed upon proxies for market, size, value and momentum factors as defined by Fama and French (1992) and Carhart (1997). They report an inverse relationship between idiosyncratic risk and expected returns across global markets. Clarke, De Silva and Thorley (2006) report that minimum variance portfolio in US markets provides comparable or better-than-market returns with 25% reduction in volatility. Blitz and Vliet (2007) find that volatility effect is stronger than beta effect. They further establish that volatility effect is a distinct effect and is by no means disguised in other classic effects such as size, value and momentum.

Baker and Haugen (2012), Blitz and Vliet (2007), and Blitz, Pang and Vliet (2013) demonstrate that risk anomaly is a global phenomenon. Baker, Bradley and Wurgler (2011) use beta as well as volatility sorting,

using only large cap stocks in US market and demonstrate that low beta-high alpha and high beta-low alpha phenomenon persists even in large cap stocks. They offer a series of explanations, rational as well as behavioural, to explain persistence of such anomaly. They argue that institutional investors' mandate to focus on beating a benchmark, coupled with borrowing and short-selling restrictions, hinders their ability to exploit a low beta, high alpha opportunity. As a result, they take exposure to high beta, low alpha stocks.

Moreover, behavioural biases such as preference for lottery, overconfidence and representativeness cause investors to chase high beta stocks. This leads to price increase in high beta stocks leading to lower returns in the subsequent periods. Bali and Cakici (2008) argue that the negative relationship shown by Ang, Hodrick, Xing and Zhang (2006) between idiosyncratic volatility and expected return is due to small, illiquid stocks only. If these small stocks are excluded from the sample, a puzzling negative relationship between idiosyncratic volatility and expected returns turns insignificant. Bali, Cakici and Whitelaw (2011) create a variable to capture lottery-like payoff and show that an inverted risk-return relationship between idiosyncratic risk and expected return is due to investors' preference for lottery-like payoffs. They also demonstrate that such inverted relationship between risk and return cannot be explained by skewness in distribution of returns. Fu (2009) argues that an inverted relationship between idiosyncratic risk and expected return is due to short term reversals. In line with Black (1993), Frazzini and Pedersen (2010), and Hong and Sraer (2012) also attribute an anomalous flat-to-negative relationship between risk and return to borrowing restrictions and short selling constraints. Brennan (1993), Karceski (2002), Falkenstein (2009), Blitz, Pang and Vliet (2013) and Baker and Haugen (2012) argue that there is an agency problem associated with delegated portfolio management and also argue that the call option-like

fund manager's compensation structure tilts their preference towards high risk stocks. Clarke, De Silva and Thorley (2010) construct an additional factor based on idiosyncratic volatility 'volatile-minus-stable (VMS)' after controlling size effect and show that VMS is an important factor in explaining a cross-section of security returns.

While there are several strands of research emerging on this exquisite anomaly of markets, we extend the strand of beta arbitrage based investment strategy. Black, Jensen and Scholes (1972) and Black (1993) first provide a framework and evidence on how unconstrained investors can exploit a flatter-than-expected security market line. More recently, Frazzini and Pedersen (2014), in their seminal work, extend the scope of beta arbitrage by constructing betting against beta (BAB) portfolios across several asset classes and markets. They report large and significant risk-adjusted returns. By design, 'betting against beta' portfolios are market neutral on ex-ante basis because of active use of leveraging of low beta portfolios and de-levering of high beta portfolios. Asness, Frazzini and Pedersen (2014) demonstrate that betting against beta strategies are not merely industry bets as suspected by many. They establish it by constructing industry neutral BAB factor.

The rest of the paper is organized as follows. Section 2 discusses data and methodology, Section 3 discusses results and Section 4 offers the conclusion.

2. Empirical Model

We follow Baker, Bradley and Wurgler (2011), Blitz, Pang and Vliet (2013), Frazzini and Pedersen (2014) and Garcia-Feijoo, Kochard, Sullivan and Wang (2015) to build our empirical model.

1. At the end of every month t , we calculate beta for each stock by regressing excess monthly return of stocks with excess monthly market returns using previous thirty-six months' data, including month t .

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i (r_{m,t} - r_{f,t}) + \epsilon_{i,t} \quad (1)$$

At the end of month t , we sort stocks in ascending order based on beta, to construct quintile portfolios. We construct three different versions of beta arbitrage portfolios by going long on low beta stocks and short on high beta stocks, and compare performance and characteristics of all three beta arbitrage portfolios.

2. We construct the first variant of zero-cost, beta arbitrage portfolio by going long on lowest beta quintile portfolio and going short on highest beta quintile portfolio (lb-hb) as widely captured in popular literature (i.e. Blitz and Vliet (2007), Baker, Bradley and Wurgler (2011)). This strategy is a zero-cost strategy, but is not a beta neutral strategy. This strategy typically results in substantial net negative beta exposure.
3. We construct a second variant of zero-cost, beta arbitrage portfolio as betting against beta (BAB) portfolio following Frazzini and Pedersen (2014) by leveraging low beta quintile portfolios and de-levering high beta quintile portfolios. We shrink stocks' beta towards their cross-sectional mean, by assigning 60% weightage to the estimated beta of stock from previous 36-months returns ($\beta_{\text{regression}}$) and 40% weightage to cross section estimate of beta (β_{prior}), which is set as 1 as prescribed by Vasicek (1973).

$$\beta_{\text{shruk}} = 0.4 \times \beta_{\text{prior}} + 0.6 \times \beta_{\text{regression}} \quad (2)$$

We construct BAB portfolio as zero-cost, beta neutral portfolio by leveraging low beta portfolio and de-

levering high beta portfolio to push both extreme quintile portfolios to unity.

$$r_{\text{BAB},t+1} = \frac{r_{L,t+1} - r_{f,t+1}}{\beta_{L,t}} - \frac{r_{H,t+1} - r_{f,t+1}}{\beta_{H,t}} \quad (3)$$

However, our approach is slightly different as we construct equally weighted BAB portfolios and we don't use any weighting to assign different weights to stocks within quintile portfolio.

4. We follow Gracia-Feijoo, Kochard, Sullivan and Wang (2015) to construct a third variant of beta arbitrage portfolio, which is an alternative betting against beta portfolio (Alt-BAB) in a much simpler manner than BAB portfolio by going long on low beta portfolio and going short on high beta portfolio in the following manner, by avoiding leveraging or delivering low and high beta portfolios respectively, or pushing both low beta and high beta portfolio to unity. We call it Alternative BAB (ABAB) portfolio.

$$r_{BAB,t+1} = (r_{L,t+1} - r_{f,t+1}) - \left(\frac{r_{H,t+1} - r_{f,t+1}}{(\beta_{H,t}/\beta_{L,t})} \right) \quad (4)$$

We repeat this process every month. We then measure returns, standard deviation, ex-post, realized beta, alpha and Sharpe ratio for the resultant time series of quintile portfolios over the entire study period.

In addition, we perform bivariate analysis using double sort, a robust non-parametric technique to evaluate whether beta effect is indeed a separate effect or the one which is disguised in one of the other well-known effects such as value, size and momentum. We first sort stocks on one of the control factors (size, value or momentum) and construct quintile portfolios. Then, we sort stocks on beta within each control factor quintile portfolio. We construct our factor neutral beta quintile portfolios that represent every quintile of control factor.

3. Data and Methodology

3.1. Data

We obtained adjusted monthly closing stock price, earnings to price, market cap, trading volume and turnover data from Capitaline database for all past and present constituents of Nifty 500 index for the period of January 2001 to December 2014. Nifty 500 stocks cover close to 95% of free float market capitalization of the stocks listed on NSE. These stocks represent

almost the full universe of the Indian market and at the same time, exclude penny and highly illiquid stocks from the sample. We have taken Fama-French and Momentum factors for the Indian Stock markets and risk-free rate for Indian markets from the IIM Ahmedabad data library from its website (Agarwalla, Jacob, & Varma, 2013).

3.2. Methodology

3.2.1. Univariate Analysis

We calculate average returns for each quintile portfolio for month $t + 1$ for the beta sorted quintile portfolios constructed at the end of period t . We repeat this process every month. We then measure returns, standard deviation, ex-post beta, CAPM style, single factor alpha and Sharpe ratio for the resultant time series of quintile portfolios over the entire study period.

3.2.2. Bivariate Analysis

We perform bivariate analysis using double sort, a robust non-parametric technique to evaluate whether the beta effect is indeed a separate effect or the one which is disguised in one of the other well-known effects such as value, size and momentum. We first sort stocks on one of the control factors (size, value or momentum) and construct quintile portfolios. Then, we sort stocks on beta within each control factor quintile portfolio. We construct our factor neutral beta quintile portfolios that represent every quintile of control factor.

3.2.3. Fama-French three factor and Fama-French-Carhart four factor regressions.

We compare performance of all three long-short, beta arbitrage portfolios using single factor CAPM style alpha, calculated using equation and Fama-French, three-factor alpha and Fama-French-Carhart, four-factor alpha using equations 5 and 6 respectively. We also analyze factor loadings of alternative beta arbitrage strategies.

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,m}(r_{m,t} - r_{f,t}) + \beta_{SMB}(SMB) + \beta_{HML}(HML) + \epsilon_{i,t} \quad (5)$$

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,m}(r_{m,t} - r_{f,t}) + \beta_{SMB}(SMB) + \beta_{HML}(HML) + \beta_{HML}(WML) + \epsilon_{i,t} \quad (6)$$

4. Empirical Results

We discuss results of our study in this section. Appendix 1 reports summary statistics of number of stocks used for each iteration in the study with their median price to earnings multiple and median market capitalization.

4.1. Univariate Analysis

Table 1 reports performance of beta quintile portfolios, zero cost, low beta minus high beta portfolio and universe portfolio.

Table 1: Main results (Annualized) for quintile portfolios based on historical beta

This table reports beta-sorted calendar-time portfolio returns. At the beginning of each month, stocks are sorted in ascending order based on their ex-ante beta at the end of the previous month. The ranked stocks are assigned to one of the five quintile portfolios. The portfolios are rebalanced every month. The first five columns report results of beta sorted quintile portfolios; the sixth column reports the result of zero cost, low-beta minus high-beta portfolio return, that is, long the low beta portfolio and short the high beta portfolio. The last column reports results of universe portfolio, which is an equally weighted portfolio of all the stocks. All the beta quintile portfolios are equally

weighted by design. The first two rows report annualized excess returns and standard deviation of excess returns. Subsequent rows report Sharpe ratios for beta quintile portfolios, followed by t-value showing the difference between Sharpe ratio of the beta quintile portfolios over universe. The next two rows show average estimated beta (ex-ante) at the portfolio construction stage, beta (realized) is realized loading on the universe portfolio. CAPM-style alpha is the intercept in a regression on monthly excess return is annualized and reported with corresponding t-statistics for all portfolios.

	P1 (low beta)	P2	P3	P4	P5 (high beta)	low-beta minus high-beta	Universe (EWI)
Excess return (Annualized %)	6.30%	6.16%	3.11%	-0.04%	-8.84%	15.15%	1.34%
Standard Deviation %	22.55%	28.98%	33.19%	38.33%	45.80%	27.88%	33.18%
Sharpe ratio	0.28	0.21	0.09	0.00	-0.19	0.54	0.04
(t-value for difference over Universe)	8.12	9.53	5.15	-4.48	-9.71	2.97	
Beta (ex-ante)	0.47	0.76	0.96	1.20	1.61	-1.14	
Beta (realized)	0.65	0.86	1.00	1.16	1.35	-0.70	1.00
CAPM-style alpha	1.22%	-0.60%	-4.56%	-9.00%	-19.36%	20.58%	
(t-value)	0.51	-0.33	-3.74	-6.73	-5.14	3.51	

The first two rows report annualized returns over risk-free return and corresponding standard deviation of excess returns. Excess returns and standard deviations show a definite trend as we move from top quintile, low beta portfolio to bottom quintile, high beta portfolio. Annualized excess return of low beta portfolio is 6.3% and that is monotonically declining as we move towards high beta portfolio. High beta portfolio observes an annualized excess return of -8.84%. The trend is exactly the reverse for standard deviation. Annualized standard deviation of excess returns for low beta portfolio is 22.55% and it keeps on increasing, and the corresponding standard deviation of high beta portfolio is as high as 45.8%. Zero cost, low beta minus high beta, long-short portfolio reports an annualized excess return of 15.5% and standard deviation of 27.88%. Universe, a proxy for market portfolio reports annualized excess return of 1.34% and standard deviation of 33.88%. Clearly, a low beta portfolio turns out to be a high-return, low-risk portfolio. High beta portfolio turns out to be a low return, high risk portfolio. Low beta portfolio is a superior portfolio and dominates both high beta portfolio as well as universe portfolio.

The following two rows report Sharpe ratios and corresponding t-values showing significance of such Sharpe ratio in comparison to Sharpe ratio of universe portfolio. Sharpe ratio for low beta portfolio is 0.28, which is the highest among beta quintile portfolios with corresponding t-value of 8.12. Sharpe ratio keeps on declining. A high-beta portfolio has Sharpe ratio of -0.19 and corresponding t-value of -9.71%. The low beta portfolio registers superior risk-adjusted performance, whereas the high beta portfolio registers inferior risk-adjusted performance over the universe portfolio. Higher excess return and lower standard deviation both contribute to superior performance of low beta portfolio; converse is the case with high beta portfolio, where lower excess return and higher standard deviation both contribute to

inferior performance. The stark difference in the performance of low beta portfolio and high beta portfolio is captured in zero-cost, long low beta and short high beta portfolio. Low beta minus high beta portfolio registers Sharpe ratio of 0.54, which is significantly higher compared to low beta portfolio.

However, such long-short portfolio is out of sync with the market. It has a negative correlation of returns, -0.82 in our sample. The next rows report both ex-ante beta (beta calculated for ranking purpose) and ex-post or realized beta of resultant time series of monthly rebalanced quintile portfolios. Ex-ante beta for low beta portfolio is 0.47, whereas realized beta is 0.65. For a high beta portfolio, ex-ante beta is 1.65, whereas realized beta is 1.35. It is evident that across quintile variation in realized betas is much lesser than ex-ante betas. However, it is worth noting that the low beta portfolio constructed using ex-ante beta ranking continues to have lowest realized beta and high beta portfolio constructed using ex-ante beta ranking continues to have the highest realized beta. The pattern remains the same for other quintile portfolios as well. The difference between the realized beta for the low beta and high beta, portfolio is -0.7, which is large and significant. These results indicate that betas predicted from past returns are a strong predictor of future betas.

The final two rows report CAPM-style single factor alpha for beta quintile portfolios and zero-cost low beta minus high beta portfolio as well as corresponding t-values. Single factor alpha for low beta portfolio is 6.75% with corresponding t-value of 3.59, which is large and significant. Alpha declines consistently as we move from low beta portfolio to high beta portfolio. Alpha for high beta portfolio is -10.65% with t-value of -3.41 that is substantially negative and significant. Zero-cost, long low beta and short high beta portfolio registers alpha of 16.08 with corresponding t-value of 3.41. This clearly shows that

low beta stocks have high (positive) alpha whereas high beta stocks have low (negative) alpha. A long-only investment strategy of investing in a portfolio consisting of low beta stocks or long-short strategy of going long on low beta stocks and short on high beta stocks can be highly rewarding on absolute as well as risk-adjusted basis.

4.1. Bivariate Analysis

Now, we turn our focus to see the strength of beta anomaly after controlling for other known factors such as size, value and momentum by using double sorting approach.

Table 2: Bivariate Analysis Results - Double sorting to control for other effects

This table reports CAPM style one-factor alphas and realized market betas for beta quintile portfolios and zero-cost, long low beta, short high beta portfolio. Panel A, Panel B and Panel C report performance beta quintile portfolios after controlling for size, value and momentum factors respectively, where size is

measured by market capitalization, value by E/P ratio and momentum as 12-months minus 1-month returns. Beta quintile portfolios are constructed in such a manner that they represent stocks from every slice of control factor, i.e. every size-controlled beta quintile portfolio represents stocks from each size quintile.

Panel A: Annualized Alpha from Double Sort on Size (Market Capitalization) and beta (past 3 years)						
	low beta	P2	P3	P4	high beta	lb-hb
Alpha	5.65%	4.99%	1.34%	-3.10%	-9.09%	14.70%
t-value	3.34	3.81	1.14	-2.71	-3.53	3.65
Panel B: Annualized Alpha from Double Sort on Value (Earnings/Price) and beta (past 3 years)						
	low beta	P2	P3	P4	high beta	lb-hb
Alpha	5.27%	3.20%	2.00%	-2.34%	-8.28%	13.55%
t-value	3.20	2.50	1.75	-1.88	-3.08	3.32
Panel C: Annualized alpha from Double Sort on Momentum (12 month minus 1 month returns) and beta (past 3 years)						
	low beta	P2	P3	P4	high beta	lb-hb
Alpha	5.67%	3.08%	2.35%	-2.15%	-9.11%	14.77%
t-value	3.09	2.16	1.96	-1.55	-3.31	3.41

Table 2 reports CAPM style alphas and corresponding t-values for double sorted beta quintile portfolios. Panel A presents results for beta quintile portfolios after controlling for size measured by market capitalization of each stock. Alpha for size controlled low beta portfolio is 5.65%, which is large and significant, and its t-value is 3.34. For a matching high beta portfolio, alpha is -9.09% which is large and significant but with negative t-value of -3.53. Panel B reports alpha and corresponding t-values for beta quintile portfolios by value effect. Alpha for low beta

portfolio is 5.27% with t-value of 3.2, which is economically and statistically significant. Matching high beta portfolio delivers alpha of -8.08% with t-value of -3.08 which is large and significant. Alpha declines systematically as we move from low beta portfolio to high beta portfolio without any exception. Alphas in Panel C show similar results for momentum controlled beta quintile portfolios. Annualized alpha for low beta portfolio is 5.67% with t-value of 3.09, whereas matching high beta portfolio delivers alpha of -9.91% with t-value of -3.31. Alphas for both low and

high beta portfolios are large and significant but have opposite signs. Alphas for zero cost, low-beta minus high beta portfolio for size, value and momentum factors are 14.70% (t-value of 3.65), 13.55% (t-value of 3.32) and 14.77% (t-value of 3.41) respectively; all are large and significant. These alphas are not materially different from one another. They are also not materially different from alpha of a matching portfolio without factor control. This shows that beta effect is robust, economically large and statistically significant after controlling for size, value and momentum effects. After establishing the robustness of beta anomaly

using univariate and bivariate analysis, we look at relative performance of various long low-beta short high-beta arbitrage strategies. As we can see from Table 1, zero-cost, long-short, lb-hb portfolio, delivers large annualized alpha of 16.08%. However, it has the market beta of -0.7. The portfolio has zero cost but it is not a beta-neutral portfolio. From a practical perspective, such high negative beta may be an undesirable trait for most investors unless such portfolio is considered as a separate asset class and is used as an effective hedge to overall market facing portfolio.

Table 3: Performance of various beta arbitrage strategies

This table reports CAPM style one-factor alpha, realized market betas, 3-factor alphas controlling for size and value factor and 4-factor alphas after controlling for size, value and momentum factors for different zero-cost, beta arbitrage strategies. While lb-

hb portfolio is zero-cost portfolio, it is not beta neutral, whereas both BAB and Alt-BAB are constructed by making them beta neutral on ex-ante basis at the end of each month.

	lb-hb	BAB	Alt-BAB
CAPM style alpha	16.08%	16.06%	10.81%
(t-value)	3.39	3.35	3.31
beta (realized)	-0.70	-0.05	-0.03
3-factor alpha	20.22%	19.63%	13.26%
t-value	4.70	4.36	4.33
4-factor alpha	16.37%	15.48%	10.43%
t-value	4.27	3.89	3.85

We report and analyze results of zero-cost, negative beta, long-short portfolio, with two alternative zero-cost, ex-ante, beta-neutral, long-short portfolios: BAB (betting against beta portfolio) constructed in the spirit of Frazzini and Pedersen (2014) and Alt-BAB (Alternative betting against beta) portfolio constructed in line with Garcia-Feijoo, Kochard, Sullivan and Wang (2015). The difference in the construction process of two beta-neutral portfolios is explained in the methodology section.

values for all the three zero-cost long-short portfolios. CAPM-style one-factor alpha for long low-beta minus short high-beta portfolio is 16.08% with economically large and statically significant t-value of 3.31. However, it has beta of -0.7 and that may not be consistent with many professional investment mandates. On the other end, BAB portfolio has one-factor alpha of 16.06% (t-value 3.35), which is very similar to the alpha of lb-hb portfolio, both in terms of magnitude and statistical significance. However, BAB has realized beta of -0.05 and it is largely beta-neutral.

Table 3 reports market beta and one-factor, three-factor and four-factor alphas with corresponding t-

Table 4: Output of Three and Four factors calendar time regression analysis

This table reports coefficients and corresponding t-values for three and four factor regressions for beta arbitrage portfolios lb-hb, BAB and Alt-BAB, and excess returns of low beta and high beta portfolios to

understand the characteristics of beta arbitrage and low and high beta portfolios in terms of strength of their alpha and factor tilt towards classic size, value and momentum factors.

	lb-hb		BAB		Alt-BAB		lb-r _f		hb-r _f	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	coefficient	t-value	coefficient	t-value
4-factor alpha (annualized)	16.37%	4.27	15.48%	3.89	10.43%	3.85	5.08%	3.03	-11.29%	-4.49
r _m -r _f	-0.45	-10.22	0.18	4.10	0.13	4.11	0.74	39.28	1.19	41.79
SMB	-0.04	-0.48	-0.05	-0.65	-0.04	-0.83	-0.03	-0.90	0.01	0.13
HML	-0.40	-6.27	-0.34	-5.18	-0.23	-5.12	-0.12	-4.44	0.27	6.60
WML	0.31	6.19	0.33	6.44	0.23	6.43	0.13	6.15	-0.17	-5.33
	lb-hb		BAB		Alt-BAB		lb-r _f		hb-r _f	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	coefficient	t-value	coefficient	t-value
3-factor alpha (Annualized)	20.22%	4.70	19.63%	4.36	13.26%	4.33	6.76%	3.59	-13.47%	-4.92
r _m -r _f	-0.55	-12.01	0.07	1.54	0.05	1.55	0.70	35.24	1.25	43.09
SMB	-0.02	-0.24	-0.03	-0.37	-0.03	-0.54	-0.02	-0.61	0.00	-0.04
HML	-0.38	-5.27	-0.32	-4.26	-0.22	-4.21	-0.12	-3.66	0.26	5.77

The practical difficulty in constructing a BAB portfolio is that it requires active and dynamic lending and borrowing to push both low beta and high beta portfolios to unity in order to achieve beta-neutrality on ex-ante basis. This is an extremely difficult and expensive process to follow in emerging markets like India. An easier to implement Alt-BAB portfolio reports one-factor alpha of 10.81% (t-value = 3.31), that is large and statistically significant, but lower in economic terms compared to alphas of lb-hb and BAB portfolios. The results are robust when we look at three-factor alphas of all the three portfolios after controlling for Fama-French factors of size and value. Three factor alphas for lb-hb, BAB and Alt-BAB portfolios are 20.22% (t-value = 4.7), 19.63% (t-value = 4.36) and 13.26% respectively. It is worth noting that 3-factor alphas are greater economically and more significant statistically than corresponding one-factor alphas for all three beta arbitrage portfolios.

We also report four-factor alphas controlling for momentum factor in addition to size and value factors in the spirit of Carhart. Four-factor alphas of lb-hb, BAB and Alt-BAB factors are 16.37% (t-value = 4.27), 15.48% (t-value = 3.89) and 10.43% (t-value = 3.85) respectively. All are very similar to corresponding one-factor alphas in terms of their value with even greater statistical significance. These results show that low beta anomaly is unique and classic. Value, size and momentum factors combined together don't affect the strength or the statistical significance of the anomaly. On the contrary, three-factor alphas for all the three long-short, beta arbitrage portfolios are greater than their corresponding one-factor alphas. This encourages us to look at the characteristics of our beta arbitrage portfolios in terms of their size, value and momentum tilt.

Table 4 reports results of three-factor and four-factor regressions to understand the portfolio characteristics of lb-hb, BAB and Alt-BAB portfolios. Looking at the

output of three and four-factor regressions, we can clearly witness that none of the three portfolios have any size tilt towards small stocks with SMB factor loading near zero, with a negative sign and statistically insignificant. However, the same is not the case with value factor. There is a clear tilt away from value stocks evident in all the three portfolios. HML factor loading of all the three portfolios is substantially large with a negative sign, and is statistically significant. Similarly, looking at four-factor regressions, we can clearly see that all the three portfolios have a clear momentum tilt with large and positive WML factor loading and it is highly significant statistically in each case.

These results are quite interesting. While none of the beta arbitrage long-short portfolios have any tilt towards size factor, these portfolios have clear negative tilt away from value factor and positive tilt for momentum factor. As we know, all these portfolios are a combination of long low-beta and short high-beta portfolios. It is important to see characteristics of both low and high-beta portfolios individually. This will help us understand which portfolio contributes to the size, value and momentum tilt of zero cost, long-short beta arbitrage portfolios. Both three-factor and four-factor loadings of low beta portfolios show that low beta portfolio has no size tilt. However, it is dominated by growth and winner stocks with negative HML factor loading and positive WML factor loading. Both HML and WML coefficients are similar in value and statistically significant, but with opposite sign. On the other end, a high-beta portfolio too has no size tilt, but has clear value tilt with large positive HML factor loading both in terms of size and statistical significance and negative WML factor loading, similarly large and significant. This clearly shows that a high-beta portfolio is dominated by value and loser or negative momentum stocks. We just want to highlight that HML loading is more significant than WML loading. Therefore, a long position in low-beta portfolio and short high-beta portfolio, both contribute to large and

negative HML factor loading and comparably large but positive momentum factor loading of all zero-cost, beta arbitrage portfolios.

5. Limitations and Potential future work

This study compares alternative beta arbitrage strategies using portfolio level analysis only. Stock level analysis can provide valuable insights in explaining differences in performance and characteristics of alternative beta arbitrage strategies. Besides, this study uses equal weighting scheme while constructing beta quintile portfolios. Results with alternative weighting schemes such as value weighting scheme would add to the robustness of the results. In addition, this study does not analyze performance of beta arbitrage strategies in markets with borrowing constraints and changing liquidity scenarios.

Future work on beta arbitrage strategies may focus on stock level analysis of beta quintile portfolios and evaluating robustness of results to change in weighting schemes while constructing beta quintile portfolios. Besides, studying the impact of borrowing restrictions and varying liquidity scenarios on performance of beta arbitrage strategies in the Indian context will explain the difference in performance of beta arbitrage portfolios in different phases of the market cycle. Future work should focus on interaction of BAB factor with other known factors such as value, size and momentum to gain further insights into combining beta arbitrage strategies with other factor investment strategies to generate superior risk-adjusted returns.

2. Conclusion

Our results show clear evidence for beta anomaly in Indian stock markets. A low-beta portfolio delivers positive alpha and a high-beta portfolio delivers negative alpha. Beta anomaly is robust after controlling for size, value and momentum factors individually and collectively. Our comparison of three

different versions of beta arbitrage portfolio establishes that all the portfolios deliver substantial alphas contributed by both long and short side of the portfolios. Moreover, all the portfolios have a clear tilt towards momentum and away from value factor, and no significant loading for size factor. While alphas of lb-

hb and BAB portfolios are similar, BAB portfolio is largely beta-neutral, whereas lb-hb portfolio has large negative beta. Alt-BAB has comparatively lower alpha, but it turns out to be the best implementable strategy in emerging markets like India with short selling and borrowing restrictions along with funding constraints.

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Appendix 1: Summary statistics

This table reports the number of eligible stocks for each iteration with their median price to earnings multiple and median market capitalization.

Year-Month	No of stocks	Median PE	Median Market-cap (million INR)
200401	465	11.61	3209.5
200402	468	9.57	2911.1
200403	471	9.12	2734.7
200404	471	8.72	2630.9
200405	476	9.24	2876.9
200406	478	7.98	2568.5
200407	479	8.24	2510.2
200408	485	8.69	2859.1
200409	484	9.54	3213.4
200410	486	10.35	3553
200411	487	9.93	3586.5
200412	490	11.32	4210.1
200501	488	12.91	4585.4
200502	489	12.11	4856
200503	490	12.56	5013.2
200504	489	12.36	5263.4
200505	486	12.76	5191.1
200506	485	14.23	5470.2
200507	487	14.80	5699.8
200508	488	14.62	6191.5
200509	487	16.18	7065.7
200510	489	16.50	7342.2
200511	486	13.92	6818.4
200512	488	15.81	7556
200601	488	16.73	8062.1
200602	487	17.26	8605.8
200603	488	17.14	8569.5
200604	490	18.10	8918.8
200605	489	19.46	9909.8
200606	491	16.49	8418.9
200607	492	14.79	7516.5

Year-Month	No of stocks	Median PE	Median Market-cap (million INR)
200608	489	13.28	7689
200609	491	14.82	8514
200610	483	15.50	8906.3
200611	484	15.51	9607.1
200612	490	15.12	9665.7
200701	497	15.56	10411.7
200702	500	15.32	10664.2
200703	502	14.10	9614.6
200704	505	13.46	9085.3
200705	508	14.38	10221
200706	512	15.35	10633.6
200707	514	15.93	10375.8
200708	516	14.47	10873
200709	519	14.05	11064.3
200710	524	15.41	12198
200711	524	14.96	13157.2
200712	526	15.62	14177.3
200801	526	18.46	17079
200802	524	13.87	12929.6
200803	521	13.94	13285.3
200804	526	11.94	10934.4
200805	531	13.13	12363.7
200806	533	12.75	11829
200807	538	10.51	9923.1
200808	546	10.27	10282.3
200809	547	10.64	10478.9
200810	547	8.85	8476.4
200811	547	5.98	5779.6
200812	547	5.25	4940.8
200901	550	6.01	5740.9
200902	557	5.78	5033.7

Year-Month	No of stocks	Median PE	Median Market-cap (million INR)
200903	561	5.49	4729.6
200904	570	5.94	5338.4
200905	575	7.57	6494.1
200906	576	11.35	9560.6
200907	580	11.34	9448.2
200908	581	10.96	10575.6
200909	583	11.84	11775.7
200910	590	12.84	12784.5
200911	593	11.20	11247
200912	599	12.53	12488.7
201001	605	13.51	13840.2
201002	610	13.09	13715.3
201003	616	13.10	13176.8
201004	625	14.03	14432.6
201005	630	13.75	15055.9
201006	636	13.11	14744.4
201007	637	14.22	15705.1
201008	640	14.26	15980.2
201009	643	14.45	16738
201010	644	15.32	18071.7
201011	650	15.55	18573.6
201012	654	14.47	17380.1
201101	660	14.54	17879.7
201102	660	12.68	16109.9
201103	665	11.82	14004.7
201104	667	13.02	15545.7
201105	669	13.33	16680.2
201106	671	12.71	15531.4
201107	671	12.85	15267.9
201108	675	12.66	15482.1
201109	674	11.49	13593
201110	674	11.20	13176.3
201111	678	11.37	13743.2
201112	678	10.11	12340.2
201201	678	9.12	10668.6

Year-Month	No of stocks	Median PE	Median Market-cap (million INR)
201202	678	10.41	12901.9
201203	678	11.47	13786.1
201204	676	11.05	13371.7
201205	674	11.74	13145.1
201206	673	11.07	11838.6
201207	674	11.78	12536.5
201208	676	10.64	12044.4
201209	677	10.61	11785
201210	680	11.62	13412.5
201211	681	11.69	13470
201212	685	12.18	13249.3
201301	688	12.59	14517.4
201302	696	12.32	14650.1
201303	700	10.87	12177.1
201304	701	9.96	11880
201305	702	11.10	12600.5
201306	700	10.94	12202.6
201307	699	10.53	11363.2
201308	696	8.96	10060.7
201309	697	8.36	9992.2
201310	699	9.17	10364.1
201311	702	9.61	11386
201312	703	9.86	11883.6
201401	701	10.61	13471.9
201402	700	10.27	12745
201403	700	10.60	12772.5
201404	702	11.58	14553
201405	701	12.89	15120.2
201406	705	14.97	18413.2
201407	704	16.75	22120.3
201408	702	15.48	21312.5
201409	705	16.18	21465.1
201410	706	16.46	21569.7
201411	708	16.32	21632.9
201412	709	16.59	22677.6

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The mediating role of work-family conflict in the relationship between demands and turnover intentions

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Abstract: The relationship between work-to-family conflict (WFC) and turnover intentions (TOIs) has not received much attention within the organisational behaviour (OB) literature, with demands emerging from the family front often being neglected. The current study investigates the role of WFC as a mediator between both forms of demand (work as well as family) and turnover intentions, among 330 sales employees across service and manufacturing sectors, in Indian organisations. Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) supported the eight item work demand and family demand scale measuring work and family demands in the Indian setup. Results of structural equation modelling (SEM) with bootstrapping showed that work as well as family demands are significantly related to WFC. As expected, WFC was found to be positively related to turnover intentions. In addition, WFC was found to mediate the relationship between work demands and turnover intentions as well as between family demands and turnover intentions. The added value of the paper is in terms of: 1) focus on sales employees (across various sectors) who are under tremendous pressures both from work and family domains; 2) using SEM with bootstrapping to test the model.

Keywords: work demands; family demands; work-to-family conflict; WFC; turnover intentions; TOIs; sales employees; structural equation modelling; SEM; mediation.

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1 Introduction

The inability to balance the equally challenging demands of work and personal life has contributed to the increasing stress and conflict of today's workforce (Edwards and Rothbard, 2000; Jin et al., 2013; Kossek et al., 2014; Goh et al., 2015). This in turn has been negatively affecting employees in the form of lowered morale, reduced productivity, reduced job satisfaction and higher turnover (Galinsky and Stein, 1990; Benedict and Taylor, 1995; Burke, 1988). The same holds true for sales as a profession.

Organisations worldwide are spending millions of dollars to investigate and hunt ways to improve sales, and there is no doubt that, sales employees are the lifeblood of any organisation (Milkovich, 1988). However, sales professionals are largely seen affected due to imbalances between personal, family, and work-related goals (Jones et al., 2007) making them sensitive to burnout (Cummings, 2001).

Narayanan et al. (1999) in their study on sales people showed that these employees are four times more likely to complain about work overload than role conflict or role ambiguity. The primary reason for the same is that sales people operate in a competitive environment that requires a timely response to the ever-changing customer demands (Van der Lippe, 2007; Mulki et al., 2008). Work load perceptions are important in stress models tested in boundary-spanning positions (e.g., Mulki et al., 2008; Babakus et al., 2009) like sales as it had a detrimental effect on employee attitudes and behaviours (Claessens et al., 2004).

Turnover research is primarily conducted from both functional as well as dysfunctional aspects [Mobley, (1982), p.42]. Current research will only focus on the dysfunctional aspects of employees' turnover. Employee turnover has ceaselessly been problematic among salespeople (Richardson, 1999), as it creates major expenses through lost sales, costs of separation, recruitment, selection, and training (Branham, 2005; Allen et al., 2010). More notably salesperson turnover can impair ongoing buyer-seller interactions (DeConinck and Johnson, 2009) which are of prime importance to any organisation. On an average, about 16% of a firm's sales force will quit in a given year (Churchill et al., 1997) though accurate statistic for the same is not available (Purani and Sahadev, 2008). According to Times News, New York (2003), overall attrition rate is 42% in USA, 29% in Australia, 24% in Europe and 18% in India whereas the global average is 24% (Shahnawaz and Jafri, 2009). Surprisingly for sales organisations like insurance, the level of employee turnover can surpass 100% a year (Tanner et al., 2009).

The current study aims to assess the mediating role of work-to-family conflict (WFC) in the relation between demands (both work and family demands) and turnover intentions (TOIs).

2 The present study

Most of the studies on work-family issues have been carried out primarily in western industrialised nations, most notably the USA, but economic and business globalisation has made work-family issues increasingly important in developing countries too (Yang et al., 2000). As India constitutes the world's second most populated nations, it is reasonable to collect data and compare the results with its western counterparts. In addition to this, there are demographic changes in the forms of increasing number of women in the workforce (Census of India, 2006) and increasing number of nuclear as well as dual earner families (Bharat, 2003), which have put massive pressure on both men and women to manage their work and family commitments. Further, it has been observed that most of the work-family studies have been conducted on either females as a sample or on conventional occupations like teaching or nursing. There are very few research studies in the Indian context which talk about work-family balance of sales employees confined to either pharmaceutical or retail banking sector, though sales is one such function wherein work-family issues are quite prominent and hence needs to be explored properly.

3 Theoretical framework and hypotheses

The prevailing theoretical perspective used to elucidate the linkages between work and family has been role theory (Katz and Kahn, 1978). The prominent perspective within role theory for relating the interaction between work and family is the scarcity hypothesis (Goode, 1960) which leads to conflict perspective. From this viewpoint, people with a greater number of roles are more likely to deplete their resources, resulting in role overload or role conflict. In addition, spillover theory, suggests that work-related activities and satisfaction also affect non-work performance, and vice versa. Over the years, WFC studies have increased in numbers and importance, and researchers have examined its causes and consequences (Kossek and Ozeki, 1998).

The review proposed by Greenhaus and Beutell (1985) is one of the landmarks in the study of work-family studies. They define work-family conflict as "a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect". Terms like work-home interference (e.g., Geurts et al., 2003), and work-non-work interference (e.g., Dikkers et al., 2005) are used by researchers interchangeably to indicate work – family conflict. According to Frone et al. (1992), work-family conflict is seen as having two distinct domains: work-to-family (WFC) and family-to-work (FWC) and these domains are bidirectional in nature (Frone et al., 1997). The current study assesses conflict arising only from work domain, i.e., WFC.

Further, there is significant evidence that work-family conflict results in serious negative consequences for both individuals and organisations such as decreased satisfaction and performance, increased burnout and intention to turnover (Eby et al.,

2005; Amstad et al., 2011). One of the important features of work-family imbalance is that it affects all individuals who are in paid jobs irrespective of whether they are having family responsibility or not (Fu and Shaffer, 2001; Rotondo et al., 2003).

3.1 Work and family demands, WFC and TOIs

Job stressors and demands are considered to be strongest predictors of work-family conflict (Carlson and Kacmar, 2000; Parasuraman et al., 1996). Researchers in the past have been using hours worked, workload (Valcour et al., 2011; Ilies et al., 2009) and number of children as parameters to gauge work and family demands. The probable reason for such a finding is the finite nature of time, i.e., longer working hours leaves an individual with limited time to handle other needs outside work (Barnes et al., 2012). However, such measures are either demographic or are situational causes of demands (Boyar et al., 2008).

Boyar et al. (2008) explored the impact of demand (i.e., work demand and family demand) on work family conflict. The findings indicate a direct impact of both forms of demand, i.e., work and family demand on both work interfering with family (WIF) and family interfering with work (FIW). Recently, also studies have confirmed that work and family antecedents are associated with both directions of work and family conflict (DiRenzo et al., 2011). Researchers have come to implicitly agree that increases in demand are a primary cause of WFC. Despite its purported importance, work and family demand has been poorly conceptualised and rarely directly measured (Boyar et al., 2008; Yang et al., 2000) in Indian scenario.

Taking into consideration the existing studies which suggest that demands arising from organisational environment and family domain may have a significant association with employees' negative feelings about work, we formulated the following hypotheses:

H1 Work demand will be positively related to WFC.

H2 Family demand will be positively related to WFC.

Greenhaus et al. (2001) argued that withdrawal intentions surface when an employee experiences a role conflict and chooses to reduce the imbalance by giving more importance either to work or family. Cutler and Jackson (2002) asserted that WFC can lead to a lack of advancement, job turnover, and change of occupation. Spector et al. (2007) compared WFC on employees' TOIs in different cultural settings – both individualist and collectivist. Findings of the study confirmed that WFC is positively related with employees' TOIs in different settings. Similar results were established by Ghayyur and Jamal (2012) wherein WFC is found to be positively related to TOIs. However these findings contradict the concept of Hofstede et al. (2010) which proposed that perceived conflict would affect people in different cultures differently. In the light of these studies, we proposed the following hypothesis:

H3 WFC will be positively related to TOIs.

Front-end employees like salespeople in most of the sectors require long and irregular working-hours and shifts (Blomme et al., 2010) that potentially cause role-conflict that further leads to WFC. This conflict in turn leads to higher TOIs (Shaffer et al., 2001; Spector et al., 2007; Ghayyur and Jamal, 2012; Eric and Kudo, 2014).

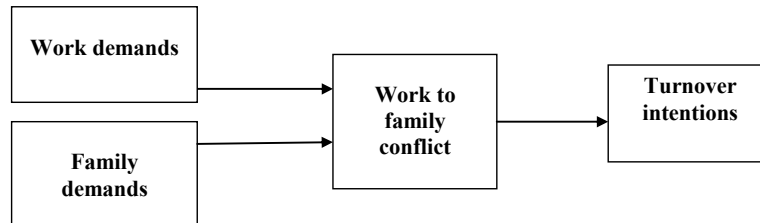
Family demands are primarily a result of the multiple roles that an individual (in this case, a sales employee) performs as a parent, a caretaker of elders or other family members at home. When a person cannot perform his role in the family well, then he will feel guilty for the family (Seto et al., 2004) which in turn may have a cascading effect on ones' WFC. Also, to overcome this guilty feeling, their TOI and desire to find a new job will be more intense (Yunita and Kismono, 2014). Prior studies in the western countries (Cordero et al., 2009; Mowday et al., 1982) also indicate that TOIs have resulted due to family demands, such as child care demands. Hence, it has been hypothesised that:

H4 WFC will mediate the relationship between work demand and TOIs.

H5 WFC will mediate the relationship between family demand and TOIs.

The proposed theoretical model of the study is depicted in Figure 1.

Figure 1 Proposed model



Overall, the model presents a mediating role of WFC between both forms of demand (i.e., work and family demand) and TOIs. Work demands (WD) and family demands (FD) are independent variables; WFC is a mediating variable and TOI is a dependent variable in the model.

4 Methodology

4.1 Sample and procedure

The data for the current study were collected from a sample of 330 sales employees belonging to different sectors namely banking and financial services, IT, FMCG, electrical firms, and pharmaceuticals through purposive sampling. Sample includes both married and unmarried employees:

- a over 21 years of age
- b currently working with an organisation for at least one year.

The reason for such choice is because of the very fact that it takes at least a year (in most of the firms) to understand an organisation and also availing the benefits meant for the employees. Table 1 displays the demographic profiling of the sample under study.

Table 1 Demographic characteristics of the participants

<i>S. no.</i>	<i>Demographic characteristics</i>		<i>Frequency (N = 330)</i>	<i>Percentage</i>
1	Gender	Male	292	88.5
		Female	38	11.5
2	Age	≤ 25 years	60	18.2
		26–30 years	153	46.4
		31–35 years	59	17.9
		> 35 years	58	17.6
3	Marital status	Married	211	63.9
		Unmarried	119	36.1
4	Presence of children	No	55	25.7
		Yes	156	74.2
5	Employed spouse	Yes	85	25.8
		No	126	38.2

4.2 Measures

- *Work demand and family demand scale*: Boyar et al. (2007) scale is used to assess the perceived work demand and perceived family demand. The measure comprises of two subscales, comprising of 5 and 4 items for assessing work and family demand respectively. A five-point Likert-scale, wherein 1 indicates ‘rarely’ to 5 indicating ‘always’ is used for each subscale. However, since the scale has not been tested in Indian scenario so it is tested for its validity. The results for the same will be discussed in the next section.
- *WFC scale*: Netemeyer et al. (1996) scale of work-family conflict is used for the study. A seven-point Likert-scale was used wherein responses ranges from 1 (strongly disagree) to 7 (strongly agree). The overall scale scores are obtained by adding the value of 5 items for WFC. This is one of the most cited and used measure for assessing WFC in non-US-based work-family research (Shaffer et al., 2011).
- *TOI scale*: Turn over intention represents an employee’s desire to leave an organisation. It is evaluated using modified version of Mitchel (1981) scale (Ku, 2007). All the items in the four item scale were reverse coded. The overall scale scores were obtained by adding the value of four items (after adjusting for reverse-scored item).
- *Control variables*: We have used five control variables in the current study: gender, age, marital status, presence of children at home and employed spouse. Presence of children of all ages living at home places more demands on the working parents, which can be a very important factor in explaining work-family interference (Voydanoff, 1988).

4.3 Data analysis

AMOS software (Arbuckle, 2011) version 20.0, which includes an structural equation modelling (SEM) package with maximum likelihood estimation, was used to test both the measurement and the structural models related to the research hypotheses. Standard statistical procedures like descriptive and inferential statistics, such as frequency, means, and factor analysis (to test the construct validity of work and family demand scale) were conducted. The following statistical procedures were completed for attaining the objectives of the study:

- 1 Assessing construct validity of work demand scale and family demand scale.
- 2 Assessing reliability of various scales.
- 3 Exploring bivariate relations between variables.
- 4 Assessing models to test the hypothesised mediation relation (Model 1 – Full mediation). Furthermore, an additional analysis was done by testing two alternative models: Model 2 (non-mediation), and Model 3 (partial mediation). Bootstrapping technique is considered to be an ideal technique for testing mediating effects (Hayes, 2009). The overall fit of the models was assessed using both absolute as well as relative fit indices as recommended by Hair et al. (2010).

5 Results

Before testing the model under study, the validation of work and family demand scale was conducted. The validation of work and family demand scale was done on 140 sales employees. Later on, additional data (N = 330) was collected and research hypotheses were tested.

5.1 Validation of work demand and family demand scale

Exploratory factor analysis (EFA) utilising a principal component analysis (PCA) method with a VARIMAX rotation was conducted to reveal the underlying dimensions of the Work and family demand. Tabachnick and Fidell (2001) suggested that KMO values of 0.60 and higher are required for good factor analysis. Further, a significant result (Sig. < 0.05) using Bartlett test indicates matrix is not an identity matrix; i.e., the variables do relate to one another enough to run a meaningful EFA. Table 2 exhibits the result of KMO and Bartlett test.

Table 2 KMO and Bartlett test

Kaiser-Meyer-Olkin measure of sampling adequacy		<i>0.831</i>
Bartlett's test of sphericity	Approx. Chi-square	514.614
	df	36
	Sig.	<i>0.000</i>

Later on multiple criteria for determining the number of factors to retain were used including Eigen values greater than 1.0 because they account for the variance of at least a single variable and variance explained of greater than 60% (Hair et al., 1998). Furthermore, only items that loaded at 0.5 or higher on the intended factor were retained as they are considered to be appropriate (Hair et al., 1998). All the nine items were entered in a single analysis (*Refer Sample Questionnaire's Section 1*). A two factor solution accounted for 63.60 of the total variance. The items of all the scales loaded in consistence with the theory-consistent factors (e.g., work demand items loaded on their own distinctive factor). Table 3 reveals the two factor structure along with their corresponding factor loadings.

Table 3 Factor loadings using varimax rotation method

	<i>Component</i>	
	<i>1</i>	<i>2</i>
WD 1	0.644	0.163
WD 2	0.792	0.131
WD 3	0.828	0.186
WD 4	0.813	0.057
WD 5	0.638	0.205
FD 1	0.036	0.800
FD 2	0.208	0.807
FD 3	0.205	0.854
FD 4	0.227	0.804

Notes: Extraction method: principal component analysis.

Rotation method: varimax with Kaiser normalisation.

Initially, when convergent validity was calculated for the scale, the value of average variance extracted (AVE) was found to be lesser than the threshold value of 0.5. Later on, the item corresponding to WD 1 was eliminated as its standard regression weight was least (0.588) amongst the given set of values. Further, deleting WD 1, convergent validity (Hair et al., 2010) was calculated again and this time it was found to be more than the prescribed values ($CR \geq 0.6$ and $AVE \geq 0.5$). The results are presented in Table 4.

Table 4 Convergent validity

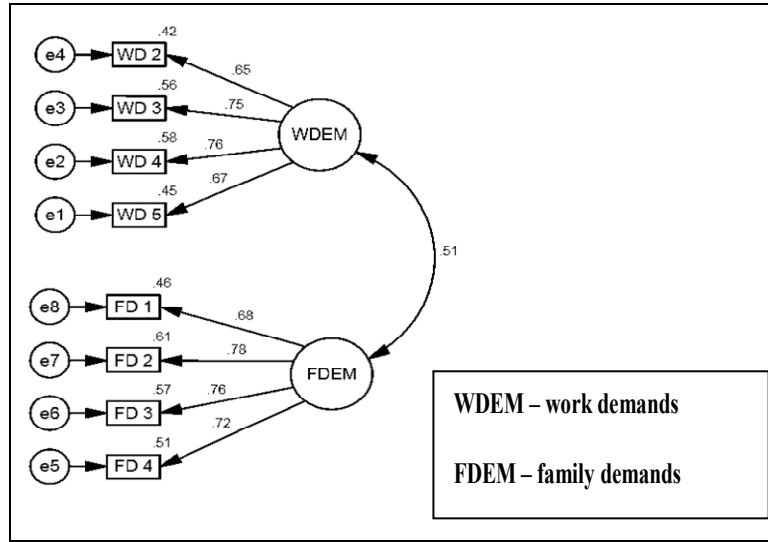
<i>S. no.</i>	<i>Construct</i>	<i>Composite reliability (CR)</i>	<i>Average variance extracted (AVE)</i>
1	Work demand	0.93	0.53
2	Family demand	0.91	0.60

In addition, discriminant validity of both the scales under study was conducted. Discriminant validity refers to the distinctiveness of different constructs (Campbell and Fisk, 1959). The rule is that variables should load significantly only on one factor. If 'cross-loadings' do exist (variable loads on multiple factors), then the cross-loadings should differ by more than 0.2. The scales were found to have sufficient discriminant validity (refer Table 3).

Later on, confirmatory factor analysis (CFA) was conducted on the eight item work demand and family demand scale to examine the appropriateness of the data to the

two-factor structure. Following model fit statistic: $\chi^2 = 19.606$, $df = 19$, $p = 0.419$, $Cmin/df = 1.03$, $CFI = 0.999$, $TLI = 0.998$, $RMSEA = 0.015$, $SRMR = 0.04$ were observed. Therefore, the two factor model was accepted. Hence, the four-item scale each of work and family demand was used for further analysis. Figure 2 represents the results of the two factor first order CFA along with corresponding factor loadings.

Figure 2 CFA model of demand with factor loadings



5.2 Reliability of scales

Table 5 reports the Cronbach alpha values for various scales under study. The Cronbach alpha values of all the scales exceeded the minimum standard (0.7) (Nunnally and Bernstein, 1994) and hence, the scales under study are considered to be reliable.

Table 5 Reliability analysis

Scale	No. of Items	Cronbach alpha value
Work demand	4	0.797
Family demand	4	0.822
Work-to-family conflict	5	0.909
Turnover intentions	4	0.933

5.3 Intercorrelations

Firstly, bivariate correlations were examined to verify the associations among the main variables in this study. Table 6 signals that both work and family demand were positively correlated with WFC conflict ($r = 0.45$, $p < 0.001$; $r = 0.37$, $p < 0.001$). We also found that WFC was positively associated with TOIs ($r = 0.19$, $p < 0.001$). Furthermore, all linkages are in the anticipated direction.

Table 6 Means, standard deviations and bivariate correlations

	Mean	SD	1	2	3	4	5	6	7	8	9
1 Gender	0.88	0.320	-								
2 Age	2.35	0.972	-0.139*	-							
3 Marital status	1.36	0.481	0.065	-0.588**	-						
4 Presence of children	0.47	0.500	-0.094	0.661**	-0.711**	-					
5 employed spouse	0.26	0.438	0.243**	0.281**	-0.442**	0.275**	-				
6 WD	17.26	1.830	-0.010	0.095	-0.085	0.177*	0.102	-			
7 FD	15.51	2.321	-0.026	0.094	-0.133*	0.362**	0.163**	0.424**	-		
8 WFC	27.24	3.796	-0.013	0.267**	-0.347**	0.381**	0.158**	0.450**	0.373**	-	
9 TOI	19.08	5.237	0.025	-0.120*	0.101*	-0.097	-0.068	0.207**	0.110*	0.192**	-

Notes: WD: work demands; FD: family demands; SD: standard deviation; *p < 0.05; **p < 0.01.

5.4 Mediating effect of WFC

To confirm the mediating role of WFC, bootstrapping (N = 2,000 samples) (Cheung and Lau, 2008) was done. We used Barron and Kenny (1986) method to test, whether WFC is mediating the relationship between work/family demands and TOI (H4, H5). Table 7 manifests the various mediation relations among both forms of demands, WFC and TOI.

Table 7 Mediation relationships among both forms of DEMAND, WFC and TOI

<i>Variable</i>	<i>WD</i>	<i>FD</i>	<i>WFC</i>	<i>TOI</i>
<i>Control variable</i>				
Gender	ns	ns	ns	ns
Age	ns	ns	ns	ns
Marital status	ns	ns	ns	0.257**
No. of children	ns	ns	0.237**	ns
Employed spouse	ns	ns	ns	ns
<i>Direct effects</i>				
WD	-	-	0.373**	0.175**
FD	-	-	0.271**	ns
WFC	0.373**	0.271**	-	0.195**
TOI	0.175**	ns	0.195**	-
<i>Indirect effects</i>				
WD	-	-	-	0.073**
FD	-	-	-	0.064**

Notes: Bootstrap, bias-corrected two-tailed tests used to calculate significance of the indirect effects.

ns = not significant.

**Relationships are statistically significant at $p < 0.01$.

Results (Table 6) indicate that both the independent variables in this study, job demands and family demands were significantly related to TOIs as well as professed mediator that is WFC thus fulfilling the first and second condition for mediation test (Barron and Kenny, 1986). Further, WFC was significantly related to TOIs hence conformity to the third condition for mediation was also demonstrated. Lastly, the effect of the mediator was tested, i.e., whether there exists partial/full or no mediation between the variables under study. It was found that (Table 7) WFC mediate the relationship between family demands and TOIs. In addition, WFC was found to partially mediate the relationship between work demands and TOIs.

5.5 Model testing

All of the SEM analyses were completed using Amos 20.0. The fit statistics for the models are shown in Table 8. In order to determine the hypothesised mediation effects, we posited a fully mediated model (see Figure 3). In addition, alternate models were tested in the current study (see Figures 4 and 5).

- Model 1 The full mediated model was tested wherein indirect paths from independent to dependent were tested.
- Model 2 The relationship between work demands/family demands to TOIs was not mediated by WFC, i.e., no mediation model.
- Model 3 The partially mediated model was tested wherein all direct and indirect paths are connected from independent variable to dependent variable.

At first, all control variables were included in the model. However, when tested in SEM only two control variables (i.e., number of children and marital status) were found to be significantly related to the endogenous variables.

As presented in Figure 3, Model 1, the fully mediated model fits the data acceptably ($\chi^2 = 14.545$; $p = 0.006$; $\chi^2/df = 3.636$; CFI = 0.979; TLI = 0.921; RMSEA = 0.09; SRMR = 0.039).

Table 8 Model fit indices for alternative models (N = 330)

S. no.	Model fit indices	Model 1 (full mediation)	Model 2 (non-mediation)	Model 3 (partial mediation)
1	χ^2	14.545	74.807	4.341
2	P value	0.006	0.000	0.114
3	χ^2/df	3.636	14.961	2.170
4	CFI	0.979	0.861	0.995
5	TLI	0.921	0.582	0.965
6	SRMR	0.0391	0.104	0.010
7	RMSEA	0.090	0.206	0.06

Notes: χ^2 : Chi square; df: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis index; SRMR: standardised root mean square residual; RMSEA: root mean square error of approximation.

Figure 3 Model 1 (full mediation) with results of SEM

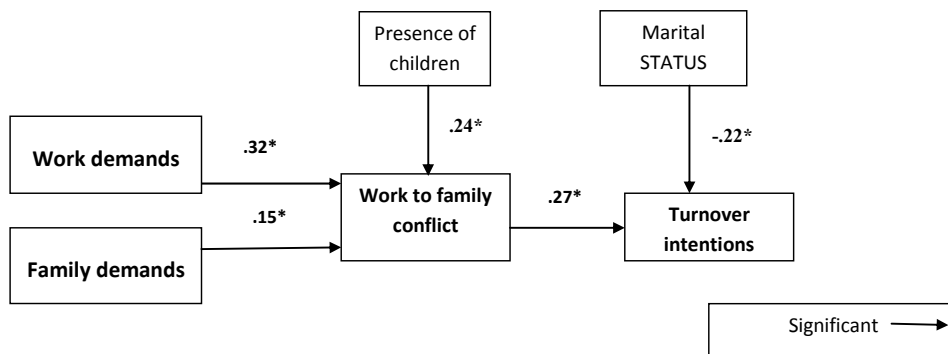


Figure 4 Model 2 (no mediation) with results of SEM

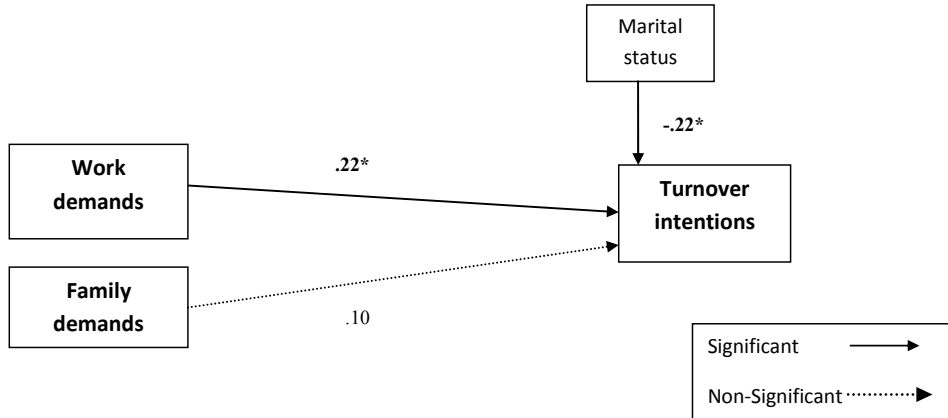
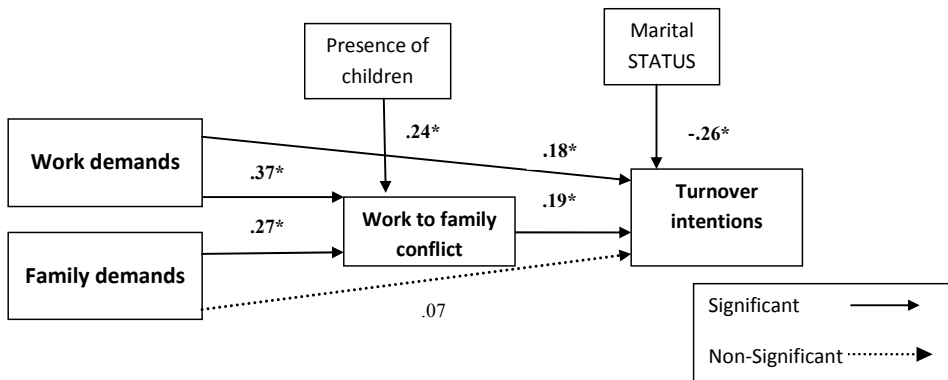


Figure 5 Model 3 (partial mediation) with results of SEM



For Model 2, we removed the direct paths from WD/FD to WFC and added two direct paths to the TOI. The fit indices demonstrate that the data do not fit as satisfactorily as in the fully mediated ($\chi^2 = 74.807$; $p = 0.000$; $\chi^2/df = 14.961$; CFI = 0.861, TLI = 0.582, RMSEA = 0.206, SRMR = 0.104). While the CFI values did not change significantly compared to the first model, a TLI, RMSEA and SRMR values are definitely not within the acceptable range (Williams et al., 2009). Further we compared the fit of the hypothesised model (fully mediated model) and the first alternative model (no mediation) by looking at the AIC results. The AIC of the fully mediated model (AIC = 48.545) was lower than the model without mediation (AIC = 106.807) which suggested that ‘no mediation model’ does therefore not provide an adequate fit to the data.

For Model 3, direct paths from WD to TOI and from FD to TOI were added leading to a partially mediated structure. The results show that the data fit adequately ($\chi^2 = 4.341$; $p = 0.114$; $\chi^2/df = 2.170$; CFI = 0.995, TLI = 0.965, RMSEA = 0.06, SRMR = 0.01). At the same time, the direct effects we added from WD to TOI ($\beta = 0.175$, $p = 0.006$) are found to be statistically significant. However, the direct effect of FD and TOI was not found to be significant ($\beta = 0.09$, $p = 0.07$). However, the AIC of the fully mediated model was higher (AIC = 48.545) than the partially mediated model (AIC = 42.381).

Therefore, the alternative model is considered better than the hypothesised model. Thus, our data indicate that family demands are related to TOI solely via the WFC. However, relationship between work demands and TOI is partially mediated by WFC.

The results of SEM in Figure 5 demonstrates that work demand and family demands are significant determinant of WFC ($\beta = 0.373$; $p < 0.01$; $\beta = 0.271$; $p < 0.01$). Therefore, H1 and H2 are supported. Also, the relationship between WFC and TOIs was supported ($\beta = 0.195$; $p < 0.01$). Hence, H3 is accepted. It was found that WD and TOI have both significant indirect effect ($\beta = 0.073$, $p < 0.001$) as well as direct effect between them ($\beta = 0.175$, $p < 0.01$). Hence partial mediation exist between WD and TOI. Therefore, Hypothesis H4 was supported. It has been established that WFC fully mediate the relation between FD and TOI, (Table 7), i.e., there is a significant indirect effect between FD and TOI ($\beta = 0.064$, $p < 0.001$) but also no direct effect is emerging between the FD and TOI ($\beta = 0.07$, $p = 0.824$). Hence, H5 is supported.

6 Discussion

The analysis starts from validating the perceived work and family demand scale. It was found that one of the items (*WD-1: My job requires all of my attention*) was deleted from the original scale because of lack of convergent and discriminant validity. Probable reason for the same could be social desirability wherein work is typically held responsible more than family in the event of a conflict (Frone et al., 1992). In addition, when the similar statement is asked with respect to family demand the responses are in accordance with the previous researches (Boyar et al., 2008).

As can be seen from Figure 5, number of children is positively related to WFC ($\beta = 0.237$; $p < 0.01$). Also, marital status is found to be negatively related to TOI ($\beta = 0.257$; $p < 0.01$). This indicates that marriage brings in a set of responsibilities for employees and hence it impacts their TOIs. It also suggests that unmarried employees are frequently switching jobs as compared to their married counterparts.

Results supported the hypothesis that work demand is an important antecedent of WFC ($\beta = 0.373$; $p < 0.01$) consistent with the existing work-family conflict model (Burke and Greenglass, 1999).

It was hypothesised that there is a positive relationship between family demands and WFC. This hypothesis was accepted ($\beta = 0.271$; $p < 0.01$). This seems to indicate that higher demands emerging from family-front contribute to an individual's WFC. These demands can be in the form of big-size families, presence of children or responsibilities of being a care taker for elders in the family, etc. In the sample, the number of respondents having children and elders is higher, which seems to be the reason for the obtained results. The results are partially in line with Boyar et al. (2008) who suggested that there is a direct impact of family demand on WFC.

TOIs and WFC are found to be positively related with each other ($\beta = 0.195$; $p < 0.01$). This fits well with sales professionals who are under tremendous pressure of work. As and when the conflict from work enhances, they tend to shift from one job to another. Prior research also supports the said hypothesis (e.g., Pasewark and Viator, 2006).

The study further investigated the mediating role of WFC in the relationship between work/family demand and TOIs among sales employees in Indian organisations. Results suggest that WFC partially mediates the relationship between work demands and TOI, whereas full mediating relationship is observed between FD and TOI.

It has been found that WFC partially mediates the relation between WD and TOI (refer Table 7). This reinforces the belief that if the demands are higher from the work domain which culminate in WFC, it can further lead to TOI. Furthermore, it was found that, work demands can also directly influence an individual's TOI. Recent study by Ghayyur and Jamal (2012), and Eric and Kudo (2014) have also reported similar findings. It is also interesting to find that marital status is negatively related to TOI, which implies that unmarried employees are having higher TOI as compared to their married counterparts. This is supported by Cotton and Tuttle (1986) as well as Chompookum and Derr (2004) who reported that marital status acts as a restraint to resign for sales professionals.

Findings from the analysis suggest that WFC mediated the relation between FD and TOI. This is an important finding as it suggests that family demands leads to WFC which in turn results in TOIs amongst sales employees. The probable reason for such a finding could be the limited time that employees give to their families. As salespeople have stretched working hours, leading to less time for family, they may develop a feeling of guilt that family is ignored at the cost of work. In addition, family demand is found to be significantly related with marital status of the employees. Amongst the married sales employees, those having an infant represent a significant number in the entire sample. The presence of children is found to be positively related to WFC, which is one more factor that further aggravates the problem. In case of unmarried sales employees, it is the family requirements (like responsibilities of elders, younger siblings) and pressures to earn more (probably to get settled or for a better marriage prospect) that acts as family demands. The findings are further supported by Mowday et al. (1982) and Cordero et al. (2009). Hence, it can be concluded that family issues may encourage employees to search for employment elsewhere. Furthermore, this also seems to reinforce the strength and power of family towards influencing job-related outcomes amongst sales employees in Indian organisations.

7 Conclusions

The study has attempted to construct a comprehensive model incorporating the antecedent, outcome, and mediating role of WFC with respect to sales employees in the Indian work context. Most of the hypotheses hold true, indicating the robustness of the model. It was found that both forms of demand, i.e., work and family demands affect one's work – family conflict. Further, work-family conflict is found to mediate the relationship between work demands and TOIs, as well as between family demands and TOIs. This is an interesting finding as it is both forms of demands, i.e., work as well as family that is having a significant impact on sales employee's TOIs.

7.1 Practical implications

Reducing sales employee's turnover that are meeting and exceeding targets could make an important contribution to an organisation's bottom line. Results of the study suggest

that WFC mediates the relationship between work/family demands and TOI. So managers are expected to understand the links between WD-WFC-TOI as well as between FD-WFC-TOI. This indicates that demands are bound to be there as part of the sales professionals' work scenario which finally would lead to conflict. Therefore, it is the responsibility of managers to ensure a supportive organisational environment in order to have an effective work force. This can be done by developing a culture wherein people irrespective of higher demands are provided with sufficient support mechanism to balance their work and family commitments. The family is largely neglected by sales professionals because of the higher time demands from work-front. Appropriate training – both behavioural as well as technical – can help sales employees in handling the newer challenges posed in the current work scenarios. Further, family-friendly policies and 'family days' should also be incorporated as part of HR policies by companies so that family is given due importance. Family members should also do the same at the family-front such that excessive and unwanted demands are not put on the sales professional. This way a supportive home environment can be created so that the sales professional is able to give his/her best in the work as well as the family domains.

The present study has some limitations that need to be taken into account. First, the study is cross-sectional in nature; thus, causal conclusions cannot be drawn. Secondly, the number of females in the entire sample is quite less. However, in Indian organisations, the number of females in sales as a profession is found to be very less as compared to their male counterparts. Further, the fact that only Mumbai city has been considered for data collection is also one more limitation of the study. Nevertheless, the choice of Mumbai was made as this city is considered to be the financial hub of the country and thereby having the presence of maximum business houses.

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Appendix

Sample questionnaires

Section I						
This section is concerned with <i>your work/family demands</i> . Kindly indicate the extent of your agreement/disagreement with each item by putting a tick mark (√)						
Strongly disagree = 1		Disagree = 2		Neutral = 3		
		Agree = 4		Strongly agree = 5		
S. no.	Statement	1	2	3	4	5
1	WD 1 My job requires all of my attention.					
2	WD 2 I feel like I have a lot of work demand.					
3	WD 3 I feel like I have a lot to do at work.					
4	WD 4 My work requires a lot from me.					
5	WD 5 I am given a lot of work to do.					
6	WD 6 I have to work hard on family-related activities.					
7	WD 7 My family requires all my attention.					
8	WD 8 I feel like I have a lot of family demands.					
9	WD 9 I have a lot of responsibilities in my family life.					

Section II								
This section is concerned with the <i>conflicts</i> that arise out of <i>work/family</i> . Kindly indicate the extent of your agreement/disagreement with each item by putting a tick mark (√)								
Strongly disagree = 1		Disagree = 2		Slightly disagree = 3				
Neither agree nor disagree = 4		Slightly agree = 5		Agree = 6		Strongly agree = 7		
S. no.	Statement	1	2	3	4	5	6	7
1	The demands of my work interfere with my home and family life.							
2	The amount of time my job takes up makes it difficult to fulfil my family responsibilities.							
3	Things I want to do at home do not get done because of the demands my job puts on me.							
4	My job produces strain that makes it difficult to fulfil family duties.							
5	Due to work-related duties, I have to make changes to my plans for family activities.							
6	The demands of my family or spouse/partner interfere with work-related activities.							
7	I have to put off doing things at work because of demands on my time at home.							
8	Things I want to do at work do not get done because of the demands of my family or spouse/partner.							
9	My home life interferes with my responsibilities at work such as getting to work on time, accomplishing daily tasks, and working overtime.							
10	Family-related strain interferes with my ability to perform job-related duties.							

Work–Family Conflict in India: Construct Validation and Current Status

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Abstract

In today's dynamic world, majority of boundary-spanning professionals like sales are expected to work for longer hours, regularly interacting with clients and, in several instances, operating across various time zones which ultimately results in blurring work–family boundaries. The sample for the current study are sales employees as they are required to respond to various demands from colleagues, customers and from their respective families as well, which finally leads to conflict from both work and family. Of importance to the research is work–family construct measurement. The study first validated the Netemeyer, Boles and McMurrin (1996) work–family conflict scale in Indian context using exploratory factor analysis and confirmatory factor analysis. The results of the data analysis are in line with the indications in the literature. In addition, the current study attempted to investigate the role of demographic variables on work to family conflict (WFC) as well as family to work conflict (FWC). The sample consisted of 330 sales employees working across different service and manufacturing sectors in Mumbai, India. Results indicated that age, marital status, hierarchy, hours worked, number and ages of children are significantly associated with both WFC and FWC. Implications of these findings are discussed.

Keywords

Work to family conflict, family to work conflict, reliability, validity, EFA, CFA, demographic variables, sales employees, India, ANOVA, post hoc Scheffe's test

Introduction

Sales is a key boundary-spanning function, which has central accountability in the organisation (Marrone et al., 2007). Hence, sales employees are considered very important for organisations (Milkovich, 1988) and that is the reason why companies make huge investments on their sales force (Zoltners, Sinha & Zoltners, 2001, p. 474). Sales professionals are largely seen affected due to imbalances among individual, family and professional goals, which finally resulted in burnout (Cummings, 2001). In addition, their work-related commitments require them to counter multiple demands from co-workers and customers, thereby resulting in role stress (Avlonitis & Panagopoulos, 2006).

Further if sales employees are not treated well, the chance of losing them becomes quite evident. From an organisations standpoint *voluntary turnover* among sales-people is quite problematical (Richardson, 1999), as it creates major expenses through lost sales, costs of separation, recruitment, selection and training (Donaldson, 1998).

Approximately 16 per cent of an organisation's sales employees will leave in a given year (Churchill, Ford & Walker, 1997), though accurate statistic for the same is not available (Purani & Sahadev, 2008). There are very few researches in the Indian context which talk about work–family balance of sales employees in Indian organisations though sales is one such function wherein work–family issue is quite prominent and hence needs to be explored properly. Additionally, the researches which suggest the usage of validated Netemeyer et al. (1996) scale are rare to find in the Indian context.

Hence, the study aims to validate the Netemeyer et al. (1996) scale for measuring work to family conflict (WFC) and family to work conflict (FWC). Furthermore, the current status of work–family conflict through assessment of demographic variables (*viz.*, gender, age, marital status, level in an organisation, tenure with a respective organisation, hours in office, number and ages of children and annual salary) was conducted.

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Review of Literature

Work–Family Conflict

The review proposed by Greenhaus and Beutell (1985) is one of the landmarks in the study of work–family conflict. They define work–family conflict as ‘a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect’. They explored the concept of work–family conflict using three distinctive conflicts:

1. Time-based conflict: Such conflict occurs when the time necessities of one domain avert an individual from participating in other domains.
2. Strain-based conflict: Such conflicts are linked with negative affective condition like anxiety that is produced in one domain but affect an individual in other domains.
3. Behaviour-based conflict: Such conflicts are observed when behaviours and cognitions appropriate to one domain proved inefficient when acted upon in another domain.

Work–family conflict is seen as having two distinct domains: work negatively affecting family, that is, WFC and family negatively affecting work, that is, FWC (Frone, Russell & Cooper, 1992). Both WFC and FWC are bidirectional in nature (Frone et al., 1992; Frone, Russell & Cooper, 1997; Kalliath et al., 2012) and have distinct patterns of correlates (Byron, 2005). Many studies in the West have suggested that WFC is found to be far more rampant than FWC (Bellavia & Frone, 2005; Netemeyer et al., 1996). The probable reason for the same could be that work boundaries are less permeable as compared to family boundaries (Dugan, Matthews & Barnes-Farrell, 2012) which result in work negatively affecting family more as compared to family affecting work.

Further, the theory that leads to conflict perspective is role stress theory (Greenhaus & Beutell, 1985) and the role scarcity hypothesis (Goode, 1960). In addition to this, spillover theory suggests that work-related activities and satisfaction also affect non-work performance, and vice versa. From this viewpoint, people with a greater number of roles are more likely to deplete their resources, which are essentially fixed in nature, resulting in devotion of greater resources to one role and lesser resources to another role (Greenhaus & Powell, 2003; Rothbard, 2001). This further leads to inter-role conflict, which means that role demands arising from one domain of life (work) were incompatible with demands from other domains of life (family) (Huffman, Culbertson, Henning & Goh, 2013).

Measures of Work–Family Conflict

Majority of the work–family conflict measures had established good reliability ($\alpha > 0.70$) (Colombo & Ghislieri,

2008). The same holds true for the Netemeyer et al.’s (1996) instrument as well, whose validation is explained in this paper. Netemeyer et al. (1996, p. 401) described WFC as ‘a form of interrole conflict in which the general demands of, time devoted to, and strain created by the job interfere with performing family-related responsibilities’. Whereas FWC is defined as ‘a form of inter-role conflict in which general demands of, time devoted to, and strain created by the family interfere with performing work-related responsibilities’ (Netemeyer et al., 1996, p. 401). This is one of the most cited and used measure for assessing WFC and FWC in US-based work–family researches (Shaffer et al., 2011). The current study validates Netemeyer et al.’s (1996) instrument because of following reasons:

1. First of all, though the scale has lesser number of items, it captures the essence of work–family conflict better than other scales and, hence, can be used in extensive studies.
2. Second, it distinguishes both directions of the conflict, that is, WFC as well as FWC.
3. Third, it does not include behavioural measures related to the behavioural aspects of conflict, as they are difficult to translate and also have weaker association in overall prediction of conflict (Colombo & Ghislieri, 2008).
4. Its validation has not yet been done in the Indian context.

Demographic Variables and Work–Family Conflict

Gender is one of the central demographic variables studied across work–family studies. Pleck (1977) contends that men are expected to experience higher WFC as compared to women who, he suggested, will be more affected by FWC. However, his assertions have largely not been supported by researches conducted afterwards (Grzywacz & Marks, 2000). A few studies suggest that both WFC and FWC were stronger for women as compared to men (Frone, 2003; Frone et al., 1992; Williams & Alliger, 1994). The probable reason suggested by Idris, Dollard and Winefield (2010) is that men feel less guilt conscious than women so the conflict they experience does not affect their social identity much. Hence, following hypotheses have been proposed:

- H1: Work to family conflict is significantly related with women as compared to men.*
- H2: Family to work conflict is significantly related with women as compared to men.*

Based on career models, many individuals link their career based on career stage (Viega, 1983). Certain studies confirms that in the primary stages of career, sales

employees often ignore their family life (Emslie & Hunt, 2009; Gordon & Whelan-Berry, 2007) but as age progresses they tend to give more attention towards balancing both work and family. So it can be inferred that age has a significant impact on ones WFC as well as FWC. Similar results were supported by Madsen, John and Miller (2005) who confirmed that age is significantly associated with work–family conflict. Therefore, the following hypotheses have been proposed:

H3: Age is significantly related with work to family conflict.

H4: Age is significantly related with family to work conflict.

Role theory suggests that marriage requires one to spare more time with household chores and family responsibility (Carıkcı & Celikkol, 2009) which finally results in higher level of WFC as well as FWC (Coffey, Anderson, Zhao, Liu & Zhang, 2009). So it can be hypothesised that

H5: Marital Status is significantly associated with work to family conflict.

H6: Marital Status is significantly associated with family to work conflict.

DiRenzo, Greenhaus and Weer (2011) in their study on work–family conflict for lower-level and higher-level employees found that both WFC and FWC are significant among higher-level workers. Till date not many researches have focused on work–family interface between higher-level versus lower-level employees, that is, managerial and manufacturing employees (DiRenzo et al., 2011; Schieman, Whitestone & Van Gundy, 2006). Also, the perceptions about WFC amongst managerial employees across levels (entry and middle level) is largely not been studied. However, it can be inferred from the above set of studies that higher the level, higher will be the responsibility and hence more conflict will be perceived by the employees. Also, as the level of responsibility at the family front increases, FWC is bound to increase. So it can be hypothesised that

H7: Hierarchy is significantly associated with work to family conflict.

H8: Hierarchy is significantly associated with family to work conflict.

Tenure in an organisation refers to the number of years of formal employment by a person in an organisation (Trimble, 2006). It is considered to be an important factor in job-related issues. Cinamon and Rich (2005) suggested that lasting job tenure helps in handing work-related demands without getting affected by family duties as experience leads to excellence and adaptability. This indicates

that more the experience, lesser will be the WFC as well as FWC. Therefore, it has been hypothesised that

H 9: Job tenure will be significantly related with work to family conflict.

H10: Job tenure will be significantly related with family to work conflict.

Work is an important aspect of human life. In recent times, longer working hours have been attracting the attention of practitioners and researchers (Burke & Cooper, 2008). The review conducted by Zhang and Liu (2011) suggested that higher work hours have a significant influence on WFC (Bruck, Allen & Spector, 2002; Byron, 2005; Grzywacz & Marks, 2000) but not on FWC. However, it can be proposed that when an individual is putting higher work hours in an organisation at the cost of family then it is bound to affect family negatively and hence would enhance FWC. Zhang and Liu (2011) further suggested that difference in income level and its impact on WFC contradict each other. Frone (2000) suggested that there is a positive correlation between income and WFC but no obvious conclusion can be drawn between income levels and FWC. In contrast, Voydanoff and Kelly (1984) proposed that higher-income people have low level of WFC, as it is the salary which satisfies people and hence reduces WFC. Furthermore, higher salaries will affect the individual's lifestyle as well as status positively. Thereafter, FWC also tends to be lower with higher levels of income. Further, it will be positively affecting the FWC too. So it can be hypothesised that

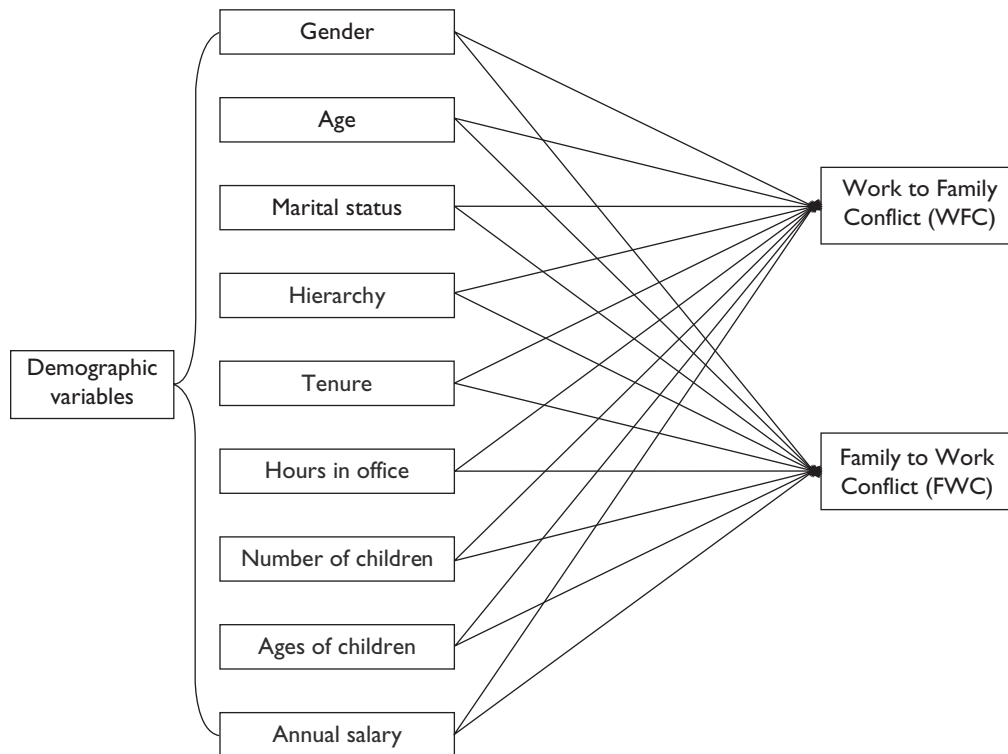
H11: Longer work hours are significantly related with work to family conflict.

H12: Longer work hours are significantly related with family to work conflict.

H13: Higher income levels are significantly related with work to family conflict.

H14: Higher income levels are significantly related with family to work conflict.

The meta-analytic review conducted by Byron (2005) suggested that individuals having children experience more WFC and FWC as compared to those who do not have children (Cooke & Rousseau, 1984; Grzywacz & Marks, 2000; Netemeyer et al., 1996). The age of the children has a significant effect on the work–family dimensions (Zhang & Liu, 2011). Since infants and preschool children require maximum time and energy of their parents (Bedeian, Burke & Moffett, 1988), it is bound to have an effect on WFC and FWC (ten Brummelhuis, Lippe, Kluwer & Flap, 2008). Higgins, Duxbury and Lee (1994) confirmed that both working males and females with younger children (less than 12 years old) have higher WFC and FWC conflict as compared to those having older

Figure 1. Demographic Variables and Work–Family Conflict

Source: Authors' own.

children. Based on this literature, the following hypotheses are proposed:

H15: The number and age of the children is significantly related with work to family conflict.

H16: The number and age of the children is significantly related with family to work conflict.

The schema of the relationships examined with respect to demographics is shown in Figure 1.

Methodology

The study is non-experimental and quantitative in nature. The survey used standardised questionnaires to collect data from sales respondents across various sectors, namely, banking and financial services, IT, FMCG, manufacturing and pharmaceuticals.

Sample

Out of the 450 sales employees who were approached for the purpose of the study, 330 employees responded leading to a response rate of 73 per cent. It was found that of the 330 respondents, only 38 are females and rest 292 are males indicating that sales is a function largely dominated by males. All participants willingly and anonymously

participated in the survey measuring the 10-item work–family conflict scale.

Measures

This research used a set of standardised self-report questionnaires. It comprised two parts. While section 1 focused on the demographic profile of the respondent, section 2 primarily captured the WFC and FWC of the respondents.

Work–family conflict scale: Netemeyer et al. (1996) scale of WFC and FWC was used in the study. However, since the scale has not been tested in Indian scenario so it is tested for its validity. The results for the same will be discussed in the next section.

Demographic variables: The demographic questions were used to understand the characteristics of the respondents. Respondents were asked to state general information including age, education, etc. Also family related information like number of children, time spent in household tasks, spouse employment was collected from the participants.

Data Analysis

To meet the defined objectives, the data were analysed using SPSS-20. The following statistical procedure was taken into account for attaining the objectives of the study:

1. Testing inter-item and construct reliability.
2. Assessing construct validity.
3. Recognising differences in the WFC and FWC based on demographic variables.

Reliability testing: For assessing the inter item as well as construct reliability Cronbach’s alpha values were calculated. George and Mallery (2003, p. 231) proposed following rule of thumb for determining Cronbach’s alpha coefficient (α): ‘ $\alpha > 0.9$ —Excellent, $\alpha > 0.8$ —Good, $\alpha > 0.7$ —Acceptable, $\alpha > 0.6$ —Questionable, $\alpha > 0.5$ —Poor, and $\alpha < 0.5$ —Unacceptable’.

Construct validity: Construct validity indicates the degree to which a study, investigation or manipulation gauges adequately the notional concept it purports to assess (Gay, Mills & Airasian, 2006). It is measured through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Further CFA was conducted in order to acquire a robust evaluation of the quality of the measures (Harrington, 2009).

Current status testing: In order to study the role of demographic variables such as gender, age, marital status, hierarchy, tenure with a respective organisation, hours in office, number and ages of children, employed spouse, and annual salary on WFC and FWC, one-way analysis of variance (i.e., ANOVA) was employed. Further, post hoc Scheffe’s test was conducted to segregate the exact difference between category means that were notably distinctive. Computations were made and the significance levels were determined at $p < 0.05$ as well as $p < 0.01$ levels.

Results

Basic Descriptive Analysis

Preliminary analysis confirmed a normal distribution rooted on prototype and type of sample distribution. Both skewness and kurtosis are found to be within acceptable ranges, that is, ± 2.00 (Garson, 2009). Every single mean score is above the midpoint signifying, in general, the affirmative response to the constructs in the study. Also not much divergence is found in standard deviation (SD) values.

Reliability

Table 1 represents Descriptive Analysis and Internal Consistency Estimates of the scales under study. Both the scales, that is, WFC and FWC are found to have excellent internal consistency George and Mallery (2003).

Validation of WFC and FWC Scales

In order to confirm whether the factor structure arrived in this study is in sync with the earlier studies or not, factor analysis is conducted. It is of two types: EFA and CFA.

Ford, MacCallum and Tait (1986) suggested that EFA should be conducted for refining measures and for evaluating

Table 1. Descriptive Analysis and Internal Consistency Estimates

	Mean	SD	Skewness	Kurtosis	Reliability
WFC 1	5.44	0.824	0.024	0.117	0.909
WFC 2	5.48	0.876	-0.486	1.533	
WFC 3	5.42	0.883	-0.061	-0.139	
WFC 4	5.38	0.895	-0.224	0.117	
WFC 5	5.53	0.952	-0.419	0.936	
FWC 1	4.71	1.043	-0.268	-0.168	0.927
FWC 2	4.55	1.094	-0.139	0.168	
FWC 3	4.51	1.170	-0.228	0.157	
FWC 4	4.58	1.223	-0.321	0.077	
FWC 5	4.57	1.171	-0.144	0.125	

Source: Authors’ own.

construct validity. KMO values of ≥ 0.60 are considered good for factor analysis (Tabachnick & Fidell, 2001). Further (sig. < 0.05) Barlett test indicates that the matrix is not an identity matrix. Table 2 explores the result of KMO and Barlett test.

Later on, an EFA utilising a principal component analysis method (PCA) (Hair et al., 2006) with a VARIMAX rotation and Kaiser normalisation was conducted to reveal the underlying dimensions (Sass & Schmitt, 2010) of WFC and FWC.

Results of EFA (see Table 3) indicated a distinct two-factor structure for both the variables under study. The loadings of both the factors are convincingly high. For WFC, loadings range from 0.783 to 0.826 whereas for FWC range of loadings is from 0.750 to 0.856.

Later on, CFA was performed to confirm the psychometric properties of the work–family conflict scale. Table 4 illustrates the CFA outcome of *model fit indices* for the work–family conflict scale. As specified in Table 4, two model structures were tested for CFA. The Chi-square results emerged as statistically significant, signifying a short of model fit with the attained data with regard to the two-factor model. However, it is known that this test is largely dependent on sample size (Hu & Bentler, 1998) hence the ratio of χ^2/df was used for a good model fit (Jöreskog & Sörbom; 1993). Further all estimates of

Table 2. Values of KMO and Bartlett’s Test

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.915
Bartlett’s Test of Sphericity	Approximate chi-square	2,385.151
	Degree of freedom	45
	Significance	0.000

Source: Authors’ own.

Table 3. Varimax Rotation Factor Loadings

	Component	
	1	2
WFC 1	0.167	0.835
WFC 2	0.150	0.848
WFC 3	0.157	0.855
WFC 4	0.212	0.831
WFC 5	0.247	0.809
FWC 1	0.763	0.358
FWC 2	0.884	0.191
FWC 3	0.880	0.167
FWC 4	0.871	0.192
FWC 5	0.882	0.110

Source: Authors' own.

Notes: Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalisation.

Table 4. Results of CFA

Model Fit							
Indices	df	χ^2	χ^2/df	RMSEA	SRMR	CFI	TLI
10 item, one factor model	35	0.000	24.720	0.269	0.20	0.650	0.550
10 item, two factor model	34	0.000	2.236	0.061	0.04	0.982	0.977

Source: Authors' own.

Notes: χ^2 , chi-square; df, degrees of freedom; CFI, comparative fit index, TLI, Tucker–Lewis index; SRMR, standardised root mean square residual, RMSEA, root mean square error of approximation.

comparative fit indices (GFI, AGFI, CFI and NNFI) for the second model were above 0.90. In addition the absolute fit indices (RMSEA and SRMR) are also found to be within acceptable limits (for RMSEA it should be <0.8 and for SRMR it should be <0.1). Therefore, the two factor model was accepted.

Figure 2 represents the results of the two factor first order CFA along with corresponding factor loadings.

Further Table 5 signifies that the sample primarily comprises of males (88.5 per cent) as compared to females (11.5 per cent). This indicates that sales profession is primarily dominated by males. The sample comprises of 53.6 per cent entry level and 46.4 per cent middle level management employees working in various Indian organisations. It also provides adequate participation of both service (51.2 per cent) as well manufacturing sector sales (48.8 per cent) employees. The representation of married employees (63.9 per cent) in the entire sample is found to be higher as compared to unmarried employees (36.1 per cent).

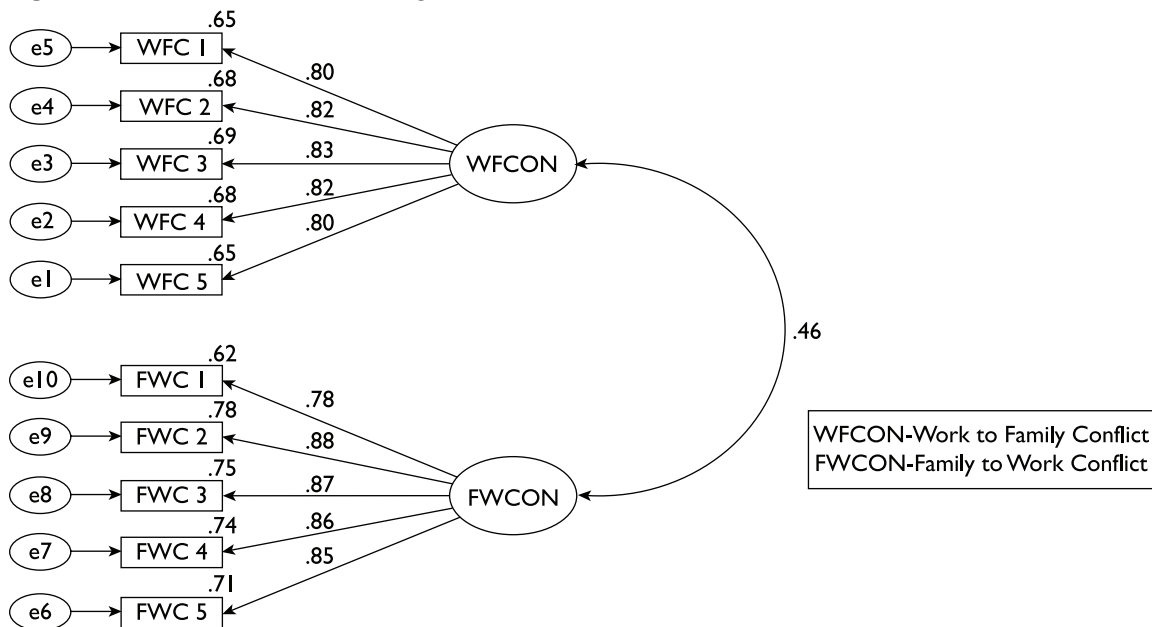
ANOVA Analysis

Tables 6 and 7 highlighted the role of demographic variables on both WFC and FWC. Contrary to the expectations there was not a significant effect of Gender on WFC at $p < 0.05$ level for the three conditions, ($F(1, 328) = 0.053, p = 0.817$). Hence, H1 is rejected.

However a significant effect of Gender on FWC at $p < 0.01$ level for the three conditions, ($F(1, 328) = 8.140, p = 0.005$) was observed. Hence H2 is accepted.

Later on Age was found to have a significant effect on WFC and FWC at $p < 0.01$ level for the three conditions,

Figure 2. CFA Model with Factor Loading



Source: Authors' own.

Table 5. Demographic Characteristic of the Participants

S. No.	Demographic Characteristics		Frequency (N = 330)	Percentage
1.	Gender	Male	292	88.5
		Female	38	11.5
2.	Age	≤25 years	60	18.2
		26–30 years	153	46.4
		31–35 years	59	17.9
		>35 years	58	17.6
3.	Marital status	Married	211	63.9
		Unmarried	119	36.1
4.	Hierarchy	Entry	177	53.6
		Middle	153	46.4
5.	Tenure in an organisation	1–1.11 years	135	40.9
		2–2.11 years	70	21.2
		≥3 years	125	37.9
6.	Hours worked	<55 hours	80	24.2
		55–60 hours	168	50.9
		>60 hours	82	24.8
7.	Number of children	None	54	16.4
		1	123	37.3
		2	34	10.3
8.	Ages of children	0	54	16.4
		1 month–2 years	62	18.8
		2.1–5 years	48	14.5
		Above 5.1 years	47	14.2
9.	Annual salary	0.1–0.5 million	98	29.7
		0.5–1.0 million	112	33.9
		>1.0 million	120	36.4

Source: Authors' own.

Table 6. WFC and Demographic Variables

Demographic Characteristics		Sum of Squares	df	Mean Square	F
Gender	Between groups	0.773	1	0.773	0.053
	Within groups	4,739.315	328	14.449	
	Total	4,740.088	329		
Age	Between groups	438.174	3	146.058	11.068**
	Within groups	4,301.914	326	13.196	
	Total	4,740.088	329		
Marital status	Between groups	571.276	1	571.276	44.948**
	Within groups	4,168.812	328	12.710	
	Total	4,740.088	329		

(Table 6 continued)

(Table 6 continued)

Demographic Characteristics		Sum of Squares	df	Mean Square	F
Hierarchy	Between groups	188.495	1	188.495	13.583**
	Within groups	4,551.593	328	13.877	
	Total	4,740.088	329		
Tenure in an organisation	Between groups	111.141	2	55.570	3.926*
	Within groups	4,628.947	327	14.156	
	Total	4,740.088	329		
Hours worked	Between groups	219.412	2	109.706	7.936**
	Within groups	4,520.676	327	13.825	
	Total	4,740.088	329		
Number of children	Between groups	233.940	2	116.970	8.742**
	Within groups	2,783.140	208	13.380	
	Total	3,017.081	210		
Ages of children	Between groups	208.439	3	69.480	5.121**
	Within groups	2,808.641	207	13.568	
	Total	3,017.081	210		
Annual salary	Between groups	187.314	2	93.657	6.727**
	Within groups	4,552.774	327	13.923	
	Total	4,740.088	329		

Source: Authors' own.

Notes: * $p < 0.05$; ** $p < 0.01$.

Table 7. FWC and Demographic Variables

Demographic Characteristics		Sum of Squares	df	Mean Square	F
Gender	Between groups	201.070	1	201.070	8.140**
	Within groups	8,102.554	328	24.703	
	Total	8,303.624	329		
Age	Between groups	471.025	3	157.008	6.535**
	Within groups	7,832.600	326	24.026	
	Total	8,303.624	329		
Marital status	Between groups	1,197.897	1	1197.897	55.295**
	Within groups	7,105.727	328	21.664	
	Total	8,303.624	329		
Hierarchy	Between groups	399.134	1	399.134	16.562**
	Within groups	7,904.490	328	24.099	
	Total	8,303.624	329		
Tenure in an organisation	Between groups	340.012	2	170.006	6.981**
	Within groups	7,963.612	327	24.354	
	Total	8,303.624	329		
Hours worked	Between groups	304.425	2	152.213	6.222**
	Within groups	7,999.199	327	24.462	
	Total	8,303.624	329		

Demographic Characteristics		Sum of Squares	df	Mean Square	F
Number of children	Between groups	108.766	2	54.383	2.292
	Within groups	4,934.978	208	23.726	
	Total	5,043.744	210		
Ages of children	Between groups	215.776	3	71.925	3.084*
	Within groups	4,827.968	207	23.324	
	Total	5,043.744	210		
Annual salary	Between groups	222.082	2	111.041	4.493*
	Within groups	8,081.542	327	24.714	
	Total	8,303.624	329		

Source: Authors' own.

Notes: * $p < 0.05$; ** $p < 0.01$.

($F(3, 326) = 11.068, p = 0.000$); ($F(3, 326) = 6.535, p = 0.000$), respectively. In addition, to this post hoc comparison using Scheffe's test (Table 8) with respect to WFC indicated that mean score for age <25 ($M = 25.15,$

$SD = 2.673$) was significantly different from age group 25–30 ($M = 27.14, SD = 3.759$), age group 31–35 ($M = 28.64, SD = 3.745$) and age group more than 35 ($M = 28.24, SD = 4.014$). Further, Scheffe's test with

Table 8. Scheffe's Test for Age (WFC/FWC)

Dependent Variable	Age (I)	Age (J)	Mean Difference (I - J)	Mean	SD
WFC	≤ 25	25–30	-1.987**	25.15	2.673
		31–35	-3.494**		
		>35	-3.091**		
	25–30	≤ 25	1.987**	27.14	3.759
		31–35	-1.507		
		>35	-1.104		
	31–35	≤ 25	3.494**	28.64	3.745
		25–30	1.507		
		>35	0.403		
	>35	≤ 25	3.091**	28.24	4.014
		25–30	1.104		
		31–35	-0.403		
FWC	≤ 25	25–30	-2.559**	20.65	3.870
		31–35	-3.858**		
		>35	-2.212		
	25–30	≤ 25	2.559**	23.21	5.336
		31–35	-1.299		
		>35	0.347		
	31–35	≤ 25	3.858**	24.51	5.114
		25–30	1.299		
		>35	1.646		
	>35	≤ 25	2.212	22.86	4.403
		25–30	-0.347		
		31–35	-1.646		

Source: Authors' own.

Notes: ** $p < 0.01$.

respect to FWC also indicated that mean score for age <25 ($M = 20.65$, $SD = 3.870$) was significantly different from age group 25–30 ($M = 23.21$, $SD = 5.336$), and age group 31–35 ($M = 24.51$, $SD = 5.114$). Hence, both H3 and H4 are accepted.

Results suggested a significant effect of marital status on WFC and FWC at $p < 0.01$ level for the three conditions, ($F(1, 328) = 44.948$, $p = 0.000$); ($F(1, 328) = 55.295$, $p = 0.000$), respectively. Hence, H5 and H6 are accepted.

ANOVA results show that hierarchy is a significant source of variance in the scores of the WFC and FWC; at $p < 0.01$ level for the three conditions, ($F(1, 328) = 13.583$, $p = 0.000$); ($F(1, 328) = 16.562$, $p = 0.000$), respectively. Hence, H7 and H8 are accepted.

Results suggested that tenure is a significant source of variance in the scores of the WFC as well as FWC at $p < 0.05$ level for the three conditions, ($F(2, 327) = 3.926$, $p = 0.021$); ($F(2, 327) = 6.981$, $p = 0.001$), respectively. In addition, to this post hoc comparison using Scheffe's test (Table 9) indicated that mean score for tenure, 1–2 year ($M = 26.56$, $SD = 3.832$) was significantly different from tenure, >3 years ($M = 27.82$, $SD = 4.036$). Also, the similar set of findings were observed with respect to FWC wherein post hoc comparison using Scheffe's test indicates that mean score for tenure, 1–2 year ($M = 21.81$, $SD = 4.998$) was significantly different from tenure, >3 years ($M = 24.10$, $SD = 5.057$). Hence, H9 and H10 are accepted.

ANOVA results show that long working hours are a significant source of variance in the scores of the WFC as well as FWC at $p < 0.01$ level for the three conditions, ($F(2, 327) = 7.936$, $p = 0.000$); ($F(2, 327) = 6.222$, $p = 0.002$), respectively. Further results of Scheffe's test (Table 10) indicated that mean score for hours worked, <55 ($M = 26.06$, $SD = 4.15$) was significantly different from hours worked, >60 ($M = 28.39$, $SD = 3.78$). Also, the

similar set of findings were observed with respect to FWC wherein post hoc comparison using Scheffe's test indicated that mean score for hours worked, <55 ($M = 21.24$, $SD = 5.278$) was significantly different from hours worked, 55–60 ($M = 23.33$, $SD = 5.154$) and hours worked, >60 ($M = 23.70$, $SD = 4.103$). Hence, H11 and H12 are accepted.

ANOVA results show that annual salary is a significant source of variance in the scores of the WFC as well as FWC at $p < 0.01$ and $p < 0.05$ level for the three conditions, ($F(2, 327) = 6.727$, $p = 0.001$); ($F(2, 327) = 4.493$, $p = 0.012$), respectively. Hence, H13 and H14 are accepted.

In addition to this post hoc comparison using Scheffe's test (see Table 11) indicates that mean score for annual salary, 0.1–0.5 million ($M = 26.16$, $SD = 3.427$) was significantly different from annual salary, more than 1.0 million ($M = 28.02$, $SD = 4.033$). Similarly with FWC also mean score for annual salary, 0.1–0.5 million ($M = 21.88$, $SD = 4.172$) was significantly different from annual salary, more than 1.0 million ($M = 23.89$, $SD = 5.625$).

To test the impact of number and ages of children and employed spouse on WFC and FWC data from only married employees was taken for analysis. ANOVA results show that number and ages of children is a significant source of variance in the scores of the WFC at $p < 0.01$ level for the three conditions, ($F(2, 208) = 8.742$, $p = 0.000$); ($F(3, 207) = 5.121$, $p = 0.002$), respectively. Hence, H15 is accepted.

However for FWC, ANOVA results are significant source of variance only for ages of children, that is, ($F(3, 207) = 3.084$, $p = 0.104$); and insignificant for number of children, that is, ($F(2, 208) = 2.292$, $p = 0.000$). Hence, H16 is partially accepted.

In addition, to this post hoc comparison using Scheffe's test (Table 12) indicates that mean score for number of children, 0 ($M = 26.61$, $SD = 3.299$) was significantly

Table 9. Scheffe's Test for Tenure in the Organisation (WFC/FWC)

Dependent Variable	(I) Experience with Current Organisation	(J) Experience with Current Organisation	Mean Difference (I – J)	Mean	SD
WFC	1–2 year	2.1–3 year	-0.959	26.56	3.832
		More Than 3 year	-1.268*		
	2.1–3 year	1–2 year	0.959	27.51	3.049
		More Than 3 year	-0.310		
	>3 year	1–2 year	1.268*	27.82	4.036
		2.1–3 year	0.310		
FWC	1–2 year	2.1–3 year	-1.135	21.81	4.998
		More Than 3 year	-2.289**		
	2.1–3 year	1–2 year	1.135	22.94	4.577
		More Than 3 year	-1.153		
	>3 year	1–2 year	2.289**	24.10	5.057
		2.1–3 year	1.153		

Source: Authors' own.

Notes: * $p < 0.05$; ** $p < 0.01$.

Table 10. Scheffe's Test for Hours Worked (WFC/FWC)

Dependent Variable	Hours in Office (I)	Hours in Office (J)	Mean Difference (I - J)	Mean	SD
WFC	<55	56-60	-1.176	26.06	4.150
		>60	-2.328**		
	56-60	<55	1.176	27.24	3.463
		>60	-1.152		
FWC	>60	<55	2.328**	28.39	3.780
		56-60	1.152		
	<55	56-60	-2.096**	21.24	5.278
		>60	-2.458**		
FWC	56-60	<55	2.096**	23.33	5.154
		>60	-0.362		
	>60	<55	2.458**	23.70	4.103
		56-60	0.362		

Source: Authors' own.

Notes: ** $p < 0.01$.

Table 11. Scheffe's Test for Annual Salary (WFC/FWC)

Dependent Variable	Annual Salary (I)	Annual Salary (J)	Mean Difference (I - J)	Mean	SD
WFC	0.1-0.5 million	0.5-1.0 million	-1.185	26.16	3.427
		>1.0 million	-1.853**		
	0.5-1.0 million	0.1-0.5 million	1.185	27.35	3.648
		>1.0 million	-0.668		
FWC	>1.0 million	0.1-0.5 million	1.853**	28.02	4.033
		0.5-1.0 million	0.668		
	0.1-0.5 million	0.5-1.0 million	-0.899	21.88	4.172
		>1.0 million	-2.014*		
FWC	0.5-1.0 million	0.1-0.5 million	0.899	22.78	4.865
		>1.0 million	-1.115		
	>1.0 million	0.1-0.5 million	2.014*	23.89	5.625
		0.5-1.0 million	1.115		

Source: Authors' own.

Notes: * $p < 0.05$; ** $p < 0.01$.

Table 12. Scheffe's Test for Number of Children (WFC/FWC)

Dependent Variable	No. of Children (I)	No. of Children (J)	Mean Difference (I - J)	Mean	SD
WFC	Nil	1	-1.893**	26.61	3.299
		2	-3.183**		
	1	Nil	1.893**	28.50	3.874
		2	-1.290		
FWC	2	Nil	3.183**	29.79	3.374
		1	1.290		

Source: Authors' own.

Notes: ** $p < 0.01$.

Table 13. Scheffe's Test for Ages of Children (WFC/FWC)

Dependent Variable	Ages of Children (I)	Ages of Children (J)	Mean Difference (I - J)	Mean	SD
WFC	0	1 month–2 years	-2.599**	26.61	3.299
		2.1–5 years	-1.847		
		>5.1 years	-1.942		
	1 month–2 year	0	2.599**	29.21	3.716
		2.1–5 years	0.751		
		>5.1 years	0.656		
	2.1–5 years	0	1.847	28.46	4.448
		1 month–2 years	-0.751		
		>5.1 years	-0.095		
	>5.1	0	1.942	28.55	3.161
		1 month–2 years	-0.656		
		2.1–5 years	0.095		
FWC	0	1 month–2 years	-2.559*	23.17	5.042
		2.1–5 years	-1.375		
		>5.1 years	-0.514		
	1 month–2 years	0	2.559*	25.73	4.571
		2.1–5 years	1.184		
		>5.1 years	2.045		
	2.1–5 years	0	1.375	24.54	4.985
		1 month–2 years	-1.184		
		>5.1 years	0.861		
	>5.1	0	0.514	23.68	4.751
		1 month–2 years	-2.045		
		2.1–5 years	-0.861		

Source: Authors' own.

Notes: * $p < 0.05$; ** $p < 0.01$.

different from number of children, 1 ($M = 28.50$, $SD = 3.874$) and number of children, 2 ($M = 29.79$, $SD = 3.374$). With age also mean score for age of children, 0 ($M = 26.61$, $SD = 3.299$) was significantly different from age of children, 1 month–2 years ($M = 29.21$, $SD = 3.716$). Similarly, FWC is found to be significant amongst those having infants. Post hoc comparison using Scheffe's test (see Table 13) indicates that mean score for age of children, 0 ($M = 23.17$, $SD = 5.042$) was significantly different from age of children, 1 month–2 years ($M = 25.73$, $SD = 4.571$).

Discussion

The analysis starts from validating the WFC and FWC scale. The two-factor model confirmed a valid measurement of work–family conflict in the Indian context based on the model fit indices (excluding the chi-square estimates) as compared to single factor model. However, it is

known that this test is largely dependent on sample size (Hu & Bentler, 1998) hence the ratio of χ^2/df (Jöreskog & Sörbom; 1993) along with comparative fit indices and incremental fit indices was used for a good model fit. It is, therefore, logical to state that work–family conflict factor structure embrace and functions aptly in the Indian cultural context.

The results suggested that gender differences are not primarily observed with respect to WFC. Hence hypothesis $H1$ was rejected. This also makes the study relevant as both male as well as female sales employees are affected by WFC. Grzywacz and Marks (2000) supported the result that gender is not significantly associated with WFC. However, hypothesis $H2$ was accepted. FWC is found to be higher for females as compared to their male counterpart. Pleck (1977) as well as Rajadhyaksha and Velgach (2009) found similar results wherein females are affected by FWC more as compared to males. This also points out to

the cultural mandate on women in Asian countries wherein family is considered to be the primary allegiance (Aryee, 1992) as compared to work.

Both hypotheses *H3* and *H4* were accepted. So it can be inferred that age is significantly related with both WFC as well as FWC (Gordon & Whelan-Berry, 2007; Madsen, John & Miller, 2005). The probable justification for the same emerges from career models (Viega, 1983). It is observed that in the early stages of the career, individuals often ignore their family life (Emslie & Hunt, 2009; Gordon & Whelan-Berry, 2007) but as age progresses one tend to give more weightage to balance both work and family. Also, individuals who are less than 25 are yet to start with their responsibilities with respect to their family but those who are in their early 30s and late 30s might have started with a family and henceforth the responsibilities have increased resulting in higher levels of FWC.

Results suggested a significant effect of marital status on WFC and FWC. Hence both *H5* and *H6* are accepted. This indicated that married employees are having higher levels of both WFC and FWC. The results are primarily substantiated by role theory which suggests that marriage requires one to spare more time with household chores and family responsibility (Cankı & Celikkol, 2009) which finally results in higher level of WFC as well as FWC (Coffey et al., 2009).

Hierarchy is found to be a significant source of variance in the scores of the WFC and FWC. This indicated that as sales employees move up in the hierarchy, he/she needs to deliver higher results leading to higher level of WFC. This, in turn, compresses his time that he otherwise will spend with his family. Hence, an increase in FWC is very much justified.

Tenure emerged as a significant source of variance in the scores of the WFC as well as FWC. This indicated that extended job tenure helps in handing work demands by sales employees without much exaggerated by family responsibility as experience heads to superiority and adaptability (Cinamon & Rich, 2005). Also, the same holds true at the family front as well.

ANOVA results confirmed that long working hours are a significant source of variance in the scores of the WFC as well as FWC. This validated the conviction that putting longer hours in work affect ones family life which in turn would affect ones work life too.

Results illustrated that annual salary is a significant source of variance in the scores of the WFC as well as FWC. This indicated that higher the salary, higher are WFC and FWC. The results are in accordance with that of Frone (2000), who suggested that there is a positive correlation between income and WFC, but no obvious conclusion can be drawn between income levels and FWC. Further, as higher income levels lead to higher set of responsibilities, the levels of conflict both at work and home front are increased, that is, it results in higher levels of WFC as well as FWC.

ANOVA results demonstrated that number and ages of children are a significant source of variance in the scores of the WFC. However, FWC ANOVA results are significant source of variance only for ages of children but insignificant for number of children. This indicated that number and age of younger child at home affects ones a sales personnel's WFC. But FWC is primarily resulted when one has a infant or preschool child/children only. The results are in harmony with the meta-analytic review accomplished by Byron (2005) who suggested that individuals having children experience more WFC as compared to those who do not have children (Cooke & Rousseau, 1984). Further the findings are in agreement with Higgins et al. (1994) also who suggested that working professionals with younger children (less than 12 years old) experience more WFC and FWC conflict as compared to the ones having older children. The age of the children has a significant effect on the work-family dimensions (Zhang & Liu, 2011). Since infants and preschool children require maximum time and energy of their parents (Bedeian et al., 1988), it is bound to have an effect on WFC and FWC (ten Brummelhuis et al., 2008).

Research Contribution

To the best of our knowledge, this is the first inclusive study to assess the validation of Netemeyer et al. (1996) scale in Indian context. Further, the role of demographic variables in Indian work context with sales employees belonging to various sectors is also the contribution of the current study.

Conclusions

The study first validated the Netemeyer et al. (1996) work-family conflict scale in Indian context using EFA and CFA. The results of the data analysis are in congruence with the previous literature. In addition, the present study examined the role of demographic variables on WFC as FWC. Results of ANOVA indicated that except gender all other demographic variables have a significant impact on play an important role in work-family conflict of sales employees. Later results indicate significant relationship of FWC with age, marital status, hierarchy, tenure in an organisation, hours worked, annual salary and number and ages of children.

Using these results as indicators, organisations should try to incorporate more family-friendly policies like celebrating family days, incorporating crèche facilities, providing incentives wherein family members can be benefitted and likewise activities would positively reduce the level of WFC. Results also cited that those who are at entry level may need a lot of assistance from the organisations but at the same time those who already have moved to the next levels should be taken care of equally well. There is a need

to incorporate more of trainings both technical as well as behavioural to assist them in balancing work–family roles. Furthermore, options like ‘work-from-home’ or telecommuting should be provided on need-basis so as to ensure that work–life balance is achieved by the affected employees.

The major limitation lies in terms of the cross-sectional nature of the research design for the study. Second, the percentage of female sales employees in the overall sample was very less. This can be attributed to the fact that sales function is one such managerial function which is dominated by men.

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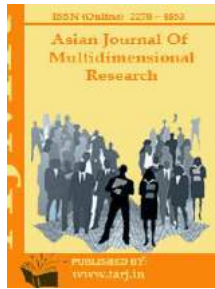
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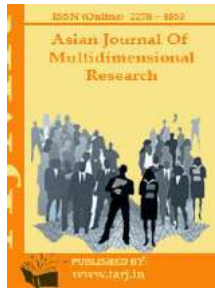
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UNDERSTANDING THE LINK BETWEEN INPUT-THROUGHPUT- OUTPUT MODEL OF ORGANIZATION BEHAVIOR AND THE INPUT- THROUGHPUT-OUTPUT MODEL FOR ADULT LEARNING AND THE LEARNING OUTCOMES

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ABSTRACT

This paper illustrates the link of input-throughput-output model of organization behavior to the concept of adult learning in organization. It exhibits a parallel model of input-throughput-output for individual adult learning and the output of learning for the organization.

In an organization, the output or the product is a result of the inputs and throughputs that you give into the system. Output can be the product or the service. For the requirements of the final product or service to be quality approved and standardized, the dimensional properties of raw materials, machinery, consumables are defined.

Although the knowledge, which is required to make that product or to deliver that service is defined, it is a tacit input for the organization, and hence can never be exactly available in the amount or form in which it is defined.

In this paper, though the input-throughput-output model for adult learning, we will see the reasons for which the learning outcomes differ every time, even for the same individual.

KEYWORDS: *Adult Learning, Organization Behaviour, Input-Throughput-Output, Andragogy*

INTRODUCTION

Different components go into making a product or service. Although there is a vast difference between a manufacturing and a service organization, the main concept, of human resource being its major input, remains the same. The main inputs in an organization are land, raw materials, machinery, consumerables, labour, knowledge. In a service organization there would be no raw materials, but the rest of the inputs would be the same.

The human inputs or the labour which makes up the workforce mix in the organization has defined skills as well. These skill inputs are outlined in a skill matrix requirement and job descriptions, personnel specifications, job analysis and put to use.

Organizations also upgrade skills and knowledge of their staff using training and ongoing development methods, wherever requirement exists.

This being, yet when we discuss labour inputs in the organization, it is difficult to judge the actual level of skill and knowledge input which is being poured to the making of the product. Since, it is difficult and almost not possible to exactly define and assign dimensional properties to human efforts.

Outputs of the organization that is the product, service, or the reason for which the organization is present in the market, are still produced using the standardised processes or methods. The human inputs although vary at most times, and the final output is and must be delivered in controlled conditions. Looking at how this is possible, we can discuss the link of input-throughput-output theory with adult learning.

RESEARCH OBJECTIVES:

- 1) This research is an effort to explore the variables which are involved in contributing towards an output in an organization.
- 2) The research explores the reasons behind which an individual will respond in a particular way, to obtain a particular outcome, in an organization, and underlying factors towards the particular response.

RESEARCH METHODOLOGY:

This research is an analysis of data obtained from secondary sources. Data is obtained from books, journals and internet references.

The Input-Throughput-Output Model of Organization Behavior:

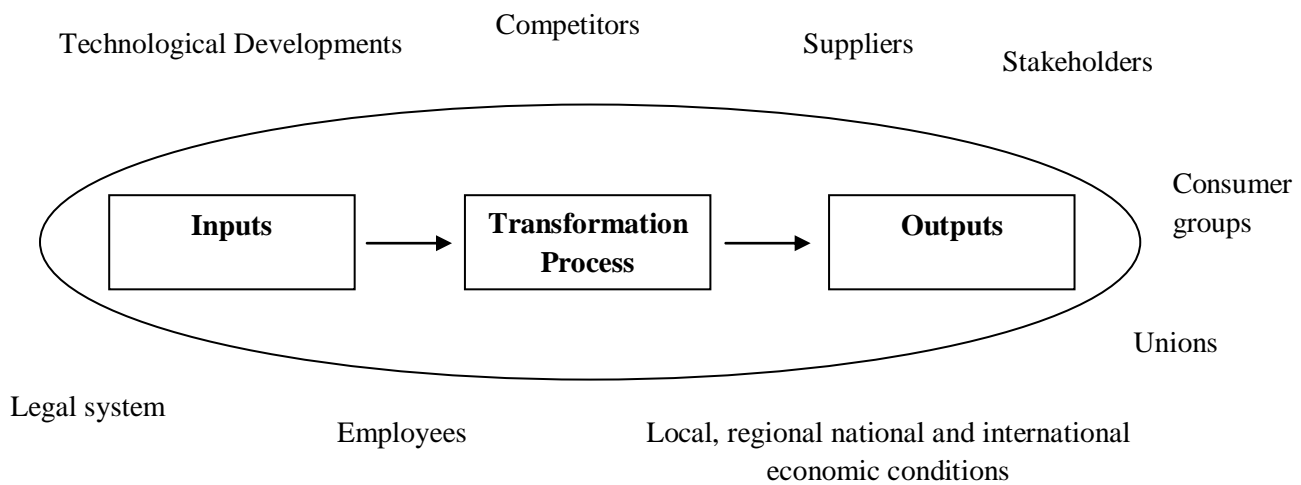
Recent years have brought much attention to the concept of “systems”. System is a collection of interrelated parts, unified by design and created to attain one or more objectives (Cascio, Aguinis 2005). The objective is to be aware of the variables involved in executing managerial functions so that decisions will be made in light of the overall effect on the organization and its objectives. These systems must consider not only the organization itself, but also the larger systems (eg. Industry, environment) in which the organization operates (Whitten, Bentley, & Dittman, 2004).

Three major pioneers in General Systems Theory (GST) are Kenneth Boulding, Daniel Katz, and Robert Kahn. The concept of GST was first advanced by Ludwig von Bertalanffy in 1940 but did not gain prominence until the 1960's. GST is primarily concerned with how systems operate, and integrates a broad range of systems by naming and identifying patterns and processes common to all of them (Bausch, 2002: 421; Capps and Hazen, 2002: 309).

A system is a set of two or more elements where: the behavior of each element has an effect on the behavior of the whole; the behavior of the elements and their effects on the whole are interdependent; and while subgroups of the elements all have an effect on the behavior of the whole, none has an independent effect on it (Skyttner, 1996: 7). In other words, a system comprises of subsystems whose inter-relationships and interdependence move toward equilibrium within the larger system (Martinelli, 2001: 73; Steele, 2003: 2).

The open systems view explains that organizations are open systems, which get affected by the external environment.

Fig1: Organizations are open systems in continual interaction with multiple dynamic environments- Source: *Applied Psychology in Human Resource Management – 6th Ed.* Wayne F. Cascio and Herman Aguinis, 2009.



This model can be explained as the organization's model of how it operates, in the internal and external environment. The internal operations consist of three elements namely input, throughput and output.

The inputs are the raw material, manpower, information, land, money, ideas, time, facilities, machinery, technologies, and the like, which go into making the product or service.

The throughput or transformation process is the interconnecting link which transforms the raw inputs to the finished product. It involves policies, procedures, functions, project teams, methods, and processes.

Output is the product or service which is critical for the success of the organization. It can also culminate into benefits to customers in form of changed and improved knowledge, changes in behavior, attitudes, values, conditions, stability, security.

These internal transformations from input to output take place in an open environment, that is the organization gets affected by external factors like changes in legislations, economic conditions, technology development, changes in customer demands, markets, competition, changes in workforce supply and demographics, changes in suppliers, changes in stakeholder views.

LEARNING AT THE INDIVIDUAL LEVEL:

The term 'Learning organization' is coined around 1988 by Hayes et al (1988) in the USE and by Pedler et al in the UK. Origins of the concept can be traced back in literature in 1920s. In 1980s the link between learning, training and company performance was further developed.

Human beings receive an input in form of education, training, learning as an outcome of socialisation and as a matter of experience, be it personal or professional. Although adults learn more efficiently through practical exposure, to interpret their ways of behavior in the organizational scenario, we have to consider their exposure to the external environment.

We must study the way in which adult learning takes place for bringing out the best in organizations and individuals.

Emphasis on self-development at workplace, people also acquire skills and knowledge while actually doing their jobs, over a period of time, this is also known as experiential learning.

Argyris and Schon 1978, 1981, have discussed ideas like how can individual learning in the organization be harnessed to produce collective learning. This brings us to the concept of organizational learning. Learning through organizational folklore, is also a vital individual learning method. This is also known as organization grapevine; however can cut down passing of essential information, as it hops through department to department and individual to individual.

ADULT LEARNING:

The concept of learning for adults, or method of delivering knowledge, is termed as 'Andragogy', just as for children it is called 'Pedagogy'. A lot of research is conducted and the theory of adult learning methods are debated over and over again.

Knowles (1980, 1984) argues that adults prefer self-directed learning, learn most effectively through experience, and by means of actual day-today jobs and routines, rather than from formal and structured training programmes.

For adults, learning is best accomplished as a social activity, while teaching is a deliberate act, which they subconsciously may resist. Adult Learning is based on the active learning principle, that is, the use of interactive learning for engaging learners.

GROUP LEARNING AND TRAINING:

Most individual learning happens through experiential learning and less through a formalised learning process that is through training, or on-the-job experience, or group discussions and brainstorming. Organizational learning deals more with individual's maturation in groups, his adjustment to work and the social forces which accelerate or inhibit this maturation.

Leymann (1989) advocates what he calls as 'unorganised learning' as an important and integral aspect of individual, group and organizational development. The organizational learning literature describes learning as a collective experience through which there is shared interpretation and integration of knowledge (Leymann 1989). It is our contention that information flow is critical to the opportunities provided for the shared interpretation and integration of knowledge. Knowledge also involves a constant change or transformation and also it involves new knowledge creation. Learning in groups involves sharing climate, group culture, vision, shared norms and values.

VIEWING INDIVIDUAL (EMPLOYEE) AS A SYSTEM:

Individuals receive inputs and interpret them and store them in different ways. They have their own mental models (Senge, 1990, Fifth Discipline) for ideas. These concepts are processed while delivering outputs. Hence there is a difference in the ways in which individuals would react to the input-throughput-output model versus the same for a brick, block of steel or log of wood (any such raw material). Adults learn best by having developed their own interconnections and meanings.

Individual learning that is the inputs can be achieved in form of pragmatic approach, cultural approach, and creative approach.

Pragmatic approach is when formal training, education and qualification is viewed as a method of disseminating knowledge and skills. Knowledge and skills can be gained as an ongoing process of socialisation which is the cultural approach. The creative method is when learning happens due to problem-solving, thinking out-of-the-box, managing new experiences. In its broadest terms, learning is seen as sense-making, as the continuous collective construction of a social reality (Billett, 2000).

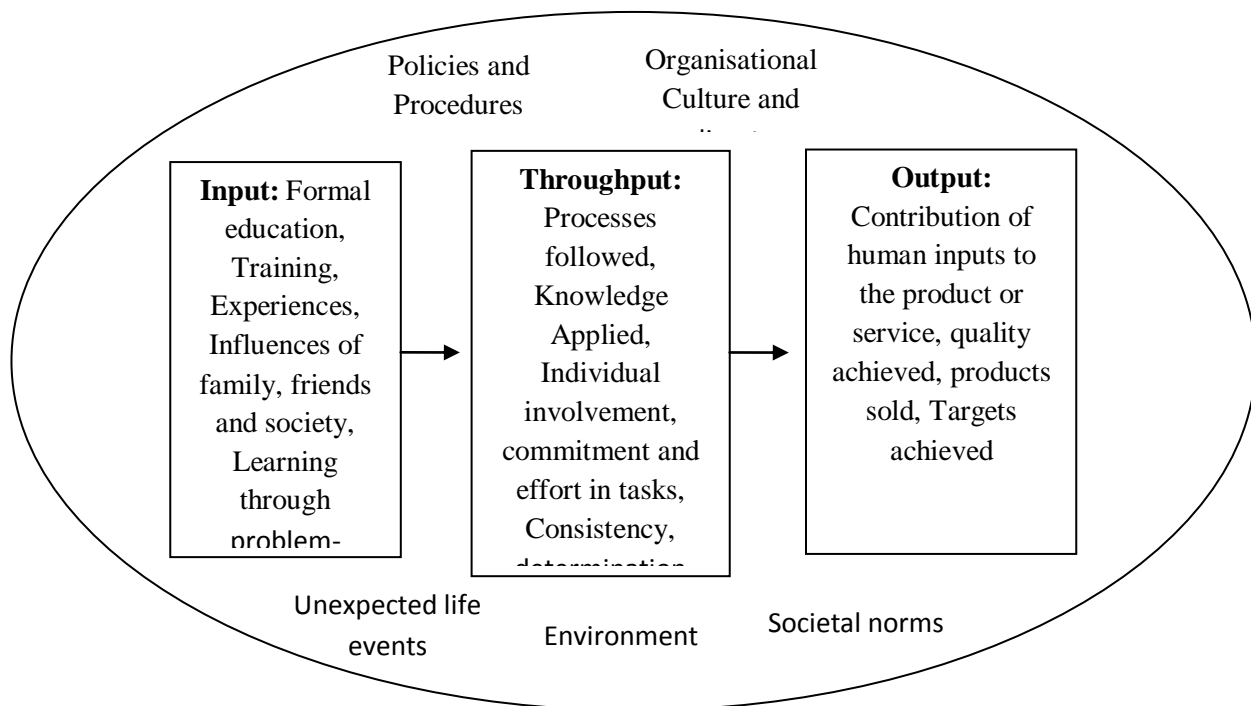
Organizations are too routine-based to follow this traditional learning sequence (Leavitt & March, 1988). Also, organizations do not provide the optimal (experimental) research site to unravel

stimulus-response sequences. Individual inputs (formal training, education, experiences, etc) and their throughputs (processes they follow, efforts, determination, commitment) are a result of the stimulus-response patterns that they are expected and taught to follow in the organization.

According to the social constructivist approach, organizational learning is seen as an institutionalizing process through which individual knowledge becomes organizational knowledge. Institutionalization is the process whereby practices become sufficiently regular and continuous collective practices as to be described as institutions. The attention is on the process through which individual or local knowledge is transformed into collective knowledge as well as the process through which this socially constructed knowledge influences, and is part of, local knowledge.

An input-throughput-output model, if constructed from an individual perspective would look like this (Refer to figure below). This model is an effort to describe the human inputs which can be seen as a part of the OB - input-throughput-output model for the entire organization, discussed earlier.

Fig 2: Input-Throughput-Output (I-T-O) model for Individual/ an employee in the organization



This model can be explained as the model for an individual employee who gains inputs, processes them and produces certain outputs for the organization. This process is a sub-part of the larger input-throughput-output model of the organization. It describes the nature of internal processes which an individual employee goes through with external influences on the individual.

The inputs which an individual employee has achieved over a period of time and gets from the organization as a part of induction and on-the-job training is in form of formal education, training, experiences, influences of family, friends and society, learning through problem-solving.

The throughput or transformation process for an individual employee involves following processes, applying knowledge, individual involvement, commitment and effort taken by the individual in tasks, consistency, determination and dedication.

The output in case of an individual employee is contribution of human inputs to the product or service, quality achieved, products sold, targets achieved.

This model also operates in an external environment which affects the individual employee. These influencing variables are organizational policies and procedures, societal norms, environment, unexpected life events, organizational culture and climate.

Thus, in the I-T-O model for individual as a system, the output is also the input for the I-T-O in the organizational model.

CONCLUSION:

The Input-Throughput-Output (I-T-O) model of an organization, consist of 'human being' as a major input / variable towards making the final outcome for the organization. As discussed the human effort, skill, even when defined cannot be exactly rated every time the I-T-O process occurs. Human inputs and responses can never be constant, they vary. This research explains the reasons for human inputs and responses to vary through the adult learning concept and the input-throughput-output concept developed for an individual employee, when defined as a system.

It can also be concluded that, although human inputs vary, other variables remaining the same, the organization manages to gain equilibrium in its system.

Humans are thinking animals and their inputs cannot be replicated over and over a number of times. Having said that, the human efforts for a particular job are also learnt over a period of time and they are reproduced in more or less the same fashion which helps the organization achieve this equilibrium.

Having said this, the first research objective proposes that "This research is an effort to explore the variables which are involved in contributing towards an output in an organization." The Input-Throughout-Output model of Organization does detail on the variables that make up to form the final organizational outcome. These include inputs and the transformation processes.

The second objective, of the research proposes that "The research explores the reasons behind which an individual will respond in a particular way, to obtain a particular outcome, in an

organization, and underlying factors towards the particular response.” The research explains that individual response is due to factors like:

- Mental models which an individual possesses over a period of time, as a result of formal or informal, intentional or unintentional learning.
- Stimuli-response patterns which an individual learns over a period of time, and as a result behaves in a set prototype method.
- The organizational learning which collectively influences individual learning and also the individual learning which together gets accepted as group or organizational learning.

RECOMMENDATIONS BASED ON CONCLUSION:

- 1) The variables in the I-T-O model of the organization and individual, both, should be understood by HR professionals, so that they can address skills and knowledge needs of the employees using different training and development methods.
- 2) The research explains how individual learning styles, mental models and reinforcing experiences add to their learning and how it can also influence collective learning or team learning.

RECOMMENDATIONS FOR FUTURE SCOPE OF RESEARCH:

- 1) Further research can be done on the nature of external influences on human inputs in the organization and its effects.
- 2) Research can also explore the influence of I-T-O model of individual learning as a system in manufacturing and service sectors.
- 3) Experimental research can be conducted keeping certain variable in the I-T-O model as controlled to get further insights to impact of type of inputs on human response to organizational requirements.
- 4) Research can be done to understand the impact of formal and informal approaches to adult learning and its impacts on the outputs produced.

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Dear

Shazneen B Gandevia & Dr. Sarita M Vichore

I am very pleased to inform you that your article/research paper titled **UNDERSTANDING THE LINK BETWEEN INPUT-THROUGHPUT-OUTPUT MODEL OF ORGANIZATION BEHAVIOR AND THE INPUT-THROUGHPUT-OUTPUT MODEL FOR ADULT LEARNING AND THE LEARNING OUTCOMES** has been published in **Asian Journal of Multidimensional Research (AJMR) (ISSN:2278-4853) (Impact Factor: SJIF 2013=4.708) Vol.5, Issue-7, (July, 2016)**.

The scholarly paper provided invaluable insights on the topic. It gives me immense pleasure in conveying to your good self that our Editorial Board has highly appreciated your esteemed piece of work.

We look forward to receive your other articles/research works for publication in the ensuing issues of our journal and hope to make our association everlasting.

Thanking you once again

With Best Regards

Dr. Esha Jain
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LOW-RISK EFFECT: EVIDENCE, EXPLANATIONS AND APPROACHES TO ENHANCING THE PERFORMANCE OF LOW- RISK INVESTMENT STRATEGIES

Abstract

The authors offer evidence for low-risk effect from the Indian stock market using the top-500 liquid stocks listed on the National Stock Exchange (NSE) of India for the period from January 2004 to December 2018. Finance theory predicts a positive risk-return relationship. However, empirical studies show that low-risk stocks outperform high-risk stocks on a risk-adjusted basis, and it is called low-risk anomaly or low-risk effect. Persistence of such an anomaly is one of the biggest mysteries in modern finance. The authors find strong evidence in favor of a low-risk effect with a flat (negative) risk-return relationship based on the simple average (compounded) returns. It is documented that low-risk effect is independent of size, value, and momentum effects, and it is robust after controlling for variables like liquidity and ticket-size of stocks. It is further documented that low-risk effect is a combination of stock and sector level effects, and it cannot be captured fully by concentrated sector exposure. By integrating the momentum effect with the low-volatility effect, the performance of a low-risk investment strategy can be improved both in absolute and risk-adjusted terms. The paper contributed to the body of knowledge by offering evidence for: a) robustness of low-risk effect for liquidity and ticket-size of stocks and sector exposure, b) how one can benefit from combining momentum and low-volatility effects to create a long-only investment strategy that offers higher risk-adjusted and absolute returns than plain vanilla, long-only, low-risk investment strategy.

Keywords

volatility effect, emerging markets, stocks, lottery effect, momentum, market efficiency, asset pricing

JEL Classification

G11, G12, G14

INTRODUCTION

Finance theory, pioneered by Modern Portfolio Theory (Markowitz, 1952) and Capital Asset Pricing Model (CAPM) (Sharpe, 1964), advocates a positive relationship between expected return and systematic risk. Capital Asset Pricing Model predicts a positive linear relationship between systematic risk and expected returns of a stock where beta is the measure of risk: a measure of security risk relative to market risk. However, early tests of CAPM (Black, 1972; Fama & MacBeth, 1973) report positive but flatter than expected risk-return relationship. However, these initial studies challenging the foundation of CAPM were simply brushed aside as an exercise of data mining. Foundation of CAPM took a major hit when Fama and French (1992) showed no relationship between beta and return after controlling for size. Black (1993) reported further flattening of the relationship between beta and return in decades since Black (1972) study sample period. Several studies at the beginning of the 21st century (Clarke, Silva, & Thorley, 2006; Ang, Hodrick, Xing, &

Zhang, 2006, 2009; Blitz & Vliet, 2007) offer strong evidence for low-risk anomaly and economic and behavioural explanations for the persistence of the low-risk effect.¹

While the debate about choice of risk measure, portfolio construction model, portfolio weighting scheme, portfolio rebalancing frequency dominated the first phase of research on low-risk effect, the focus of the second phase of research shifted towards explanations for the persistence of low-risk anomaly. The academic debate is still on, but the outperformance of low-risk investment strategies over market-cap weighted benchmark indices across the globe with much lower volatility and drawdowns has caught the attention of the investment management community. The focus of academic research is on looking for factors orthogonal to market-cap weighted benchmark portfolios, explaining the cross-section of equity returns and, hence, requiring a long-short version of factor portfolios. However, most institutional, as well as individual investors, have leverage and short-selling constraints. Even in developed markets, short-selling comes with a high cost. Most institutional investors such as mutual funds, pension funds, insurance companies have long-only mandates and, hence, the long-only leg of the factor portfolio needs to be attractive enough. Analytic Investors Inc. and Robeco launched funds between 2004 to 2006 to exploit low-risk anomaly. While Analytic Investors Inc. launched funds based on minimum variance portfolio construction approach, Robeco launched funds based on volatility ranking-based approach. Both have contributed significantly to the body of literature in the early phase of research before Ang, Hodrick, Xing, and Zhang (2006, 2009) caught the attention of academic research community.

The authors intend to address the following key research questions in the Indian context:

1. Is risk-return relationship positive, flat, or negative?
2. How strong is the low-risk effect?
3. Is low-risk effect independent of value, size, and momentum effects?
4. Is low-risk effect a macro effect (sector level) or micro effect (stock level)?
5. Is it possible to integrate long-only low-risk strategy with momentum effect to generate superior risk-adjusted performance?
6. What are the characteristics of long-only low-risk portfolio in Indian markets?

To investigate these questions, the authors use Blitz and Vliet (2007) framework and further develop alternative approaches to enhance the performance of long-only, low-risk investment strategy by adding momentum booster to it while retaining low-risk nature of the strategy. They further analyze portfolio characteristics such as monthly portfolio churn requirement and portfolio concentration for the low-risk portfolio for the practical implementation of long-only, low-risk investment strategy.

The rest of the paper is organized as follows. Section 1 covers the literature review. Section 2 covers data and methodology. Section 3 documents empirical results, Section 4 offers a discussion on empirical results. Final section offers the conclusion.

1. LITERATURE REVIEW

The Capital Asset Pricing Model (CAPM) predicts a linear relationship between systematic risk and expected security returns in which beta is the measure of systematic risk (Sharpe, 1964). However, the early tests of CAPM by Black (1972) and Fama and Macbeth (1973) indicate flatter than

expected slope for the security market line. This implies that the risk-return relationship remains positive, but much flatter than expected. Haugen and Heins (1975) were the first to offer evidence for a negative risk-return relationship. Thus, one can trace early evidence of risk-anomaly much before the discovery of return-based anomalies such as size, value, and momentum. At the beginning

¹ The terms low-risk anomaly, low-risk effect, and low-volatility effect are used interchangeably throughout this paper. The anomaly explains that low-risk stocks earn a higher return, and high-risk stocks earn a lower return than predicted by the Capital Asset Pricing Model (CAPM).

of the 1990s, Fama and French (1992) report that beta remains unpriced in the cross-section of the stock universe once controlled for size effect. This implies that beta cannot predict the expected return, and there is no relationship between systematic risk and expected return of a stock.

The real impetus for research on low-risk anomaly came about at the beginning of the 21st century. There is increasing evidence about the presence of low-risk anomaly across the global markets and asset classes beyond equities.

Finally, global financial crisis of 2008 led to large drawdowns across global equity markets and caused significant damage to equity portfolios of many sovereign wealth funds and pension funds. As a result they switched to low-risk investment strategies, that earn equity returns with smaller drawdowns and lower volatility than market portfolio, which resulted into to an explosion in the launch of long-only variants of indices intending to exploit the benefits of a low-risk anomaly. By the end of the first decade of the 21st century, MSCI launched a minimum variance version of the index, whereas S&P launched an index with a low-volatility version. These facilitated the benchmarking of low-risk investment strategies and the launch of exchange-traded funds (ETF). 25 ETFs are traded in the US markets with asset under management (AUM) worth USD 71 billion (ETF, n.d.). Despite the stellar 10-year bull market in S&P500, the return of S&P500 low-volatility index is comparable to that of S&P500 and is less volatile. This has attracted many individual and institutional money to long-only low-risk investment products. For example, by 2012, UN staff pension fund invested more than USD 500 million in low-volatility equity strategies (P&I, n.d.).

One can classify the studies on low-risk anomaly based on portfolio construction methods, and choice of risk measures, look-back and holding periods, markets and asset classes and portfolio weighting schemes. As the evidence for low-risk anomaly started mounting on, the focus of research shifted to explaining away the risk anomaly. The recent studies focus on the implementation issues of low-risk investment strategies, decomposing the low-risk anomaly into micro and macro effect “micro and macro effects” instead of

“micro and macro effect”, and understanding the relationship between low-risk effect and other effects such as size, value, and momentum.

The major contribution to low-risk anomaly literature came through in 2006–2007. Clarke, Silva, and Thorley (2006), Blitz and Vliet (2007), and Ang, Hodrick, Xing, and Zhang (2006) provide evidence for low-risk anomaly using different risk-measures, different look-back periods, and covering the US and other developed markets. Clarke, Silva, and Thorley (2006) use a minimum variance portfolio, whereas Blitz and Vliet (2007) use a ranking-based portfolio construction approach with a three- to five-year look-back period and one-month holding period. Ang, Hodrick, Xing, and Zhang (2006) use the one-month look-back period and daily data to calculate idiosyncratic risk. These studies, despite the difference in methodological choices, offer strong evidence for the low-risk anomaly. Ang, Hodrick, Xing, and Zhang (2009) and Blitz, Pang, and Vliet (2013) provide evidence for major global markets, including emerging markets. Bali and Cakici (2008) argue that the low-risk anomaly is an outcome of the poor performance of penny stocks with lottery-like payoffs, and removing them from the sample restores the positive risk-return relationship. Martellini (2008) reports a positive relationship between risk and return; however, the study has survivorship bias issues. Fu (2009) argues that most studies use backward-looking risk measures, and using forward-looking risk estimation techniques such as the EGARCH model to estimate idiosyncratic risk results in a positive risk-return relationship. Frazzini and Pedersen (2014) develop the Betting-Against-Beta (BAB) factor and established low-risk anomaly as a factor. Among others, Baker, Bradley, and Wurgler (2011), Baker, Bradley, and Taliaferro (2014), Soe (2012), Choueifaty and Coignard (2008), and Leote de Carvalho, Lu, and Moulin (2012) find strong evidence for the low-risk anomaly.

Increasing evidence on the presence and persistence of low-risk anomaly had started the debate on its explanation. Various studies offer economic and behavioral explanations for the same. One can categorize major economic and behavioral explanations offered to explain the persistence of low-risk effect into various categories:

- a) performance mandate and agency problem;
- b) market friction and constraints;
- c) behavioural biases and preference for skewness.

Performance mandate and agency problem: Baker, Bradley, and Wurgler (2011) argue that investors with a mandate to outperform a benchmark cannot arbitrage away the low-beta, positive-alpha stocks and show the preference towards high-beta, negative-alpha stocks. This results in the persistence of low-risk anomaly. Brennan, Cheng, and Li (2012) show that the simultaneous presence of absolute and relative performance-driven investors contributes to flattening of the security market line, and the flattening depends on the proportion of these two types of investors. Beveratos, Bouchaud, Ciliberti, ... and Simon (2017) further confirm that mutual funds tilt towards smaller and high-volatility stocks. Haugen and Baker (2011) argue that call options like compensation structure for investment managers push them to prefer high-volatility portfolios even with slightly lower expected returns. Agarwal, Jiang, and Wen (2018) find that new mutual funds or funds with poor performance in recent past own lottery-like stocks. Hsu, Kudoh, and Yamada (2013) offer evidence that sell-side analysts prefer high-risk stocks, which allows them to take a long shot at fame.

Market friction and constraints: Black (1993) argues that the leverage constraints push investors expected to tilt their investment towards high-risk stocks rather than leverage to increase returns while investing in low-risk stocks or market portfolios. Frazzini and Pedersen (2014) offer further evidence on the same. The BAB factor returns are stronger when funding constraints are tighter. The short-selling constraints contribute to the flattening of the security market line (Miller, 1977).

Behavioral biases: Bali, Cakici, and Whitelaw (2011) attribute low-risk anomaly to investors' preference for lottery-like payoffs, which makes high-risk stocks overvalued, leading to subsequent lower returns. Barber and Odean (2008) explain that representativeness bias and overconfidence make investors choose more volatile stocks as they expect to meet volatility on the right side. Blitz and Vliet (2007) attribute it to a two-stage investment decision-making process, where investors

show conservative behavior at the asset allocation stage but then prefer risky stocks at the second stage of the investment process. This is consistent with rational-thinker, irrational-doer version of prospect theory.

The other research branch pertains to decomposing a low-risk anomaly into macro (sector level) and micro (stock level) components. Baker, Bradley, and Taliaferro (2014) decompose the low-risk effect into the country, sector, and stock level effects and show that both micro and macro effects contribute to the low-risk anomaly. Asness, Frazzini, and Pedersen (2014) use a different approach to show that Betting-Against-Beta (BAB) delivers after controlling for industry bets or macro part of the low-risk anomaly.

More recent research concentrates on implementation issues and performance of low-risk investment strategies in various market cycles where researchers focus on comparing and contrasting low-volatility strategies based on the choice of risk measure, look-back period, rebalancing frequency, portfolio weighting scheme, implementation costs, and impact of turnover and other constraints on performance (Asness, Iilmanen, Israel, & Moskowitz, 2015; Alighanbari, Doole, & Shankar, 2016; Chow, Hsu, Kuo, & Li, 2014; Vliet, 2018). Further research focuses on the effect of other factors such as value and momentum on performing low-risk strategies (Blitz, 2016; Garcia-Feijóo, Kochard, Sullivan, & Wang, 2015).

Blitz and Vliet (2018) report that a simple conservative portfolio construction approach with top-100 liquid stocks with low-volatility, high-payout yield, and strong price momentum outperforms not only market portfolio but also most investment strategies based on size, value, momentum, and quality factors. The conservative formula works in the USA, Europe, Japan, and emerging markets. On the other hand, stocks with high volatility, low payout, and weak momentum deliver poor returns.

In India, NSE launched the NSE Low-Volatility 50 Index in November 2012 with base date of December 31, 2003, and the index has delivered superior returns to all major market-cap weighted benchmark indices, including bellwether Nifty

Index both in absolute and risk-adjusted terms. However, low-volatility investing in India is yet to pick up. There is only one ETF tracking this index launched by ICICI prudential mutual fund in India, and its AUM is too small to mention. That said, the scope for low-volatility investment strategies in India is immense. India has very vibrant primary and secondary equity markets, with more than 5,000 stocks listed on major stock exchanges. India is among the top-10 global equity markets ranked by market-cap. According to the Association of Mutual Funds in India (AMFI), the mutual funds' industry in India has grown more than five-fold in the last 10 years, with a total AUM close to USD 350 billion at the end of December 2019. The pension fund industry in India is in a nascent stage, and there is a great potential for low-cost, low-risk equity products.

The research on low-risk effect in India is at a nascent stage. M. Joshipura and N. Joshipura (2016) report strong evidence for a low-risk effect. Peswani and Joshipura (2019) report evidence of low-risk effect in stocks belongs to different size buckets. However, research on the attractiveness of long-only factor investment strategies, implementation challenges, and integrating size, value, and momentum effects with low-risk effect to enhance the performance of low-risk investment strategies is as at nascent stages in developed markets and a yet-to-start stage in emerging markets like India. The focus is on several under-investigated aspects of low-risk effect in the Indian markets, including testing robustness of low-risk anomaly after controlling for liquidity, ticket-size, and sector exposure; testing practical aspects of long-only, low-risk investment strategy like sector concentration, turnover requirement, sensitivity to alternative weighting scheme, and enhancing the performance of low-risk investment strategy by adding the benefit of momentum effect using alternative approaches.

2. METHODOLOGY

At the end of every month, the data on Adjusted monthly closing price, Market capitalization, Price-to-book ratio, Monthly trading turnover, Global Industry Classification Standards (GICS) sector, are collected from Centre for Monitoring

Indian Economy's (CMIE) Prowess Database for all the listed stocks on National Stock Exchange (NSE) of India starting from January 2004 to December 2018. Then the authors sort the stocks based on size measured by market capitalization at the end of every month and then pick the top 500 stocks with available returns for at least 12 months out of the previous 36 months and next 1 month. The adjusted closing price at the end of the month is a proxy for ticket-size and monthly trading turnover as a proxy for liquidity. Momentum for each stock at the end of the month is calculated using the previous 12-month minus 1-month total return. Besides, the authors collect the data for size, value, and momentum factor returns and well as risk-free monthly returns (based on 91-days treasury bills) for the Indian markets from the Indian Institute of Management, Ahmedabad online data library (CMIE, n.d.).

At the end of every month, the authors sort the universe of largest 500 stocks based on the volatility of monthly excess returns (over risk-free returns) of the past three years and construct equal-weight risk quintile portfolios. For each quintile portfolio, the excess return for the month following the portfolio construction period is calculated. For the resultant time series, simple annualized average excess return, annualized standard deviation, compounded excess returns (CAGR), Sharpe ratios, ex-ante and ex-post betas, CAPM style one-factor alpha over equal-weight universe portfolio (a proxy for market portfolio) and corresponding t -statistics are calculated. Also, tracking errors and skewness for quintile portfolios are calculated.

To test the significance of the difference between the Shape ratio of each risk-quintile portfolio over the market portfolio, Jobson and Korkie (1981) test with Memmel's (2003) correction is used.

The authors calculate CAPM style alpha using the following one-factor regression model:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m} (R_{m,t} - R_{f,t}) + \varepsilon_{p,t}, \quad (1)$$

where $R_{p,t}$ is the return on portfolio p in period t , $R_{f,t}$ is the risk-free return in the period t , α_p is the alpha of portfolio p , $R_{m,t}$ is market portfolio return in the period t , $\beta_{p,m}$ is the beta of portfolio p , and $\varepsilon_{p,t}$ is the

idiosyncratic return of portfolio p in the period t . Equal weight universe is used as proxy for market portfolio.

Fama-French (FF) and Fama-French-Carhart (FFC) models are further deployed to evaluate whether size, value, and momentum factors explain the low-risk anomaly. Small-Minus-Big (SMB), Value-Minus-Growth (VMG), and Winner-Minus-Loser (WML) are the proxies for size, value, and momentum factors (Fama & French, 1992; Carhart, 1997). IIMA online data library is used for monthly factor returns.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m} (R_{m,t} - R_{f,t}) + \beta_{p,SMB} \cdot R_{SMB} + \beta_{p,VMG} \cdot R_{VMG} + \varepsilon_{p,t}, \quad (2)$$

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m} (R_{m,t} - R_{f,t}) + \beta_{p,SMB} \cdot R_{SMB} + \beta_{p,VMG} \cdot R_{VMG} + \beta_{p,WML} \cdot R_{WML} + \varepsilon_{p,t}, \quad (3)$$

where R_{SMB} , R_{VMG} , and R_{WML} represent the size, value, and momentum factor premiums, respectively, and $\beta_{p,SMB}$, $\beta_{p,VMG}$, and $\beta_{p,WML}$ represent factor loadings of portfolio p on size, value, and momentum factors, respectively.

The study applies bivariate analysis, a strong non-parametric technique using a double sorting approach, to separate low-risk effect from other effects. It is a robust technique and does not get impacted by time-varying exposure of low-risk and high-risk portfolios in three- and four-factor regressions. It allows us to control for the effect of one factor at a time to check the robustness of the low-risk effect. First, one ranks stocks on one of the control factors (size, value, momentum, tick-size, liquidity) to create quintile portfolios, then one sorts the stocks based on volatility within each control factor quintile portfolio and constructs risk quintile portfolio to represent each quintile of control factor. For example, to control for the size effect, one first sorts stocks based on size to create size quintile portfolios. Next, the stocks are sorted based on volatility within each size quintile portfolios and then 20% least volatile stocks from every size bucket are combined to construct a low-risk portfolio representing each size quintile and, hence, controlled for any size exposure. To con-

trol for any concentrated sector exposure, low-risk and high-risk portfolios are created to represent each sector and, hence, capture only micro (stock level) low-risk effect while controlling for macro (sector level) effect. The study also reports median sector exposure for low-risk portfolios over the entire period, and the graphically illustrates the time-varying sector exposures to GICS sectors.

A version of the Herfindahl index for low-risk portfolios is used to come up with stock and sector concentration. The Herfindahl index is calculated as the sum of squared weights. Its inverse, N ranges from 1 for a portfolio with only one stock (sector) and N for a portfolio of N equally weighted stocks (sectors). Higher N shows lower concentration risk and vice versa.

Alternative approaches are developed to enhance the performance of low-risk investment strategy by plugging in the benefits of momentum investing to our pure low-risk portfolio. A 2x5 portfolio construction approach is used. At the end of each month, the stocks to high-momentum or low-momentum sub-universe are first assigned based on their past 12-month minus 1-month returns. Stocks above median momentum returns are assigned to high-momentum universe, and stocks below median momentum are assigned to low-momentum universe. Then risk-quintile portfolios from high-momentum stocks and separately from low-momentum stocks are constructed. The idea is to evaluate whether one can improve the performance of long-only, low-risk portfolio by adding momentum filter.

A scaled volatility measure is further proposed, which scales down the volatility for positive momentum stocks and scales up the volatility for negative momentum stocks. Such scaling helps systematically prefer low-volatility positive momentum stocks, and avoid low-volatility negative momentum stocks. This approach allows us to combine the benefits of risk anomaly and momentum effect while avoiding the stocks with the worst combination of high-risk and negative momentum:

$$scaled\ volatility = \frac{volatility}{1 + momentum\ return}, \quad (4)$$

where momentum return is lesser of momentum return and 100%.

The horse race is run between three different low-risk portfolios:

- 1) pure low-risk portfolio;
- 2) low-risk portfolio constructed from the high momentum universe; and
- 3) low-risk portfolio constructed using scaled volatility sorting to compare performance and portfolio characteristics of alternative low-risk investment strategies.

3. RESULTS

Table 1 reports the results of univariate analysis for resultant time-series of risk quintile portfolios constructed by sorting stocks on a 36-month look-back period and 1-month holding period. The time-series covers 144 monthly-rebalancing iterations on a rolling forward basis from January 2007 to December 2018. Panel A, reports the annualized simple excess returns, standard deviations, compounded returns, Sharpe ratios, Memmel's statistics for the difference of Sharpe ratio of risk-quintile portfolios over universe portfolio, ex-ante, and ex-post betas, and alphas for risk quintile portfolios sorted on volatility and beta with their corresponding *t*-statistics. Panel B

reports the performance of risk quintile portfolios in up and down markets over universe portfolio, maximum drawdown of risk-quintile and universe portfolio, tracking error, and the skewness of risk-quintile portfolios.

Panel A of Table 1 reports the main results of volatility sorted quintile portfolios. Portfolio P1 is the low-risk portfolio and Portfolio P5 is the high-risk portfolio. The simple average annualized excess return for low-risk portfolio (P1), high-risk portfolio (P5), and the equal-weight universe portfolio (EWI) are 13.28%, 11.8%, and 13.63%, respectively. While the low-risk portfolio has a higher return than the high-risk portfolio, the return increases as one moves from portfolio P1 to P3 with portfolio P3 return of 15.06% and portfolio P4 return of 14.73%. The compounded return for a low-risk portfolio, high-risk portfolio and universe are 11.57%, 3.02%, and 9.66%, respectively. The long-short portfolio of the long low-risk stocks and short high-risk stocks (L-H) delivers 8.55% compounded annualized return. The third row of Panel A reports the annualized standard deviation of risk quintile portfolios. The annualized standard deviation of excess returns drops consistently as one moves from P1 to P5. The returns of low-risk portfolio (P1) are 40% less volatile than market portfolio. The Sharpe ratios of the low-risk portfolio, high-risk portfolio, and market are

Table 1. Main results (annualized) for quintile portfolios based on historical volatility

Panel A: Quintile portfolios based on historical volatility						
Return analysis	Low-risk (P1)	P2	P3	P4	High-risk (P5)	EWI (universe)
Simple return	13.28%	13.29%	15.06%	14.73%	11.80%	13.63%
CAGR (excess return)	11.57%	9.87%	10.64%	8.41%	3.02%	9.66%
Standard deviation	18.47%	26.16%	29.74%	35.56%	41.89%	29.84%
Sharpe ratio	0.72	0.51	0.51	0.41	0.28	0.46
Memmel's statistic	7.05	7.94	4.06	-0.40	-1.60	0.00
Ex-ante beta	0.77	0.94	1.08	1.24	1.44	-
Ex-post beta	0.59	0.87	0.99	1.18	1.38	-
Alpha (volatility sorted portfolios)	5.24%	1.50%	1.59%	-1.37%	-6.96%	-
<i>t</i> -value	3.19	1.21	1.45	-0.98	-2.88	-
Alpha (beta sorted portfolios)	2.73%	2.80%	1.94%	-0.78%	-7.44%	-
<i>t</i> -value	1.33	1.80	1.64	-0.58	-2.85	-
Panel B: Risk analysis of portfolios based on historical volatility						
Risk analysis	P1	P2	P3	P4	P5	EWI (universe)
Return up (excess return over universe)	-1.82%	-0.72%	0.03%	0.93%	1.58%	0.00%
Return down (excess return over universe)	2.78%	1.06%	0.25%	-1.22%	-2.88%	0.00%
Max drawdown	-50.36%	-67.39%	-72.53%	-76.68%	-81.17%	-70.82%
Tracking error	13.48%	5.83%	3.77%	7.19%	13.94%	-
Skewness	-0.42	0.34	0.55	0.78	0.79	0.49

0.72, 0.28, and 0.46, respectively. Memmel's statistics show the significance of the difference between Sharpe ratios of risk quintile portfolios and the market portfolio. The subsequent rows show ex-ante and ex-post betas of risk-quintile portfolios. Both ex-ante and ex-post betas increase in tandem as we move from low-risk to high-risk portfolios. The annualized CAPM style alphas of the low-risk portfolio (P1) and high-risk portfolio (P5) are 5.24% ($t = 3.19$), and -6.96% ($t = -2.88$), respectively; both are large and economically and statistically significant, albeit with opposite signs. The reported alphas for beta-sorted portfolios show a similar trend.

Panel B of Table 1 performs the risk analysis of the quintile portfolios and decodes the source of the low-risk portfolio's superior long-term returns. The first two rows of panel B show that while low-portfolio underperforms market in up-market periods, it outperforms in down-market periods. The low-risk portfolio drawdown in our sample period is -50.36% compared to -81.17% for the high-risk portfolio and -70.82% for the market portfolio. The last two rows of Panel B of Table 1 report the tracking error and skewness of risk-quintile portfolios. Extreme risk-quintile portfolios P1 and P5 have very high tracking errors of 13.48% and 13.94%, respectively. The skewness increases as we move from portfolio P1 (-0.42%) to P5 (0.79%).

Panel A of Table 2 reports three-factor and four-factor alphas for risk quintile portfolios constructed based on volatility sorting with their corresponding t-statistics. Panel B reports the regression coefficients of market size, value, and momentum factors for low-risk and high-risk portfolios. Together they report the strength of risk effect after controlling for size, value, and momentum effects.

Table 2 reports the results for the three-factor Fama-French (3F) and four-factor Fama-French-Carhart (4F) regressions for risk quintile portfolios. Panel A reports 3F and 4F alphas of risk-quintile portfolios. 3F and 4F alphas for low-risk portfolio (P1) are 5.3% ($t = 3.23$) and 3.19% ($t = 2.00$), respectively, and are economically and statically significant; the same is true for high-risk portfolio (P5). 3F and 4F alphas for high-risk portfolio (P5) are -7.11% ($t = -3.02$) and -4.39% ($t = -1.9$), respectively, and are economically and statistically significant.

Panel B of Table 2 reports regression coefficients for 3F and 4F regressions on extreme risk quintile portfolios. The regression coefficients for 3F regression for low-risk portfolio (P1) shows that the size factor loading is 0.02 ($t = 0.59$) and value factor loading is -0.04 ($t = -1.7$), and similar factor loading for 4F regression shows that low-risk portfolio (P1) has insignificant size exposure and significant exposure

Table 2. Three-factor (Fama-French) and four-factor (Fama-French-Carhart) style regression analysis for risk quintile portfolios

Panel A: Three- and four-factor alphas for risk quintile portfolios					
Multi factor alphas	P1 (LV)	P2	P3	P4	P5 (HV)
Three-factor alpha (annualized)	5.30%	1.51%	1.72%	-1.42%	-7.11%
t-value	3.23	1.26	1.59	-1.02	-3.02
Four-factor alpha (annualized)	3.19%	0.90%	0.86%	-0.74%	-4.39%
t-value	2.00	0.79	0.95	-0.51	-1.90

Panel B: Three- and four-factor regression coefficient analysis					
Fama-French style regression coefficient for low-risk (LV) and high-risk (HV) portfolios					
LV portfolio	Coefficient	t-value	HV portfolio	Coefficient	t-value
Market exposure	0.60	32.72	Market exposure	1.34	50.92
Size	0.02	0.59	Size	-0.06	-1.14
Value	-0.04	-1.70	Value	0.12	3.15

Fama-French-Carhart style regression coefficient for low-risk (LV) and high-risk (HV) portfolios					
LV portfolio	Coefficient	t-value	HV portfolio	Coefficient	t-value
Market exposure	0.64	33.50	Market exposure	1.29	46.47
Size	0.02	0.52	Size	-0.05	-1.11
Value	-0.04	-1.78	Value	0.12	3.29
Momentum	0.11	4.62	Momentum	-0.14	-4.09

Table 3. Double-sorted results

Quintile alphas	Low-risk (P1)	P2	P3	P4	High-risk (P5)	P1-P5
Panel A: Annualized alpha from double sort on size (market capitalization) and volatility (past 3 years)						
Alpha	5.63%	1.63%	0.54%	-0.27%	-7.53%	13.16%
t-value	3.34	1.18	0.54	-0.21	-3.18	3.46
Panel B: Annualized alpha from double sort on value (earnings/price) and volatility (past 3 years)						
Alpha	4.71%	1.85%	1.22%	-2.44%	-5.34%	10.05%
t-value	3.42	1.42	1.08	-1.77	-2.36	3.02
Panel C: Annualized alpha from double sort on momentum (12-months minus 1-month returns) and volatility (past 3 years)						
Alpha	5.29%	2.82%	1.33%	-1.64%	-7.81%	13.10%
t-value	3.59	2.15	1.28	-1.27	-3.37	3.78
Panel D: Annualized alpha from double sort on turnover (liquidity) and volatility (past 3 years)						
Alpha	5.17%	1.33%	2.09%	-2.24%	-6.34%	11.51%
t-value	3.26	0.98	1.97	-1.75	-2.73	3.19
Panel E: Annualized alpha from double sort on ticket-size and volatility (past 3 years)						
Alpha	4.68%	1.65%	1.92%	-1.38%	-6.86%	11.54%
t-value	3.60	1.32	1.62	-1.09	-3.32	3.82

to value factor but with a negative sign. The factor loading of the low-risk portfolio on momentum factor is 0.11 ($t = 4.62$). The analysis of regression coefficients of 3F regression for high-risk portfolio (P5) shows that the size factor loading is -0.06 ($t = -1.14$) and value factor loading is 0.12 ($t = 3.15$). The momentum factor loading in the 4F regression for the high-risk portfolio is -0.14 ($t = -4.17$).

Table 3 reports the annualized alpha and corresponding t -statistics of risk-quintile portfolios after controlling for size, value, and momentum, as well as ticket-size and liquidity. First, quintile portfolios are created by sorting stocks on the control variable and then by sorting on volatility within each quintile portfolio. The risk quintile portfolios are constructed to represent each quintile of control variable. It enables us to separate the alpha of risk-effect after controlling for the effect of other factors, one at a time.

Table 3 reports the results of the double sorting approach to disentangle the low-risk effect from other known effects and factors. The double sort is a robust non-parametric technique that allows testing the robustness of low-risk effect after controlling for other factors, one at a time. It also captures any time-varying exposure of low-risk effect to size, value, and momentum factors, which are assumed to be constant in Fama-French and Fama-French-Carhart regressions.

Panel A of Table 3 reports CAPM style 1-factor alphas for risk-quintile portfolios with their statistical significance. This ensures that each risk-quintile portfolio has stocks representing all size buckets. Such portfolios are controlled for size exposure. One follows the same process to control for value and momentum effects and other variables such as liquidity and unit stock price (ticket size).

The alpha for low-risk portfolio after controlling for size effect is 5.63% ($t = 3.34$), where the corresponding alpha for high-risk portfolio is $-7.53%$ ($t = -3.18$). The alpha for the low-risk portfolio is large, positive, and statistically significant, whereas the alpha for high-risk portfolio remains large, negative and statistically significant after controlling for size effect. Panels B and C report alphas for risk quintile portfolios controlled for value and momentum factors, respectively, and results are similar. Alphas for low-risk portfolio are large and positive, whereas for high-risk portfolios are large and negative. All are economically and statistically significant.

Panels D and E of Table 3 report alphas for risk quintile portfolios after controlling for liquidity (measured by monthly turnover) and ticket size (measured by unit stock price). The results show large positive alphas for low-risk portfolios and large negative alphas for high-risk portfolios.

Table 4. Performance of low-risk and high-risk portfolios controlling for sector effect (macro effect)

Sector controlled risk quintile portfolios	Low-risk	High-risk
Simple annualized average return	13.68%	13.62%
CAGR	10.85%	7.41%
Standard deviation	23.80%	36.36%
Ex-post beta	0.78	1.21
Alpha (annualized)	3.01%	-2.86%
<i>t</i> -value	2.41	-2.18
Sharpe ratio	0.48	0.20
Skewness	0.01	0.64

Table 4 reports the performance of sector-neutral low-risk and high-risk portfolios. The stocks are first assigned to one of the GICS sectors, and then stocks within a sector are sorted based on volatility. The low-risk (high-risk) portfolio is constructed from all the stocks with below median (above median) volatility from each sector. The table further reports the ex-post beta, annualized alpha and corresponding *t*-statistics, simple and compounded returns, standard deviation, Sharpe ratio, and skewness for low-risk and high-risk portfolios.

Table 4 reports the results for sector controlled low-risk and high-risk portfolios. The stocks are first assigned to one of eleven GICS sectors, and then within each sector, stocks are assigned to either low or high-risk bucket with median volatility breakpoint. One then creates a low-risk (high-risk) portfolio by pulling together low-risk (high-risk) stocks from each sector to create sector-neutral low-risk (high-risk) portfolios, and controls for sector concentration risk of low-risk portfolio in this manner. The sector-controlled low-risk portfolio delivers a positive alpha of 3.01% ($t = 2.41$), whereas high-risk portfolio delivers a negative alpha of -2.86% ($t = -2.18$); both are economically and statistically significant, albeit with opposite signs. The simple annualized average returns for low-risk, high-risk, and market portfolios are 13.68%, 13.62%, and 13.63%, with corresponding standard deviations of 23.8%, 33.33%, and 29.84%, respectively. There is not much difference in simple returns of sector-neutral low-risk and high-risk portfolios. The difference is large between their compounded returns. CAGR for low-risk and high-risk portfolios is 10.85% and 7.41%, respectively. The Sharpe ratio of the low-risk portfolio is higher than that of both high-risk portfolio and market portfolio because of its less volatile returns.

Panels A, B, and C of Table 5 report performance statistics including annualized simple return, standard deviation, CAGR, Sharpe ratio, ex-ante, and ex-post betas, and CAPM style alpha for risk-quintile portfolios constructed from high-momentum and low-momentum universe, as well as based on scaled volatility measure.

Table 5 reports the results of risk quintile portfolios constructed from universe of high-momentum and the low-momentum stocks. Panel A of Table 5 reports the results for risk-quintile portfolios from the universe of high-momentum stocks. The high-momentum universe portfolio itself has an alpha of 5.97% over the market portfolio and a Sharpe ratio of 0.67 compared to 0.46 for the market portfolio. The CAGR, Sharpe ratio and annualized CAPM style alphas for low-risk portfolios are 16.16%, 0.99%, and 10.6%, respectively. The corresponding statistics for high-risk portfolios are 8.97%, 0.43%, and -0.04%.

Panel B of Table 5 reports results for the risk-quintile portfolios constructed from the low-momentum universe. The low-momentum universe portfolio itself has a negative alpha of -5.97%, and a CAGR of just 3.54% and Sharpe ratio of 0.28, all performance statistics are poor in comparison to market portfolio. All risk-quintile portfolios report negative alphas and lower Sharpe ratios with respect to market portfolio. The worst performing portfolio is the high-risk and low-momentum portfolio. The CAGR, Sharpe ratio, and annualized CAPM style alphas for high-risk portfolio are -3.69%, 0.15%, and -13.13%, respectively.

Panel C of Table 5 reports the results of low-risk portfolio (P1) and high-risk portfolio (P5) constructed based on volatility scaled by momentum (as explained in the methodology section). The results are very similar to Panel A. Low-risk port-

Table 5. Performance statistics of momentum blended risk-quintile portfolios

Panel A: Risk quintile portfolios from high-momentum universe							
High-momentum risk quintile portfolios	Low-risk	P2	P3	P4	High-risk	EWI	High-momentum
Simple return	17.79%	16.61%	20.00%	19.45%	15.01%	13.63%	17.77%
Standard deviation	18.06%	24.56%	27.52%	31.86%	34.76%	29.84%	26.68%
CAGR	16.16%	13.59%	16.22%	14.38%	8.97%	9.18%	14.21%
Sharpe ratio	0.99	0.68	0.73	0.61	0.43	0.46	0.67
Ex-ante beta	0.77	0.95	1.06	1.20	1.36	–	1.06
Ex-post beta	0.53	0.78	0.88	1.03	1.10	–	0.87
Alpha	10.60%	5.98%	7.96%	5.36%	–0.04%	–	5.97%
Panel B: Risk quintile portfolios from low-momentum universe							
Low-momentum risk quintile portfolios	Low-risk	P2	P3	P4	High-risk	EWI	Low-momentum
Simple return	11.06%	11.91%	9.15%	8.39%	6.95%	13.63%	9.49%
Standard deviation	25.82%	30.21%	34.95%	38.92%	46.13%	29.84%	34.50%
CAGR	7.72%	7.34%	3.04%	0.82%	–3.69%	9.18%	3.54%
Sharpe ratio	0.43	0.39	0.26	0.22	0.15	0.46	0.28
Ex-ante beta	0.80	0.95	1.09	1.25	1.49	–	1.12
Ex-post beta	0.82	0.98	1.14	1.26	1.47	–	1.13
Alpha	–0.18%	–1.41%	–6.37%	–8.78%	–13.13%	–	–5.97%
Panel C: Risk quintile portfolios from scaled volatility							
Scaled momentum risk quintile portfolios	Low-risk	P2	P3	P4	High-risk	EWI	
Simple return	20.25%	16.32%	13.37%	11.42%	6.80%	13.63%	
Standard deviation	22.81%	25.91%	28.67%	33.83%	43.06%	29.84%	
CAGR	17.64%	12.96%	9.26%	5.70%	–2.47%	9.18%	
Sharpe ratio	0.89	0.63	0.47	0.34	0.16	0.46	
Ex-ante beta	0.89	0.99	1.07	1.17	1.34	–	
Ex-post beta	0.69	0.85	0.95	1.12	1.39	–	
Alpha	10.87%	4.73%	0.38%	–3.81%	–12.17%	–	

folio results in a higher CAGR of 17.64% comparable to 16.16% in the low-risk, high-momentum portfolio in Panel A. However, with little higher volatility and, hence, lower Sharpe ratio. The alpha of the scaled volatility based low-risk portfolio is 10.87%, similar to 10.6% of low-risk portfolio filtered for high-momentum. The erosion in the performance of high-risk portfolios is comparable in both approaches.

Table 6 reports sector concentration *N* score, maximum weight, and the corresponding sector in a given month during the sample period. The table further reports one-way annual churn required to implement the investment strategy like volatility-sorted, beta-sorted, high-momentum, and scaled volatility-sorted low-risk investment portfolios, as well as a broad-based value-weighted market index, NSE 500.

Table 6 and Figures 1a, 1b, 1c, and 1d report the portfolio characteristics of pure and enhanced low-risk strategies discussing sector concentration and the one-way turnover required for these strategies².

The major worry surrounding low-risk investment strategy is that it exposes the portfolio to concentrated exposure to a few sectors such as utility and real estate. Hence, it can create undesirable idiosyncratic sector concentration risk that can lead to sharp portfolio decline. Figure 1 provides the graphical representation of time-varying sector exposure for volatility sorted, beta sorted, scaled volatility sorted, and volatility sorted high-momentum universe, long-only, low-risk portfolios. It is evident from the results of table 6 that the sector *N* score for all versions of volatility strategies is approximately 7, whereas the *N* score for NSE 500

² In addition to results presented here, long-only, low-risk portfolios have been constructed using downside volatility as risk-measure, and inverse-volatility and inverse-beta as portfolio weighting schemes and the results show that low-risk effect is robust to the choice of risk-measure and portfolio weighting scheme.

Table 6. Sector exposure statistics and one-way turnover for low-risk investment strategies

Portfolio characteristics	Volatility sorted	Beta sorted	Volatility sorted high-momentum	Scaled volatility sorted	NSE 500
Sector <i>N</i>	7.24	7.44	7.40	7.34	5.50
Max weight for any sector in a given month	31%	32%	21%	31%	39%
Max weight sector in a given month	Financials	Healthcare	Financials	Financials	Financials
Average one-way annualized turnover requirement	55%	63%	104%	115%	15%

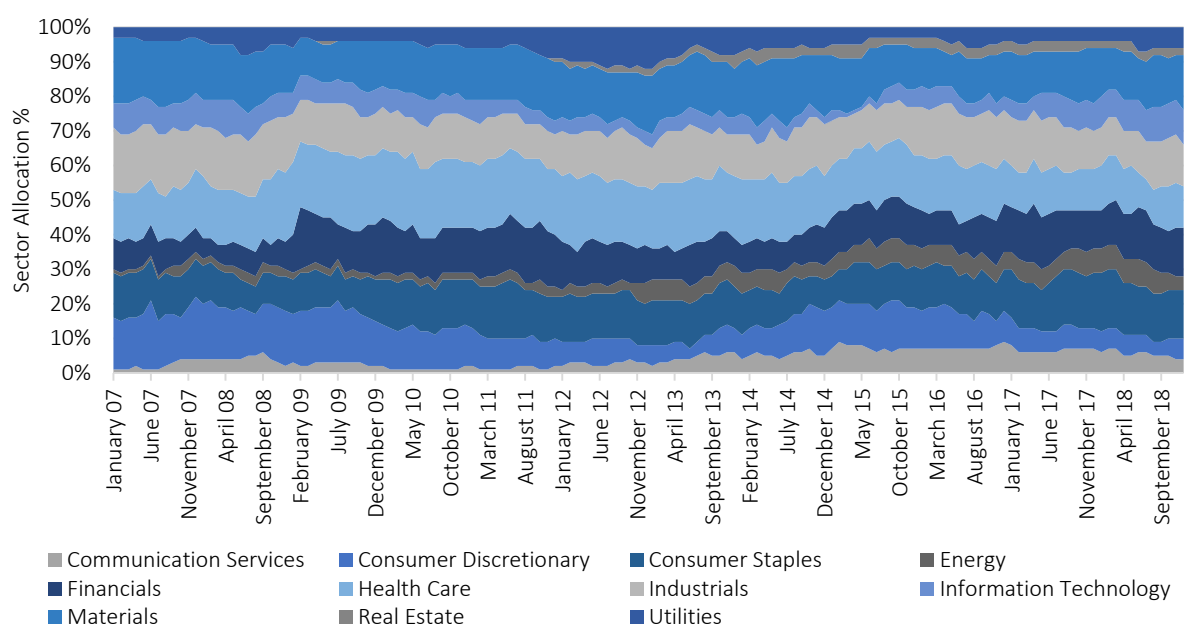


Figure 1a. Volatility sorted low-risk portfolio sector profile

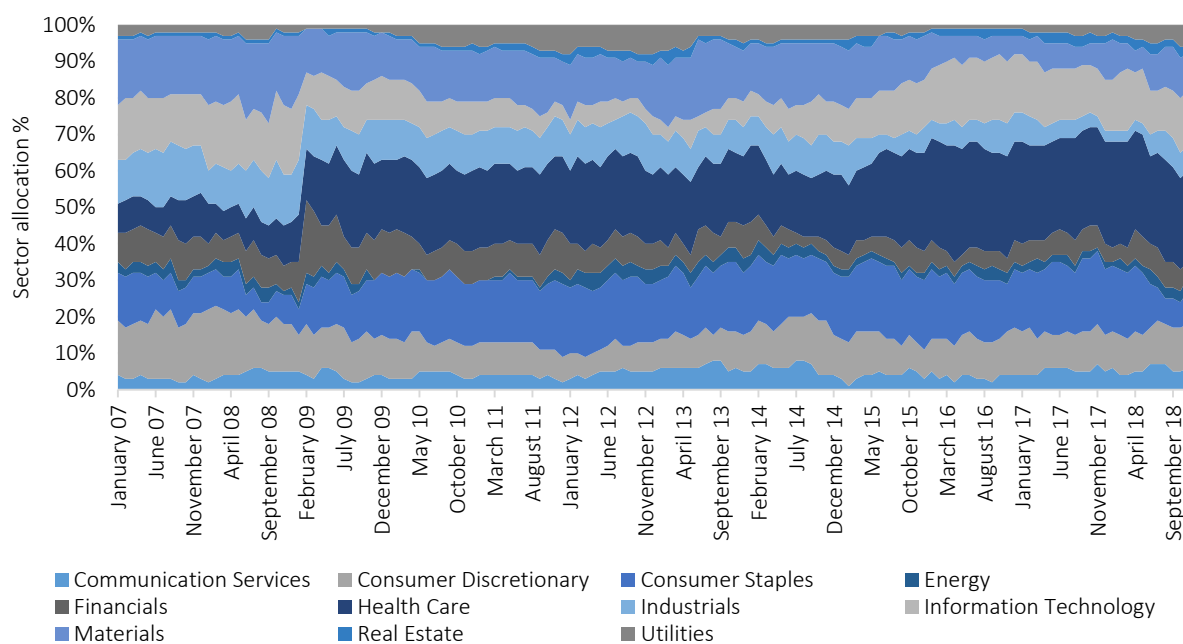


Figure 1b. Beta sorted low-risk portfolio sector profile

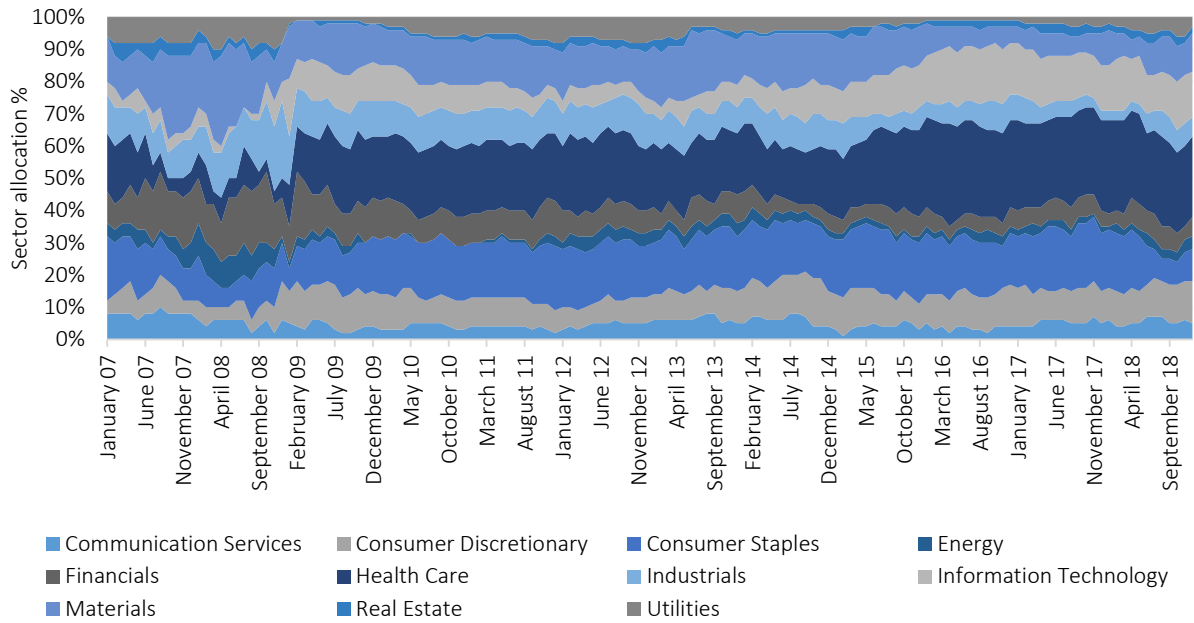


Figure 1c. High-momentum sorted low-risk portfolio sector profile

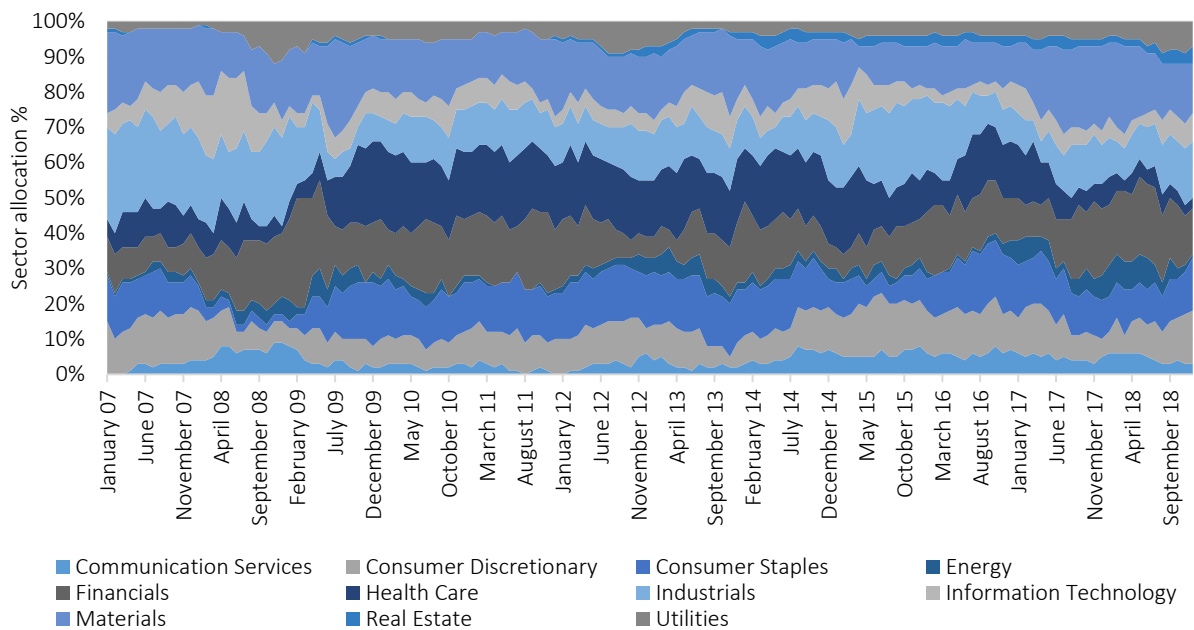


Figure 1d. Scaled volatility sorted low-risk portfolio sector profile

Note: Figures 1a, 1b, 1c, and 1d report time-varying sector profile of low-risk portfolio constructed using volatility sorting, beta sorting, volatility sorting from high-momentum bucket, and scaled-volatility sorting.

Figure 1. Time-varying sector exposure of long-only low-risk portfolios

index, The *N* score for the most broad-based value-weighted market index is 5.5. The *N* score of 11 means the portfolio represents all the eleven sectors equally, and the *N* score of 1 means the portfolio represents only one sector, as explained in

the methodology section. For example, the latest weight of the financial sector in the NSE 500 index is 37%, whereas, at no point in the entire study period, any of the low-volatility strategies has sector exposure over 31%.

4. DISCUSSION

4.1. Is risk-return relationship positive, flat, or negative?

It is evident from the results in Panel A of Table 1 that there is no clear relationship between risk and return. The simple annualized excess returns for risk-quantile portfolios initially increase and then decrease. However, the expected positive risk-return relationship turns on its head for compounded returns. The CAGR increases (exception: 2nd to 3rd quintile) as one moves from low-risk portfolio to high-risk portfolio. The standard deviation of risk quintile portfolios increases monotonically as one moves from low-risk to high-risk portfolio, and the volatility of a high-risk portfolio is more than double that of low-risk portfolios. The volatility drag has a large negative impact on high-risk portfolios and leads to negative risk-return relationship on a CAGR³ basis. Both higher return and lower volatility contribute to the highest Sharpe ratio for low-risk portfolio than other risk quantile portfolios and market portfolio. Ex-post beta too monotonically increases as one moves from low-risk to high-risk portfolio, and the same trend is visible for ex-ante beta. This implies that risk is sticky and low-risk portfolios continue to remain low-risk and high-risk portfolios continue to remain high-risk portfolios. The CAPM style alpha for volatility sorted low-risk portfolio is large and positive, whereas it is large and negative for high-risk portfolios. Both are economically and statistically significant and imply a negative risk-return relationship. The CAPM alphas for beta sorted risk-quintile portfolios show similar trends, except alpha for a low-risk portfolio for beta sorted, is not as large and significant as volatility sorted low-risk portfolio.

Low-risk (high-risk) portfolio tends to underperform (outperforms) during rising markets and outperforms (underperforms) during falling markets. However, the low-risk portfolio outperformance in falling markets is much stronger, resulting in a low-risk portfolio's superior performance. Maximum drawdown is the real measure of risk for any investor and low-risk portfolio has much lower drawdown than both high-risk portfolio and market portfolio and, hence, the success of low-volatility investment

strategy lies in winning by losing less⁴. As Baker, Bradley, and Wurgler (2011) reported, the fund managers with relative performance mandate cannot afford large tracking errors, resulting in flattened risk-return relationship. Both low-risk and high-risk portfolios have large tracking errors. It explains low preference for low-risk yet high-tracking error portfolio by fund managers with relative performance mandate. However, such investors should also avoid high-risk portfolio as that too has large tracking error. Perhaps fund managers with call option like compensation structure and investors with a preference for lottery-like payoffs look for high-risk stocks for their positive skewness and avoid low-risk stocks for their negative skewness in return distributions.

4.2. Is the low-risk effect distinct?

As reported in Panel A of Table 2, three-factor and four-factor alphas for low-risk (high-risk) portfolios are positive (negative) and economically and statistically significant. This implies that size, value, and momentum cannot explain large positive (negative) residual alpha for low-risk (high-risk) portfolio and, hence, low-risk effect is a distinct effect. Analyzing factor loadings of three-factor and four-factor models reveals that low-risk portfolio has a clear tilt towards growth and winner stocks, whereas high-risk portfolio has a tilt towards value and loser stocks. The growth tilt of low-volatility portfolios is different from the value tilt of low-risk portfolios seen in the developed markets. However, Chow, Hsu, Kuo, and Li (2014) report the growth tilt of low-risk portfolios in the emerging markets. Both low-risk and high-risk portfolios do not show any tilt on size factor, which is due to the selection of the largest 500 listed stocks on NSE.

4.3. Is low-risk effect robust to time-varying exposure to classic factors, liquidity, and ticket-size exposure?

The double sorting is a strong non-parametric approach to detangle the low-risk effect from other effects, one at a time. The three-factor and four-fac-

3 CAGR = Simple return - 0.5 × variance of returns, hence given the level of simple return, higher the variance of returns, lower the CAGR.

4 An investment losing 50% in a given period needs to gain 100% in the following period to breakeven. In contrast, an investment losing 80% in a given period needs to gain 400% in the following period to breakeven.

tor regressions do not capture any time-varying exposure to size, value, and momentum factors; double sorting tides over that potential limitation as well. The results in Panels A, B, and C of Table 3 establish that large-positive (small-negative) alpha of low-risk (high-risk) portfolio persist after controlling for size, value, and momentum effects. The results in Panels D and E of Table 3 suggest that large-positive (large-negative) alpha of low-risk (high-risk) portfolio persists after controlling for liquidity and ticket size exposure and, hence, the low-risk effect is truly distinct⁶ and one cannot fully explain it by systematic exposure of extreme risk-quintile portfolio to liquidity and ticket-size.

4.4. Is low-risk effect a concentrated macro (sector-level) or micro (stock-level) bet?

The results from Table 4 give interesting insights. As Baker, Bradley, and Wurgler (2011) reported, low-risk anomaly is a combination of macro (sector level) and micro (stock level) effect, and, hence, portfolio of low-cost sector exchange-traded funds (ETFs) cannot fully capture it. The approach of constructing sector-neutral low (high) risk portfolios controls the volatility effect of the macro (sector level). It captures pure micro (stock level) effect, and significant positive (negative) alpha for sector-neutral low-risk (high-risk) portfolio implies that the low-risk effect is strong and significant after controlling for macro effect, albeit of smaller magnitude.

4.5. Can one enhance the performance of low-risk investment strategy by adding momentum booster to it?

The power of adding momentum filter while constructing low-risk investment strategy is visible in results presented in Panels A and B of Table 5. All risk quantile portfolios constructed from universe of high-momentum stocks deliver superior absolute and risk-adjusted performance over corresponding pure risk-quintile portfolios (see Table 1). The high-momentum universe portfolio outperforms low-momentum universe portfolio by a huge margin. The combined benefit of high-momentum and low-risk is visible in the performance

of low-risk, high-momentum portfolio. The low-risk, high-momentum portfolio (Panel A, Table 5) delivers close to 5% higher CAGR than pure low-risk portfolio (Panel A, Table 1) without any increase in volatility. A momentum booster is added to pure low-risk investment strategy. On the other hand, the CAGR of low-risk portfolio constructed from low-momentum universe is close to 4% lower than pure low-risk portfolio and is more volatile. It is observed that the performance of high-risk portfolio further deteriorates when combined with low-momentum. The CAGR for high-risk, low-momentum stocks is negative in about 7% lower than pure high-risk portfolio. It implies that low-risk, high-momentum stocks are ideal for long only investors, high-risk, low-momentum stocks are the perfect candidates for shorting. The results are similar using alternative approach to add momentum booster to low-risk investment strategy. Low-risk (high-risk) portfolio constructed based on scaled volatility measure delivers superior (inferior) absolute, as well as risk-adjusted returns over pure low-risk (high-risk) portfolio. In sum, notwithstanding the approach, combining momentum effect with low-risk effect results in enhancing performance of low-risk investment strategy.

4.6. Portfolio characteristics of pure and enhanced low-risk investment strategies

Table 6 and Figure 1 show that low-risk portfolio is not a concentrated portfolio and the sector concentration of low-risk portfolio is actually lower than the most broad-based value-weighted market index in India, NSE 500. Hence, low-risk portfolio does not lead to any undesirable sector concentration and a resulting tail risk associated with such concentration. Contrary to developed markets where the utilities and real estate dominate minimum variance portfolios, Indian markets have hardly any exposure to utilities and real estate sectors. It is spread across health care, financials, consumer staples, industrials, and materials and has small exposure to real estate and utility sectors.

Turning attention to the monthly portfolio churn requirement, the average one-way monthly portfolio churn required for pure low-risk strategies is about 5%, which means close to 100% of two-way

churn for the year. The monthly churn needed for enhanced strategies is close to 10% and the annual two-way churn of close to 200%. However, as reported by Chow, Hsu, Kuo, and Li (2014) and implemented by MSCI minimum volatility index, independently imposing an explicit limit on annual turnover does not dilute exposure to low-risk effect. Besides, in the case of Indian markets, there are several discount brokerage houses now offering genuine zero brokerage services. The transac-

tion costs have come down to a maximum of 0.2% per transaction, including regulatory charges, security transaction tax, and impact cost. So, even 200% of an annual churn causes a performance drag of only 0.4% per annum.

In sum, low-risk investment strategy requires little churning and remains robust after implementing turnover constraints. It is easily implementable with little cost.

CONCLUSION

In conclusion, strong evidence for low-risk effect with low-risk stocks outperforms high-risk stocks both on an absolute and risk-adjusted basis is found. The effect is more pronounced for compounded returns than simple returns. The low-risk portfolio delivers high-positive alpha, whereas high-risk portfolio delivers high-negative alpha. The low-risk effect remains robust after controlling for size, value, and momentum factors. The low-risk portfolio shows systematic growth-tilt as against value-tilt observed in developed markets. The low-risk anomaly remains robust after controlling for ticket-size and liquidity exposures. The low-risk effect remains robust after controlling for sector exposure, which means the low-risk effect is both macro (sector level) and micro (stock level) effect. Contrary to developed markets, where low-risk portfolios have significant sector concentration towards real estate and utility sectors, low-risk portfolio in Indian markets is less concentrated, and the sector concentration is even less than the broad-based market index. The performance of low-risk investment strategies improves significantly by eliminating low-risk but poor momentum stocks and focusing on constructing low-risk investment strategies that systematically prefer high-momentum stocks. Such improvement in performance is robust to alternative approaches. It is established that while the low-risk effect is universal, the characteristics of low-risk portfolios are different in different markets. The authors further show that the performance of simple low-risk investment strategies can be enhanced by integrating the benefits of momentum effect into low-risk effect.

The paper contributes to the body of literature, especially in the Indian context, in several ways. First, the authors use the top 500 largest stocks in the Indian stock market and, hence, eliminate small and illiquid stocks. Bali and Cakici (2008) attribute extreme negative returns of illiquid and penny stocks to high idiosyncratic risk. Our results show that the low-risk effect is present in the universe of large stocks and remain robust after controlling for ticket-size and liquidity of stocks. Second, the authors reinforce that low-risk effect is robust after controlling for size, value, and momentum factors, and it is a distinct effect. The three-factor and four-factor alphas remain highly significant and positive, and this offers strong evidence against Scherer (2011) who claims that Fama-French factors explain a large part of minimum variance portfolio alpha and the low-risk effect is a mere proxy for the value effect. We report that the low-risk portfolio has growth tilt rather than value tilt, as seen in developed markets. The low-risk effect is present both in emerging and developed markets. It has value tilt in developed markets, whereas growth tilt in emerging markets. The results are similar to Chow, Hsu, Kuo, and Li (2014). Third, the authors show that the low-risk effect is strong after controlling for sector exposure and both macro (sector level) and micro (stock level) effects contribute to the low-risk effect and fourth, the authors show various approaches to integrate benefits of momentum effect into low-risk investment strategy and how it can deliver superior absolute and risk-adjusted returns over pure low-risk investment strategy. It is concluded that the long-only low-risk investment strategy is one of the most prudent ways to generate superior returns over a full market cycle with much smaller drawdowns, and it is possible to enhance the performance of low-risk investment strategy by integrating benefits of momentum effect without compromising its low-risk nature.

AUTHOR CONTRIBUTIONS

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Supervision: Mayank Joshipura.

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Writing – original draft: Mayank Joshipura, Nehal Joshipura.

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Risk Anomaly: A Review of Literature

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Abstract

Number of studies show that portfolio of low risk stocks outperforms portfolio of high risk stocks as well as the market portfolio over the full market cycle on risk adjusted basis and in some cases, absolute basis as well. This surprising contradiction to classic finance theory led by CAPM has held its ground over long periods of time, across different markets and different methodological choices. This review paper aims at contributing to the body of knowledge in four ways. One, it highlights and links different strands of literature on low risk anomaly that has evolved over a period of time. Second, it highlights, different methodological choices that have been used. Third, it classifies explanations for persistence of risk anomaly into economic and behavioral explanations and explanations that try to explain the anomaly away. Fourth, it reviews the state of current research and explores potential but yet underexplored areas of research on risk anomaly.

Keywords: Market efficiency, risk anomaly, CAPM, Preference for lottery, limits of arbitrage, volatility effect

1. Introduction

Finance theory suggests that there is clear and linear positive relationship between the risk and the return. One needs to assume higher risk in order to earn higher return. Modern Portfolio theory (Markowitz, 1952) offers the framework to optimize risk return trade-off based on investors' risk budget by allowing them to construct a portfolio that offers the highest level of expected return at the given level of volatility or alternatively allows to construct a portfolio that offers the higher expected return at given level of volatility. Capital Asset Pricing Model (CAPM) (Sharpe, 1964) argues that while there is a positive relation between the risk and return, the reward for the additional risk is limited to the systematic risk only and not available on the total risk. The logic is that a rational investor should be able to diversify away the unsystematic risk and hence no risk premium should be associated with such risk. However, when it comes to measuring performance of any managed portfolio, the most popular measure is the Sharpe ratio that measures the excess return (return of a portfolio over risk free return) to volatility, measured by standard deviation and not beta. The reason why an actively managed portfolio may not be a fully diversified is that it intends to outperform the benchmark market portfolio (A proxy for fully diversified portfolio with zero unsystematic risk) on a risk-adjusted basis. Therefore they may retain unsystematic risk for the superior returns. In such cases, investors need reward not only for the systematic risk of the portfolio but for the unsystematic risk retained in the portfolio as well.

However, empirical evidence showcasing superior risk adjusted performance of Low Volatility (LV) and Minimum Variance (MV) investment strategies compared to benchmark as well as high risk have raised questions about direction and degree of positive risk return relationship preached by classic finance theory. A large body of overlooked academic research reveals that risk and return within the equity markets are not correlated, or if they are, it is negative correlation. This surprising contradiction seems to be true and persisting and not varying a great deal with difference in methodological choices and markets. More recently, there are several studies that have highlighted that risk and expected return relationship is not only flat but also actually negative within the asset class such as equity if not across the asset class. This is known as "low risk anomaly". The proposition is that "portfolio consisting of low risk stocks not only outperforms its high volatility counterpart but also market capitalization weighted benchmark portfolio over a period of full market cycle".

Now the next question that immediately comes to mind is that is it possible to have portfolios, which give returns greater than High Volatility (HV) portfolio and market portfolio with lesser risk? Is it possible to have a portfolio, which lies above the Capital market Line? This is the basic premise behind 'exploring for risk anomaly in stock markets!'

There are two ways to test and exploit risk anomaly – [a] Low volatility (LV) portfolio and [b] Minimum variance (MV) portfolio. Many studies in developed markets report superior returns associated with low volatility portfolios over the market portfolio as well as the portfolios with higher risk. The risk being measured either by standard deviation of returns or by beta of the stock returns.

Here is the brief explanation of the LV and MV investment strategies –

(a) Low Volatility investing – This strategy sorts or ranks all the stocks by their historical volatility and/or beta and then forms a portfolio using subset of these stocks – comprising those with the lowest beta and/or volatility.

(b) Minimum Variance investing – It relies on observations and/or estimates of correlations of individual stocks. Individual stocks have higher risk, but a well-diversified portfolio when optimized for minimum risk is identified as the Minimum Variance Portfolio.

These investment strategies have been noteworthy in the sense that they have been able to deliver higher absolute returns as well as risk-adjusted returns over time. Both MV and LV portfolios reduce volatility and face least drawdowns¹.

We organize remaining part of this paper as follows. Section 2 discusses review of literature in general, Section 3 discusses different methodological choices, Section 4 discusses possible explanations and Section 5 discusses Road ahead followed by Section 6 conclusion.

2. Review of Major Literature

Initial evidence on “Betting against beta” version of risk anomaly throwing light on flatter than expected or even inverse relationship between risk and return as predicted by CAPM (Sharpe, 1964) traces back to 1970’s where ((Black, 1972),(Haugen & Heins, 1975)) show flatter than expected and negative relationship between beta and expected returns. Further (Fama & French, 1992) report flat relationship between beta and cross section of returns in U.S. markets for 1963-1990 period. (Haugen & Baker, 1991) and (Haugen & Baker, 1996) offer initial evidence on inverse relationship between risk and return.

More recent studies on risk anomaly can be classified based on choice of

- 1) portfolio construction method- minimum variance vs. volatility sorting
- 2) choice of risk measures- standard deviation, beta, idiosyncratic risk
- 3) choice of portfolio construction and holding period-short vs. long

We further classify various studies based on the way they attempt to explain or explain away, the risk anomaly.

- 1) Studies attempting to explain the volatility effect either by economic reasoning or by behavioral explanation
- 2) Studies attempting to explain away the risk anomaly.

Minimum variance investing or low volatility investing has been inspired by early work from Haugen and Baker (Haugen & Baker, 1991)². For the period covering the years 1972 to 1989, the authors report that repeatedly investing into a stock portfolio constructed to expose

¹Drawdown is defined as peak to trough decline during a specific period in the stock price.

²Acadian Asset Management, AXA Rosenberg, Analytic Investors LLC, Invesco, LGT Capital Management, MSCI Barra, Robeco, SEI, State Street Global Advisors, Martingale Asset Management LLC and Unigestion are running minimum variance index concepts. Ishare & Russel have already launched ETFs based on MV indices.

investors to minimum risk (as measured by variance) would outperform the Wilshire 5000 index (provide a higher Sharpe ratio³). Today, the body of research supporting the low risk anomaly studies the period from 1926 to the present.

Many other studies specific to U.S. markets including (Chan, Karceski, & Lakonishok, 1999), (Schawartz, 2000), (Jagannathan & Ma, 2003) report both higher returns and lower realized risks for the minimum variance portfolio (MVP) versus a capitalization-weighted benchmark (MWP).

We discuss some of the major studies and their propositions below.

Clarke et al. (Clarke, DeSilva, & Thorley, 2006a) study focus on the characteristics of minimum-variance (MV) portfolios. The study reports that MV portfolios based on the 1,000 largest U.S. stocks over the period of 1968 – 2005, achieved a volatility reduction of about 25% while delivering comparable or even higher average returns than the market portfolio. This means that the MV portfolios had around 75% of the risk of the market portfolio, with returns comparable to those of the broad market. MV portfolios gave average 6.5% excess return above T-Bills with a volatility of 11.7% whereas the market index gave average excess return of 5.6% with a volatility of 15.4%.

Blitz & Vliet (Blitz & Vliet, 2007) report that low volatility stocks have superior risk-adjusted returns relative to the FTSE World Development Index. The study also reports that low beta stocks have higher returns and high beta stocks have lower returns than predicted by CAPM. They also provide detailed analysis of the volatility anomaly and demonstrated its robustness across regions and to controls for size, value and momentum effects. They show outperformance associated with low historical volatility stocks both in terms of higher Sharpe ratio and higher positive CAPM alpha. They attribute such sustainable outperformance to restricted borrowing as reported by (Black, 1972), decentralized investment approach and behavioral biases such as preference for lotteries. Further details on explanations are given in possible explanations section of this document.

Ang et.al. ((Ang, Hodrick, Xing, & Zhang), 2006, 2009) report evidence for inverted relationship between idiosyncratic volatility as opposed to systematic and total risk for a very short term-one month volatility measure in U.S. as well as other global markets.

In another recent study by (Baker & Haugen, 2012) finds that from 1990 – 2011, low risk stocks have produced higher returns in every market worldwide – including emerging markets.

Frazzini & Pedersen (Frazzini & Pedersen, 2010) document that low-risk securities have high risk-adjusted returns in global stock, treasury, credit and futures market.

Most recently, (Frazzini & Pedersen, 2014) report evidence for betting against beta and attributed to leverage constrained investors seeking superior returns bid up the high beta stocks that in turn results into lower expected returns on high beta stocks.

³Sharpe Ratio = Excess return on portfolio over risk free rate divided by standard deviation of portfolio returns.

Choueifaty & Coignard (Choueifaty & Coignard, 2008) argue that maximizing a diversification ratio, the weighted average of the stocks' volatilities divided by the portfolio volatility, as an approach to achieve risk-adjusted returns is superior to those of the market cap-weighted portfolios. Based on the results on the universe of U.S. and Eurozone securities, they conclude that, if all of the stocks in the study's universe possess the same volatility, then the maximum diversification portfolio is equal to the global minimum-variance portfolio.

Baker et. al. (Baker, Bradley, & Wurgler, 2011) report that contrary to basic finance principles, high-beta and high-volatility stocks long underperformed low-beta and low-volatility stocks.

Karceski (Karceski, 2002) provides behavioral explanation to low risk anomaly. According to him, mutual funds investors tend to chase returns over the time and across the funds, possibly because of an extrapolation bias. These forces make fund managers care more about outperforming in bull markets rather than underperforming in bear markets and therefore increase their demand for high beta stocks and reduce required rate of returns.

Baker et. al. (Baker, Bradley, & Wurgler, 2011) & (Baker, Bradley, & Taliaferro, 2013) provide some explanation for the presence and sustainability of low risk anomaly. According to them, the typical institutional investor's mandate to outperform a fixed benchmark discourages arbitrage activity in high-alpha, low-beta stocks and low-alpha, high-beta stocks. They replicate (Pettengill, Sundaram, & Mathur, 1995) study which reports higher (lower) total return associated with high beta stock in months where market return above (below) median return compared to their low beta counterparts. The results are similar. However, on CAPM adjusted basis, low beta stocks still outperform in bull as well as bear markets and provide evidence for presence of low risk anomaly over market cycles.

Soe (Soe, 2012) tests the low-risk anomaly in different markets and across various market cap stocks to find that the low-volatility effect is not unique to the U.S. equity markets; it is present on a global scale.

Carvalho et. al. (Carvalho, Raul, Xiao, & Pierre, 2012) find that a rankings-based or quintile-based low volatility construction approach could be considered as an equal risk budget strategy that does not account for the impact of correlations between stocks.

While evidence for risk anomaly is growing, some recent studies report findings in favor of classic positive risk-return relationship or dispute the methodological choices of other studies reporting flat or inverted risk-return relationship.

Martellini (Martellini, 2008) finds that positive relationship between risk and return is intact. However, one must note that the study uses only surviving stocks and therefore systematically ignores stocks delivering significant negative returns before disappearing. (Fu, 2009) claims that one should focus on expected rather than historical volatility, and reports a positive relation between risk and return by using EGARCH models to estimate idiosyncratic volatility.

3. Methodological Choices

Following variations in term of methodological choices are popular to test presence of risk anomaly.

- Minimum variance vs. simple volatility sorting based approach
- Choice of measure of risk- historical standard deviation, beta or idiosyncratic risk
- Choice of return measures-simple vs. compounded
- Choice of period for volatility estimation- short vs. long
- Choice of universe- developed countries vs. emerging markets, size and liquidity of the stocks
- Weighing scheme: Equally weighted vs. value weighted
- Division of portfolios-Decile vs. quintiles

Given below are some of the examples of different methodological choices used in some of the important studies. (Clarke, DeSilva, & Thorley, 2006a), (Chan, Karceski, & Lakonishok, 1999), (Schawartz, 2000), (Jagannathan & Ma, 2003) use minimum variance based approach whereas (Blitz & Vliet, 2007), (Ang, Hodrick, Xing, & Zhang, 2006), (Baker & Haugen, 2012), (Frazzini & Pedersen, 2014) use risk measure based sorting approach.

(Clarke, DeSilva, & Thorley, 2006a), (Bali & Cakici, 2008), (Baker, Bradley, & Wurgler, 2011) use standard deviation or variance as risk measure, (Frazzini & Pedersen, 2014) use beta as risk measure. (Blitz & Vliet, 2007) use both standard deviation as well as beta as risk measure. (Ang, Hodrick, Xing, & Xhang, 2009) use idiosyncratic volatility as risk measure. (Fu, 2009) uses volatility using EGARCH rather than historical volatility.

(Ang, Hodrick, Xing, & Zhang, 2006), (Martellini, 2008), (Bali & Cakici, 2008) use simple returns, whereas (Blitz & Vliet, 2007), (Baker, Bradley, & Wurgler, 2011) use compounded returns.

(Blitz & Vliet, 2007) use three year volatility of weekly returns, (Baker, Bradley, & Wurgler, 2011) use five year volatility of monthly returns. On extremes, (Martellini, 2008) use ten-year volatility of monthly returns, whereas, (Ang, Hodrick, Xing, & Xhang, 2009) and (Bali & Cakici, 2008) use very short term one month volatility of daily returns. (Fu, 2009) does not use historical volatility at all and uses EGARCH estimate of daily returns volatility.

Most of the studies focus on U.S. markets using CRSP data including (Clarke, DeSilva, & Thorley, 2006b), (Ang, Hodrick, Xing, & Zhang, 2006), (Fu, 2009), (Baker, Bradley, & Wurgler, 2011). However, there are number of studies focusing on data from other regions and emerging markets and specific size and liquidity based screen in choice of their universe. (Blitz & Vliet, 2007) use FTSE world stocks sample with focus on large stocks with regional focus on Japan and Europe data, besides U.S. (Baker, Bradley, & Wurgler, 2011) use CRSP top 1000 sample besides all CRSP stocks in their study. (Ang, Hodrick, Xing, & Xhang, 2009) use MSCI Europe and Asia sample in their study. (Blitz, Pang, & Vliet, 2012) focus on

universe from emerging markets only. (Martellini, 2008) chooses universe with only survivor stocks from CRSP during entire period of 1975 to 2004.

(Blitz & Vliet, 2007), (Fu, 2009) use decile portfolios, (Ang, Hodrick, Xing, & Zhang, 2006), (Ang, Hodrick, Xing, & Xiang, 2009), (Bali & Cakici, 2008), (Martellini, 2008), (Baker, Bradley, & Wurgler, 2011), (Blitz, Pang, & Vliet, 2012) use quintile portfolios.

While (Blitz & Vliet, 2007), (Martellini, 2008), (Baker, Bradley, & Wurgler, 2011) use equal weighing scheme, (Ang, Hodrick, Xing, & Zhang, 2006), (Ang, Hodrick, Xing, & Xiang, 2009), (Bali & Cakici, 2008) use value weighing scheme and (Fu, 2009) uses both.

4. Possible Explanations

While it is difficult to explain presence of such low risk anomaly and its persistence using traditional finance theory and models such as capital asset pricing model (CAPM) and Markowitz modern portfolio theory (MPT), there are some plausible explanations to explain such consistent outperformance of low volatility investment strategies. As we report earlier, there are two sets of explanations available. One set of explanations tries to explain evidence of low risk anomaly using economic or behavioral reasoning. Whereas the other set of explanations tries to explain it away.

4.1 Economic explanations

Following are some of the economic explanations.

1. Borrowing restrictions: Leverage is essential to take full advantage of attractive absolute returns of low-risk stocks. However, in practice there are several restrictions on short selling and leverage allowed for investment purpose. (Black, 1972) documents borrowing restrictions applicable for both the individual as well as most of the institutional investors. Black (Black, 1993) argues that one should look at asset allocation between bonds and low risk equity rather than bond and market portfolio of equity. However, for that, one has to recognize low risk equity as a separate asset class. (Blitz & Vliet, 2007) and (Baker, Bradley, & Wurgler, 2011) explain underpricing of low volatility stocks and overpricing of high volatility stocks due to such borrowing restrictions.
2. Limits of arbitrage: (Baker, Bradley, & Wurgler, 2011) attribute low-beta high-alpha and high-beta low-alpha scenario to the fact that most of the institutional investors are working for beating some benchmark and in order to achieve that they tend to go for high beta stocks. This is because chasing high beta stocks is an easier way to beat the benchmark rather than search for stock with alpha that is high enough to enable them to outperform the benchmark. The alternative way of doing it is by investing in low beta stocks using leverage and outperforming benchmark and benefiting from alpha as well. However, restrictions on borrowing including 'long only' mandate leads to elimination of possibility of exploiting arbitrage opportunity between low beta-high alpha and high beta-low alpha stock.
3. Decentralized investment approach: In professional investment industry, the practice is that the chief investment officer makes the asset allocation decision and in second stage, capital is allocated to managers who buy securities within the different assets classes. Binsbergen et al.

(Binsbergen, Brandt, & Kojen, 2008) attribute inefficiencies in decentralized investment management approach to profit maximizing asset managers' search for outperformance in up market rather than in the down market.

4. Short selling constraints: (Hong & Sraer, 2012) show that high-risk stocks have greater divergence of opinion about their payoffs making them more prone to speculative overpricing than low-risk ones. Short selling constraints, does not allow arbitrageurs to correct the inflated prices of high volatility stocks immediately by going long on ignored low risk stocks and shorting high risk stocks, which in turn, leads to underperformance of high volatility stocks.

5. Agents maximize option value: (Baker & Haugen, 2012) observe that portfolio managers are typically paid a base salary and sufficiently high bonus based on the portfolio return. This makes their compensation resembling a call option with payoff function: $c + \max(Rp - X, 0)$, where Rp is portfolio return, c is base salary or fee and X is the hurdle rate. This in turn results in portfolio managers seeking higher risk and focusing on outperformance during up market rather than down market and taking higher risk by tilting portfolios towards high beta stocks.

4.2 Explanations based on investor's behavior and biases

There is the other set of explanations highlighting irrational behavior of not fully diversified investors and how behavioral biases influence investment decision and make investor prefer high volatility stocks with positive skewness and lottery like payoffs and thereby pushing them in to overpriced territory.

1. *Preference for lottery*: The general assumption is that investors are risk averse and that is true under normal circumstances. A layman tends to reject a bet with 50 percent probability of winning Rs.110 and 50 percent probability of losing Rs.100 despite positive expected payoff associated with this bet. (Kahneman & Tversky, 1979) explain such behavior as "loss aversion". However something strange happens with individuals when probability shifts. If the same individual who rejected the bet with positive expected payoff of Rs.5 earlier is now offered a bet with almost certain loss of Re.1 and a small chance (probability is 0.15 percent) of getting Rs.5000, is willing to accept the bet despite negative expected payoff associated with it. That's the very reason, people buy lottery! This has something to do with positive skewness of payoffs and not volatility. However, (Mitton & Vorkink, 2007) highlighted that high volatility individual stocks with limited liability, are also positively skewed. Buying a high volatility, low priced stock is like buying a lottery - high probability of losing money vs. a small chance of doubling or tripling money in short term. (Kumar, 2009) shows that individual investors show clear preference for stocks with lottery like payoff measured as idiosyncratic volatility or skewness. (Boyer, Mitton, & Vorkink, 2010) argue that volatility is a proxy for expected skewness.

2. *Mental Accounting*: (Blitz & Vliet, 2007) give a related mental-accounting explanation for the volatility effect, arguing that investors may make rational risk-averse choices for asset allocation decision, but when it comes to security selection within the asset class, they become risk seeking or risk neutral and show preference for high volatility investments with lottery like payoffs.

3. *Preference for attention-grabbing stocks*: (Falkenstein, 1996) documents that mutual funds hold firms-in-news more. (Barber & Odean, 2008) also find that individual investors are net buyers of attention-grabbing stocks. Boring low-volatility stocks are neglected causing the volatility effect.

4. *Representativeness Bias*: (Falkenstein, 2009) argues that representativeness bias may also explain the volatility effect. As explained by (Kahneman & Tversky, 1983), representativeness bias is that people rely more on appealing anecdotes than on dull analysis. So it creates a logical error: stocks that had the highest returns were risky, therefore risky stocks should have higher expected returns. The widespread heuristic that ‘risk creates returns premium’ causes investors to overweight risky stocks to generate return premium. This actually negates the effect through their collective action.

5. *Overconfidence*: People generally see themselves as better than average on nearly any subjective and socially desirable dimension. (Falkenstein, 2009) argues that many people believe that they are capable of successful stock picking. Thus investors may be biased towards high-risk stocks for so-called alpha discovery purposes, rooted in overconfidence. Also with regard to market timing, there is an implication leading to risk anomaly. If an investor is confident about market rising, he will surely park his money into high-beta stocks to benefit most. If he senses that the market will go down, he will not invest into low-beta stocks; rather will stay away from the equities.

4.3 Explanations trying to explain it away

There are many studies that try to explain away risk anomaly based on arguments related to methodological choices and other known investment effects. Following studies offer such findings.

(Bali & Cakici, 2008) argue that the negative expected returns associated with high volatility stocks reported by (Ang, Hodrick, Xing, & Zhang, 2006) are due to presence of small and illiquid stocks with lottery like payoffs. Removing these stocks from the sample makes the anomaly insignificant. (Martellini, 2008) finds that positive relationship between risk and return is intact using long term volatility rather than short term. However, one must note that the study uses only surviving stocks and therefore systematically ignores stocks delivering significant negative returns before disappearing. (Fu, 2009) claims that one should focus on expected rather than historical volatility, and reports a positive relation between risk and return by using EGARCH models to estimate idiosyncratic volatility. (Scherer, 2011) argues that large part of excess return of minimum variance portfolio over benchmark portfolio is attributable to systematic exposure to size and value factors and volatility effect in large part a mere proxy for value effect. (Poullaouec, 2010) shows that while MSCI MV index has outperformed MSCI World index by 0.5% per annum over a period of 1988 to 2010, large chunk of this outperformance comes from a period of June 2000 to June 2003, period representing the aftermath of dotcom crisis and therefore superior returns of minimum variance strategy are concentrated during extreme bearish periods. (Bali, Cakici, & Whitelaw, 2011) further contest results of (Ang, Hodrick, Xing, & Xhang, 2009) by arguing that inverted risk-return relationship is attributable to lottery like payoffs associated with high

idiosyncratic volatility stocks and substantiate their results by developing variable MAX to proxy for the preference for lottery-like stocks. They try to establish that MAX is an independent variable and not a mere proxy for idiosyncratic volatility.

5. Road Ahead

5.1 Critical review

Risk anomaly has turned out to be one of the longest standing anomalies in the history of modern finance era. It seems to be a global phenomenon and has seriously challenged classic finance theory based on positive risk return relationship. While we have some studies highlighting positive risk-return relationship recently including (Martellini, 2008) and (Fu, 2009), both studies suffer from survivorship bias and look ahead bias respectively. Persistence of risk anomaly has led to researchers looking for explanations and there are enough and compelling economic as well as behavioral explanations to explain persistence of such anomaly. Some studies try to explain the anomaly away but that part of the evidence is weak and small at the moment. In closing, it looks like that while positive risk-return relation as prescribed by CAPM and MPT certainly holds true as asset class level but have come across severe scrutiny within the asset class, especially equity, where the evidence is growing for low volatility with higher expected return and vice versa.

The question here is that “Is this anomaly going to stay here forever or market learns over a period of time to phase it out?” The answer is as long as we have market frictions such as borrowing restrictions and short selling constraints, call option like compensation structure for portfolio managers that incentivizes them to pursue higher risk and reward them more for outperformance during positive markets only and benchmarking and minimizing tracking error as key performance measure, this is going to stay. Besides, emergence of behavioral finance has already established that investor behavior is far from rational both as well as institutional level and therefore preference for lottery, overconfidence, representativeness bias and limits of arbitrage are going to stay for a long. However, as professional investors learn about this, more and more investment strategies will target to benefit from this anomaly and in turn will make it less attractive. For sure, compensation structure of portfolio managers will undergo change to align it in such a manner that the portfolio managers don’t have enough incentive for preferring high beta-low alpha stocks and will reward them for outperformance during down markets as well rather than only during up markets. Going forward, some of the changes may reduce the intensity of such anomaly in some of the markets but it seems to be far away.

5.2 Scope for further research

While there is plenty of work done in exploring and explaining (or explaining it away) risk anomaly, there is a scope for lot of work.

First, many strategies that have worked well on paper or theoretically have failed in practice due to execution problems due to market microstructure effects. Next phase of work may focus on evaluating potential of low volatility investment strategy vis-à-vis value weighted market portfolio in light of transaction cost, impact cost, taxes and such other microstructure issues.

Second, is to provide more empirical evidence on some of the behavioral explanations. Except for preference for lottery where (Bali, Cakici, & Whitelaw, 2011) have developed a clear and measurable variable to proxy for lottery-like stocks, other explanations are still more qualitative in nature.

Third, is to look at testing low volatility effect using implied volatility data from options markets rather than using historical volatility or using conditional volatility estimates such as EGARCH. The other area of work may be to look at equity mutual fund schemes rather than stocks and see whether risk anomaly can explain cross section of mutual funds' performance.

Forth, is some more work to provide clear linkage between positive risk-return relationship in cross section of asset returns and flatter or negative returns within the securities of given asset class.

6. Conclusion

We conclude that the risk anomaly is one of the strongest and longest standing anomalies of equity markets, which, it is going to stay here for a long time. It has posed significant challenge to classic finance theory. There are several compelling reasons that explain persistence of risk anomaly. One the one hand, we have economic and market friction based explanations, whereas on the one hand, there are behavioral explanations highlighting behavioral biases and irrational investors behavior causing risk anomaly. Yet another set of explanations attempt to challenge the very existence of risk anomaly and try to explain it away. In closing, it seems that while institutively appealing positive risk-return relationship is intact and capable of explaining cross section of returns of various asset classes, such relationship seem to be violated on a consistent basis across the securities within given asset class such as equity market friction that impose limits on arbitrage and irrational behavior on part of market participants that affect rational investment decision making lead to systematic overpricing of high volatility stocks and under pricing of low volatility stocks.

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A STUDY ON BEACH TOURISM AND ITS OVERALL DEVELOPMENT – A SPECIAL REFERENCE TO BEACHES IN TRIVANDRUM DISTRICT

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ABSTRACT

The travel industry seems, by all accounts, to be an industry that anybody can get it. The travel industry in Kerala is being advanced as a monetary improvement procedure for country networks dependent on contentions of its immediate and backhanded advantages. The travel industry advertisers, in any case, don't promptly recognize the ecological effects and the subsequent social costs that the neighbourhood networks will endure when they bring the travel industry into their zone. There is no uncertainty that travel industry, alluded to as 'the world's biggest industry', is a major business. Amid the recent decades, numerous nations in this world have left in the travel industry situated strategies. The travel industry is the movement of people making a trip to and remaining in spots outside their typical condition for recreation and different purposes. In the modern days, the travel industry is additionally a monetary movement. It lands position openings and win outside trade. The travel industry is a procedure including visitors, places they visit and exercises they include into. Beach the travel industry, subsequently, is the travel industry offered as a powerful influence for the beach front condition and its common and social assets. It happens along the beach and in the water quickly contiguous the beach lines. In this investigation, the term beach front district includes not just the locale situated near the ocean, yet additionally its expansions through the substantial arrangement of estuaries and backwaters far into the inland of Kerala. Attributable to the convicts of interests of the partners of this business, the contention for and against the travel industry improvement in immature and least creating countries is probably going to proceed. It is viewed as proper in this setting to assess the status of India's travel industry. Tourists involve a critical position in the travel industry since they are the customers of the travel industry items. Thusly, the perspectives on the visitors are expected to improve the travel industry. It will likewise support the monetary improvement. A huge number of sightseers visit India since it unimaginably has the most various assortments of beaches anyplace on the planet. Peaceful backwaters and tidal ponds, bayous and unpleasant magma shook oceans, marine estuaries with fish, slamming surf, fine brilliant sand or palm bordered beaches profound India has them all.

Keywords: Beach, Travel, Tourism.

1. INTRODUCTION

The beach is the limit among land and ocean. The advancement of the travel industry has been personally connected with the sea beach. Individuals needed to escape from the drudgery of day by day life and appreciate the incredible marvels of nature along the beach. India is lucky in having a long beach line of 6100 km from West Bengal to Gujarat limited by the Arabian Sea, the Bay of Bengal, and the Indian Ocean. The beaches, sea beaches, estuaries and deltas of the streams all through the beach district offer chances to create the travel industry and financial advancement. The travel industry assumes a noteworthy job in the nations like China, England, Germany, Hong Kong, Thailand, and United States. They are drawing in more visitors and producing tremendous income in regard of remote trade. Before, the travel industry was restricted due to the non-accessibility of frameworks like transport and correspondence, yet in the present time, the general populations are living in the time of Science and Technology. The improvement of air, ocean, street transport and partnered foundations like lodgings, beach, resorts and human services focuses have been in charge of the advancement of the travel industry around the globe. Numerous nations have come to understand that worldwide the travel industry is one of the quickly developing businesses of the world. It has additionally turned into the fundamental area of the economy of any country.

More than the development in the piece of the overall industry which is as yet pitiful in a worldwide setting, the state has been recognized just like a goal with the most astounding potential. This finding has been over and over affirmed by movement middle people both with in India and in the conventional producing markets of Europe. In this manner the broadly acknowledged end is that for Kerala the travel industry could be a most dominant motor that could move the state's economy. Truth be told on the off chance that we are sincerely dissect the restrictions and shortcoming of huge numbers of our other monetary segments, we will understand that we have couple of options, being bio-innovation and data innovation the two of which we presently can't seem to create. India isn't a nation however a landmass to the extent the vacation destinations are concerned. For no nation on the planet can flaunt so differed an atmosphere, so unique wide open spaces thus rich legacy. India

is dynamically turning into the cynosure of the vacationers inferable from the endeavors of the administration and open to understand the maximum capacity of its huge and changed geographical, social and worldly assets. In rustic India, the town experience gives a characteristic scene which could shift from a tea ranch to an angling town. From the strong peaks in Ladakh to the regular backwaters of Kerala, the conceivable outcomes are huge.

2. IMPORTANCE OF THE STUDY

The travel industry is special since it includes industry without smoke, training without classroom, and reconciliation without enactment and tact without custom. It perceived that travel industry is an essential and alluring human movement meriting the consolation surprisingly and governments. In view of these perspectives the significance of the investigation is given beneath:

- Tourism is a vital movement on account of its immediate impacts on social, social, instructive and financial divisions of social orders.
- Tourism can add to the foundation of new global financial request. It will dispense with the enlarging monetary hole between the created and creating nations.
- Tourism gives a noteworthy commitment to outside trade profit of the creating and created nations.
- Tourism is a noteworthy thing of global exchange.
- Tourism makes generosity for sightseers to take an interest in numerous occasions like gatherings and shows. And furthermore it gives a chance to improve collaboration just as to extend a genuine picture of a nation to the outside world.
- Tourism has an instructive hugeness and it includes social trades. The social components draw in voyagers to goals, for example, models and authentic landmarks.
- Tourism is uniting individuals of various foundations from various nations.
- Tourism is a vital piece of modern life as a power for social change.

3. STATEMENT OF THE PROBLEM

In India, Tourism is considered as second biggest remote trade worker. Since, the foundation offices like power, street just as rail and air transportation, convenience and so forth help to attempt travel and visit to an impressive degree. The travelers, who come to India and particularly Kerala, value the job of the Government especially in the travel industry division. The travel industry is definitely not a solitary industry however it is associated with numerous different businesses. So the present investigation is embraced to evaluate the nature and development of the travel industry and its commitment to the provincial monetary advancement. A sizable measure of studies has been directed over the previous decades on the travel industry, significance of the travel industry, effect of the travel industry, wellbeing the travel industry, and costal the Beach Tourism.

4. KERALA'S BEACH TOURISM

Kerala, the State with the Arabian Sea in the west, the Western Ghats transcending 500-2700 m. in the east and arranged by forty four waterways, Kerala appreciates special topographical highlights that have made it a standout amongst the most looked for after vacationer goal in Asia. Kerala is one of the littlest states having quite recently 1.27 percent of the complete zone of India. The state is isolated into three areas - the beach swamps, the rich midlands and the good countries. The swamps in Kerala are organized by unlimited backwaters and the deltas of forty four waterways. The midlands are rich with cashew, coconut, areca nut, custard, banana, rice, ginger, pepper, sugarcane and vegetable manors. The forested good countries possess large amounts of tea, espresso, elastic and flavor estates and natural life holds. The land along these lines revealed was Kerala – "The God's Own Country". A land liberally honored naturally. A land where conventions unfurl and traditions murmur. Beach line the travel industry establishes one of the biggest sections of present day the travel industry. Beach lines have a peaceful and profound magnificence in themselves. Beaches have dependably been a fascination. The marvel on the distances of the oceans, their substance, the ocean, the wave and the surf, man has constantly gone to beach lines. Slopes and mountains isolate individuals, streams and oceans unite them from time immemorial, people crossed the oceans and achieved beach lines. Beach lines bear the cost of good daylight and sprinkling breeze. It is useful for sunbath and ocean shower that is the reason countless hotels are orchestrated in all pieces of the world. Beach line the travel industry satisfies all parts of the travel industry sun, ocean and sand. Beach line the travel industry uses the tasteful and ecological estimations of the beach line. It likewise joins water and land assets utilization. Water utilization involves swimming, surfing, cruising and other water sports. Land use exercises consolidate development of various kinds of convenience,

recreational zones, vehicle and transport leaving zones, excitement and shopping regions, streets and transportation systems..

Beaches might be characterized as the aggregation of materials along the beach, generally characterized as lying between the most astounding point come to by the tempest waves and the low water spring tide line. It is one of the results of the waterfront highlights of testimony and is the most predominant type of the valuable work of the ocean. Beaches might be characterized as the amassing of materials along the beach, typically characterized as lying between the most astounding point come to by the tempest waves and the low water spring tide line. It is the results of the beach highlights of statement and is the most prevailing type of the development work of the ocean. The beaches on the beach line of the southern promontory extend more than 7500 km. In this way we discover beaches both along the western and eastern bank of India. Anyway increasingly created beach lines, especially valuable for the travel industry are found along the western beach due to a more grounded wave activity there and a normal beach line. In this manner water sports is a customary element of the beaches on the western beach where as beaches along the eastern beach are progressively noted for their physical magnificence.

Kerala is honored with wonderful beach lines which are the most critical vacation spots. The state has around 550 km. long beach lines, studded with world's best series of beach lines. Very much kept up, conveniently kept and safely monitored, the beach lines of Kerala are transforming into a perfect beach line get-away goal in India. Visiting the beach line locales of Kerala can make any beach line occasion a brilliant one, as Kerala's beach lines are prestigious for the delicate surf and blue waters. Individuals from everywhere throughout the world has recognized, experienced and composed that water affects everyone's psyche and body and discharges the faculties and spirits of the individuals who look for comfort on its beaches.

5. BEACH TOURISM IN THIRUVANANTHAPURAM DISTRICT

Kerala beaches, with a rich blessing of characteristic attractions of changing significance, can definitely guarantee financial advancement as far as salary and work through the reasonable advancement of the travel industry action in the state. Having comprehended the enormous potential for beaches the travel industry improvement, it is essential to make an examination of statistics and appearance of vacationers to comprehend the developing patterns sought after for beaches the travel industry of the state.

5.1. Kovalam

Kovalam is a standout amongst the most wonderful and acclaimed beaches of Kerala. This shoreline encourages holidaying with the sun, sand, ocean and surf. Attributable to its normal excellence, the shoreline resort of Kovalam is regularly alluded to as the 'heaven of the south'. Kovalam implies a forest of coconut trees and really the coconut trees along the beaches gives it a charming look. The sickle formed beaches of Kovalam can be separated in three sections. The three beaches are called Lighthouse shoreline, Hawah shoreline and Samudra. Kovalam is a characteristic inlet on the Arabian ocean shoreline of Kerala and with its blue waters, while sand and green coconut trees resemble an image postcard picture of a tropical heaven. A visitor can appreciate numerous exercises on Kovalam beach line. They can swim in the ocean; go for a sailboat ride, go surfing, kayaking, windsurfing and parasailing. At the point when a traveler is burnt out on aquatics, swimming or sunbathing, they can investigate the painstaking work, goldsmiths and material shops spread along the waterfront. Great ocean sustenance's are accessible in the shoreline eatery, which was found very vicinity to the beaches. Kovalam shoreline is extremely prevalent with both Indian and universal voyagers. The sun, ocean, sand, cool coconut forests all were and still are an overpowering blend to top of the line voyagers from numerous pieces of the world, particularly Europe. September to May is the best time to visit Kovalam shoreline. We had no lack of business people who were eager to put their time, vitality and cash into upgrading Kovalam's charms as a prime beach line goal. Worked in the customary Kerala design style, the inn turned into a milestone on a scene covered with staid solid structures and set the pattern for the advancement of the region's travel industry foundation. From that point numerous different retreats created, which gives ayurvedic treatment too.

5.2. Shanghumugham

Situated 8 km. from Thiruvananthapuram city, this is a well known city shoreline and most loved frequent for sunset watchers. The beach is neighboring the Thiruvananthapuram Airport and Veli Tourist Village. The other fascination of this shoreline is 'MatsyaKanyaka' - a 35 meters in length model of a mermaid. The significant lot of clean sand is a captivating stunner of this Beach. The water here anyway isn't appropriate for bathing.

5.3. Somatheram

It is 20 km. far from Trivandrum city. This beach is called as a human's fantasy goal. This is celebrated for ayurvedic treatment focuses. A visitor can accomplish flawless bloom and harmony throughout everyday life and can restore brain and body in the shoreline. There is a 15 sections of land of green land in this beach.

5.4. Poovar

Poovar beach is a standout amongst the most beautiful shorelines in India. This beach is roughly a 45 minutes head out from Kovalam. Poovar shoreline has an alternate appeal as it offers unlimited miles of sand, charming the sunrays by influencing palms. Poovar shoreline is viewed as "a virgin area" where a traveler can encounter the nearby appeal and conventional Kerala's friendliness taking care of business.

5.5. Vizhinjam

This beach is only 15 km. from Trivandrum; which was left unnoticed for quite a while. One of the fundamental attractions of this shoreline is the stone cut sanctuaries that are worked in eighth century. This is an angling town and is a wonderful sight to see the anglers participating in different angling techniques, fixing their nets and so on. There is additionally a characteristic port here. In time long past occasions, this was considered as a business community for the Europeans and other remote nations that desired exchange to India.

5.6. Chowara

This is a virgin shoreline of Kerala and 9 km. south of the famous Kovalam Beach. This shoreline is the problem area for the nature and relaxation explorers. The shoreline is the all around flawless mix of nature where the traveler can appreciate rich the stunning greens, murmuring ocean breeze and the mumbling surf.

5.7. Veli

This beach is situated in Thiruvananthapuram area and close to Kochuveli railroad station. It is a wonderful shoreline with a recreation center close to the Veli vacationer town joins the Veli shoreline by a skimming span. There is a sand bar that different the ocean from the Veli Lake. It is a delight to go for a stroll through these sand bars. There is a skimming eatery that is offered by this shoreline. Individuals can go for watercraft rides and horse rides from this shoreline

5.8. Varkala

Varkala is a standout amongst the latest disclosures of sightseers and is 41 kms north of Thiruvananthapuram city. The shoreline, in any case, is just around 500 meters in length. Varkala is a beach resort, a spa and a vital Hindu focus of journey. A calm, separated stretch of sand, the Papanasam Beach in Varkala, is known for its mineral springs and rough bluffs. The multi year old Sree Janardhana Swamy Temple and the medicinal services focuses are alternate attractions here.

6. BEACH TOURISM – ECONOMIC CONCEPT

The travel industry arranging and advancement must be imagined with regards to the general improvement of the region, as it includes adjusting the convicting needs of numerous intrigue gatherings. An advancement plan must be incorporated with the nearby economy so its outcomes are unmistakable in the improvement of the material and social states of the general population. Such incorporation is essential in the travel industry improvement to guarantee the dynamic interest of the nearby individuals in the advancement of the travel industry and in the safeguarding of the sensitive nature of the locale so the travel industry isn't seen as a vital insidiousness. The travel industry area not just gives direct work and pays advantages to the significant partners yet in addition makes linkages which give comparable advancements to a large group of different segments and individuals. This is the reason governments incline toward areas with the most astounding inside linkages as the best choice for speculation.

Monetary effect investigation follows the movement and analyze secondary going through related with the travel industry movement in an area to distinguish changes in deals, charge incomes, salary and employments because of the tourism industry action. Monetary effect studies conducted in littler land regions typically focused exclusively on guests, that is, non-occupants entering the zone on an outing far from home Referring to the business and pay multiplier impacts of beaches the travel industry in Kerala, it is been seen that any use by the administration or the business in the part will make new interest for data sources and administrations prompting new factor salaries, and the spending of these wages by beneficiaries will fill in as the spring board for the prime round of multiplier impacts, and this procedure of working of the multiplier will proceed as long as beneficiaries of new pay spend their pay. Notwithstanding this impact of introductory interest in the travel industry by Government and industry, the immediate spending by vacationers amid their stay in the state will likewise make new interest for different products and enterprises, which will lead to another rush of pay/business age and multiplier impacts, as portrayed previously. Far beyond this, travel industry advancement

can likewise prompt the extension of maker's products industry, which will additionally quicken the procedure of development in the economy. It all, be that as it may, relies upon the dimension and example of traveler spending over the span of their visit and the amount of that spending or circles in the nearby economy.

8. METHODOLOGY

The study is descriptive in nature. The viewpoints of were beach tourism customers in Trivandrum were determined and analyzed using statistical techniques.

(a) Sample Size

The universe of the study was the beach tourism customers in Trivandrum district. The sample consisted of 60 respondents.

(b) Tools for Data Collection

The tool employed for data collection was a questionnaire having three parts: the first part designed to determine the demographic profile of the respondents in relation to the various demographic factors, the second to assess the satisfaction factors of beach tourists and the third, statements to evaluate the future development of Beach Tourism in Trivandrum.

(1) Primary Data

The primary data were collected through questionnaire from 60 respondents. Questionnaires and interview schedules were used for this.

(2) Secondary Data

The study also made use of various types of secondary data including studies, reports and data collected by government and non-governmental organizations.

C. Data Analysis - Tools

Statistical tools such as percentage, Mean score and Garrett Ranking Test were used for analyzing the data.

9. ANALYSIS AND INFERENCE

Table-1: Demographic Profile of the Beach Tourists

Demographic distribution		Number of Respondents	Percentage
Gender	Male	32	53.33%
	Female	28	46.67%
Total		60	100.00%
Age	Less than 25 years	17	28.33%
	26 – 35 years	15	25.00%
	36 – 45 years	11	18.33%
	45 – 60 years	8	13.33%
	Above 60 years	9	15.00%
Total		60	100.00%
Marital status	Single	27	45.00%
	Married	33	55.00%
Total		60	100.00%
Tourist Category	Domestic	21	35.00%
	Foreigner	39	65.00%
Total		60	100.00%
Occupation	Salaried	12	20.00%
	Business	18	30.00%
	Agriculture	16	26.67%
	Others	14	23.33%
Total		60	100.00%
Educational qualification	School	11	18.33%
	Intermediate	10	16.67%
	Higher secondary	11	18.33%
	Graduation	5	8.33%
	Post-graduation	8	13.33%
	Technically qualified	15	25.00%
Total		60	100.00%

Inference: Out of the 60 respondents about 53 percent of the tourists are men and rest belongs to female, 28 percent of the tourists are coming under the age group of below 25, 55 percent tourists are married, 65 percent of tourists are belongs to domestic and rest of the tourist are foreigners, 30 percent tourists are coming under the occupation of Business, 25 percent of tourists are educational qualification of Technical education.

Table No-2: Factors which Dictate the satisfactory level of Beach Tourism

Sl No.	Particulars	SA	A	N	D	SDA	Total Score	Mean Score
1	Food and Beverages	69	72	57	42	5	245	3.50
2	Accommodation	30	83	24	9	3	149	2.13
3	General Price Level	60	103	79	64	8	314	4.49
4	Boat Race	52	86	32	17	2	189	2.70
5	Safety Features	98	127	51	36	8	320	4.57
6	Natural Beauty	49	104	54	48	2	257	3.67
7	Health Treatment	91	200	21	15	5	332	4.74
8	Attitude of Local People	54	86	76	70	4	290	4.14
9	Leisure and Recreation	42	127	29	23	5	226	3.23
10	Cleanliness	61	69	48	42	4	224	3.20

Inference: The result obtained from 60 respondents had been thoroughly analysed and the output of the result had been clearly analysed in this section with regards to view point of beach tourists in regards to the factors which are directly affects the satisfaction level. As far as view point of tourists in connection with the satisfaction level, ‘Health Treatment’ and ‘Safety Features’ are the most considering factors. The least considering factors is ‘Accommodation’ and ‘Boat Race’.

Table No-3: Customer Perception towards Future Development of Beach Tourism

Major Factors	Total Score	Average	Rank
Economy of the State	2450	40.8	XII
Decrease in the Airline Charges	2940	49.0	X
Peaceful Nature of thte State	3290	54.8	VI
Level of Education	3065	51.1	VIII
Better living conditions	3395	56.6	IV
Feasible Tour Packages	3890	64.8	III
Overall Resources	4390	73.2	I
Innovative Policies of KTDC	3340	55.7	V
Advancement in Transportation	2775	46.3	XI
Govt. Policies	2995	49.9	IX
Environment Friendly Approach	4040	67.3	II
Advanced Computer Reservation	3245	54.1	VII

Inference: The scores provided by the respondents are summed using the Garrett method and the average scores for each factor are obtained. The average scores are converted into rank and it is evident from the above table ‘Overall Resources’ (Rank I) was the major satisfactory factor with the average score of 73.2 followed by ‘Environment Friendly Approach’ (Rank II) with the average score of 67.3. ‘Feasible Tour Packages’ (Rank III) which had an average score of 64.8 is the other factor which dictate the customer perception towards future development of Beach Tourism.

FINDINGS

- It is been found that the major issues discussed in them included the general trend in the growth of Indian tourism, the poor infrastructure and accommodation facilities.
- The study of the satisfaction levels exposed that both foreign and domestic tourists attributed their satisfaction to the Health treatment and safety features.
- An assessment of the tourists’ opined that overall resources and friendly approach are the basic factors which dictate the future development of beach tourism.
- It is been noted ecological impacts have significance for forecasting for the sustainable development of beach tourism in Kerala.

- The major sustainability issues of beach tourism in Kerala which were grouped as financial, ecological and socio-cultural.

SUGGESTIONS

- Integration of coastal tourism with coastal zone management is also suggested to minimise the conflicts between various coastal activities by harmonising the interests of the different sectors.
- Government should take necessary actions to attract more female tourists to Kerala.
- Reorganized tourism development is considered as an operative tool to avoid the over-exploitation of indigenous resources and to ensure the participation of resident community in beach tourism development.
- Public-private partnership (PPP) is considered to encourage infrastructure progress including development of accommodation, conveyance, location development, other facilities, etc.

CONCLUSION

Kerala is famous for its rich vegetation, peaceful and lovely beaches, rambling backwaters and staggering slope stations. This makes it an ideal spot to appreciate common magnificence that charms the eye and warms the heart. Maybe no other state in India has been honoured with characteristic assets as rich and enormous as that of Kerala. Kerala is known everywhere throughout the world for its captivating greenery, delightful atmosphere, customary prescriptions, craftsmanship and painstaking work. Kerala being the place where there is flavours is an ideal spot to have a reasonable sound, dietary and scrumptious sustenance notwithstanding for the non Keralites. Whatever a visitor needs the land offers the best. Kerala is one of the vital places of interest with all possibilities to pull in household and outside sightseers, yet it isn't completely investigated and used. In this circumstance the legislature should find a way to build up the foundation offices and make man-made attractions. Govt. should offer need to improve condition on beaches to keep its biological parity and should check ecological decay which can be adverse in drawing in the sightseers.

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A STUDY ON EMOTIONAL INTELLIGENCE AT WORK PLACE

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ABSTRACT

Emotional Intelligence (EI) must somehow combine two of the three states of mind cognition and affect, or intelligence and emotion. Emotional intelligence refers to the ability to perceive control, and evaluate emotions. Some researchers suggest that emotional intelligence can be learned and strengthened, while other claim it is an inborn characteristic. A number of testing instruments have been developed to measure emotional intelligence, although the content and approach of each test varies. If a worker has high emotional intelligence, he or she is more likely to be able to express his or her emotions in a healthy way, and understand the emotions of those he or she works with, thus enhancing work relationships and performance. Emotional Intelligence is not about being soft! It is a different way of being smart - having the skill to use his or her emotions to help them make choices in the moment and have more effective control over themselves and their impact on others. Emotional Intelligence allows us to think more creatively and to use our emotions to solve problems. Emotional Intelligence probably overlaps to some extent with general intelligence. The emotionally intelligent person is skilled in four areas: Identifying emotions, using emotions, understanding emotions, and regulating emotions.

Keywords: Emotional intelligence, employees, age, work, experience

INTRODUCTION

Emotions are involved in everything we do: every action, decision, and judgment. Emotionally intelligent people recognize this and use their thinking to manage their emotions rather than being managed by them. Just like the term 'coaching' which will be addressed different theories define Emotional intelligence in different ways. We agree with the definition offered by Sparrow and Knight in applied Emotional intelligence. Emotional intelligence is the habitual practice of:

- Using emotional information from ourselves and other peoples;
- Integrating this with our thinking;
- Using these to inform our decision making to help us get what we want from the immediate situation and from life in general.
- Emotional intelligence is using thinking about feeling (and feeling about thinking) to guide our behavior

This will lead to better management of ourselves and better relationships with others, The employees emotional intelligence at work place and to help in future why some employees are outstanding performers while others are not. Emotional Intelligence calls for recognizing and understanding of the issues in the organizations on the basis of the results organization can choose a strategy and actions to improve the performance of their employees.

EMOTIONAL INTELLIGENCE

To be successful requires effective awareness, control and management of your own emotions, and awareness and understanding of other people. Emotional intelligence therefore embraces two aspects of intelligence. understanding your goals yourself, intentions, response, behavior and all understanding others and other feelings.

In 1980's research into multiple intelligences, Howard Gardner describes these two aspects of intelligence as interpersonal intelligence being intelligent in picking up what is going on inside us and doing what we need to do about it; and intrapersonal intelligence - being intelligent in picking up what is going on in other people and between other people and doing what we need to do about it. Here is a case study demonstrating how a lack of self-management and relationship management can show itself in the workplace.

IMPROVING EMOTIONAL INTELLIGENCE

All attitudes can be changed if we want to change them, so all aspects of emotional intelligence can be developed and improved. There are five basic principles that form the foundation of emotional intelligence;

1. Emotional intelligence is not one single thing, but is made up of a mixture of attitudes, feelings and thoughts and the actions that result from them.
2. Emotional intelligence predicts and performance

3. Emotional intelligence can be measured, Emotional can be changed.

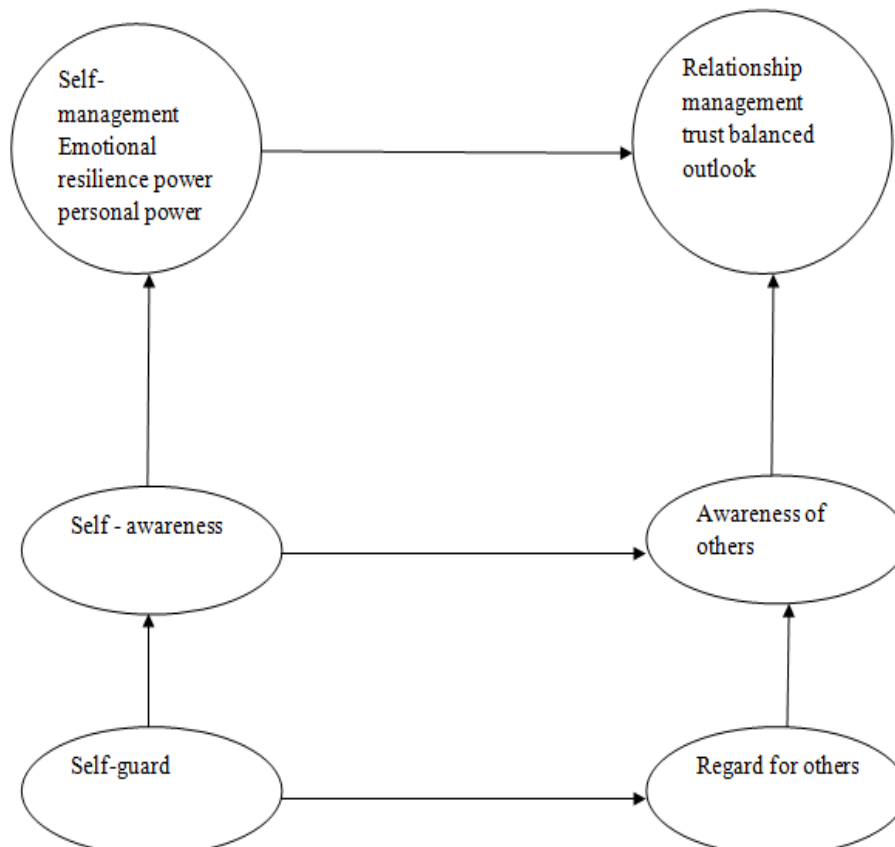
EMOTIONAL INTELLIGENCE AND WORK EXPERIENCE

The level of emotional intelligence was measured using Goleman scale, to find the understanding level of the questionnaire, reliability statistics was done. Deville's (1991) suggested that an acceptable level of reliability for psychometric test starts from .65 in this analysis most of the reliability value is above .65. The Cronbach's alpha value of the study is .884 (88.4%). In this study, the value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.798 (79.8%) which is adequate for proceeding with factor analysis. The total variance explained for the study is 65.539% by the 10 extracted components that are explained in detail to understand the determinants of employees' emotional intelligence at work place.

EMOTIONAL INTELLIGENCE AND ACADEMIC PERFORMANCE

Performance have produced mixed results. A study by Schulte et al. (1998) found that scores one self-report measure of emotional intelligence completed at the beginning of the academic year significantly predicted grade point average at the end of the year. In a study by Rozell, Petition,& Parker (2002), there was a small, but significant relationship between academic success, as measured by grade point average, and three out of the five factors within the utilized emotional intelligence scale utilizing the Goleman (1995, 1998) scale. Petrides, Frederickson, and Furnham (2004) looked at the relationships between trait emotional intelligence, academic performance, and cognitive ability in a sample of 650 British secondary education students (Grade 11). They found that emotional intelligence moderated the relationship between academic performance and cognitive ability. In a study conducted by Parker et al. (2004), various dimensions of emotional intelligence were found to be predictors of academic success. At the beginning of the semester, 372 first-year full-time students completed the short form of the Emotional Quotient Inventory (EQ-i:Short) at a small Ontario university. At the end of the academic year, data from this inventory was matched with the students' academic records and two levels of very different academic success were identified: highly successful students who achieved a first-year university grade point average of 80% or better and relatively unsuccessful students who received a first year grade point average of 59% or less. The results showed that the highly successful students scored higher than the unsuccessful group on three out of the four subsets (intrapersonal ability, stress management, and adaptability) of emotional intelligence as defined by the EQ-i:Short. The two groups did not score significantly different on interpersonal ability (Parker et al., 2004).

INTRAPERSONAL & INTERPERSONAL INTELLIGENCE ARE CONNECTED WITH EMOTIONAL INTELLIGENCE



INTERPERSONAL RELATIONSHIPS

Both participants' and friends' reports on the quality of interpersonal relationships were obtained using an abridged version of the Network of Relationships Inventory (NRI; Furman & Bushmaster, 1985; see also Furman, 1996). The full measure includes 30 items and yields three factor scores: positive interaction (social support), negative interaction (conflict), and power imbalance.

INTRAPERSONAL RELATIONSHIPS

Both self- and peer-reports on two dimensions of interpersonal competence (emotional support and conflict resolution) were obtained using the Adolescent Interpersonal Competence Questionnaire (AICQ; Bushmaster, Furman, Wittenberg, & Reis, 1988).

INITIATIVE OF THE EMPLOYEE

The American Heritage Dictionary defines initiative as "the power, ability, or instinct to begin or to follow through energetically with a plan or task; enterprise and determination". Initiative is the readiness to act and seize opportunities. Many employers look for initiative as a "must have" trait for every position they are attempting to staff. In addition, it is critical to demonstrate initiative to be promoted in an organization. Demonstrating initiative proved to be the most powerful work skills tool for bridging the chasm between the intelligent, average worker and the super productive, star worker. If an employee is starting out in a new workplace, they will quickly be judged on whether they will go beyond their specific responsibilities and take initiative to face the challenges.

EMOTIONAL COMPETENCE

Nowadays companies are facing an increasing stress of competition. They have to cope with shorter product lifecycles, rising customer demands, quicker technological developments and higher cost pressure. In order to create strategic competitive advantages, companies have to concentrate on their core competencies, which are significantly influenced by the skills and the knowledge of their employees. The main goal of business process management is to increase efficiency and effectiveness of companies by improving business processes and thus to increase the company value. For the employees, change implies continuous learning in order to tackle new challenges and tasks by competing with their emotions.

CONCLUSION

Emotional intelligence plays an important role for employees in the organization. This paper has made a better understanding about the various reasons for emotion and better control over the emotion. Handling emotions is an important requirement for a HR for himself and among the employees as well. This will help to increase organizational commitment, improve productivity, efficiency, retain best talent and motivate the employees to give their best. This study confirms that both emotional intelligence and work life balance together create organizational success and develop competitive advantage for organizations. Understanding the potential and the talent that the employees and ensure the difference that employees bring to the work place and value them to make it a part of the organizational success. The work place should be better so that the employees can have a better team work, find solutions for problem, enhanced job responsibility, group mission, challenges, routine work, self confidence among workers. Emotional intelligence will bring in better adaptability, empathy towards employee, leadership qualities, group rapport, participative management, decision making, and understanding among colleagues. Most of the organizations are nowadays taking those employees who are emotionally intelligent, so that they can face the workplace problems easily and they can become more productive for the organization. Emotionally intelligent organization can be made through organizational strategies, leadership skills, development programmers, self awareness and self management tools. The researcher from the study concludes that emotional intelligence is linked at every point of workplace performance and it is of utmost importance nowadays. Hence, to be successful in life Emotional intelligence plays a vital role.

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A STUDY ON PERCEPTION OF CUSTOMERS TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS IN MADURAI**S. Senthilkumar¹ and Dr. R. Kannan²**Research Scholar¹ and Professor², Centre for Tourism & Hotel Management, Madurai Kamaraj University, Madurai

ABSTRACT

Customer relationship management is progressively enveloping the wide range framework of generating and maintaining relations with customers, sales, satisfaction and profits. The existence and sustainability of business of star hotels are completely depending on the customer relationship management practices. The findings reveal that nearly two fifth of customers have moderate level of perception towards customer relationship management practices in star hotels. Significant difference prevails among perception of customers towards customer relationship management practices in star hotels and their profile. Perception of customers towards customer relationship management practices in star hotels has positive, moderate and significant relation with their satisfaction. To enhance customer relationship management practices in star hotels and satisfaction of customers, star hotel should make efforts to identify needs of customers and employees of star hotel must response to calls of customers immediately.

Keywords: Customer, Customer Relationship Management, Perception, Star Hotel

1. INTRODUCTION

The hotel industry in India is witnessing stiff competition, higher turnover of customers, increasing cost for acquisition of customers and ever growing demands from customers. The success, performance and competitiveness of hotels are highly relying on their capabilities to satisfy customers in the most efficient ways (Kasim and Minai, 2009). Customer relationship management is comprehensive strategy including generation, management and expansion of relationships with customers (Anderson and Kerr, 2001).

Customer relationship management is the proficient business approach to search and hold the most precious relations with customers (Adenbajo, 2003). Customer relationship management is progressively enveloping the wide range framework of generating and maintaining relations with customers, sales, satisfaction and profits (Peppers and Rogers (2004). Hence, to increase profits and satisfaction and loyalty of customers, hotels have to concentrate on adoption of practices of customer relationship management effectively that search, collect and store accurate information, authorize and share it across all functional areas of hotels (Goyal, 2011).

The main purpose of customer relationship management is making very good long term relations that make customers to revisit to hotels in future. Hotels do not have assurance that customers will come back again thus, they have to maintain better relations with customers through providing quality services along with sustainable benefits for them (Malonza and Lucy, 2016).

Out of different categories of hotels, star hotels are big and modern hotels emerged because of big business houses and new entrepreneurial activity in hotel industry. Star ratings are given to hotels on the basis of location, amenities, standards and infrastructural facilities. The existence and sustainability of business of star hotels are completely depending on the customer relationship management practices. Therefore, it is important to study perception of customers towards customer relationship management practices in star hotels in Madurai.

2. REVIEW OF LITERATURE

Wu and Li (2011) concluded that customer relationship management practices were the most efficient means to create and enlarge customer base and in turn it increased satisfaction and loyalty of guests for hotel. Kamau and Waudu (2012) revealed that customer relationship management practices in hotels were affecting satisfaction of customers and performance and profit of hotels.

Banga et al (2013) indicated that all the managers were aware and adopting customer relationship management practices in their hotels and practices of customer relationship management increased satisfaction and rate of retention of customers and it led to higher level of profitability. Mohammed et al (2014) showed that adoption of customer relationship management practices was positively influencing performance of hotels and those practices were highly useful to hotels to provide personalized services and unique experiences to their customers.

Chadha (2015) found that majority of the employees were having positive and favourable attitude towards customer relationship management practices. Maintaining data base for customers and counseling were

important activities carried out by hotel Taj. The customer relationship management practices were positively related with satisfaction and retention of customers towards hotel.

Al-Azzam (2016) concluded that dimensions of customer relationship management namely organization of customer relationship management, customer orientation, technology based customer relationship management and knowledge management were positively and significantly influencing performance of hotels. Madhovi and Dhliwayo (2017) revealed that customer relationship management practices had positive impact on satisfaction, loyalty of customers and market share and profitability of hotels.

3. OBJECTIVES OF THE STUDY

1. To study perception of customers towards customer relationship management practices in star hotels.
2. To scrutinize difference among profile of customers and their perception towards customer relationship management practices in star hotels.
3. To study relation among perception of customers towards customer relationship management practices in star hotels and their satisfaction.

4. HYPOTHESES OF THE STUDY

1. There is no significant difference among perception of customers towards customer relationship management practices in star hotels and their profile.
2. There is no significant relation among perception of customers towards customer relationship management practices in star hotels and their satisfaction.

5. METHODOLOGY

The present study is carried out in Madurai. The customers of star hotels are chosen by using random sampling method. The data are collected from 300 customers of star hotels through questionnaire method. Percentages are calculated to understand profile of customers and mean and standard deviation are worked out to study perception of customers towards customer relationship management practices in star hotels. The t-test and F-test are used to scrutinize difference among profile of customers and their perception towards customer relationship management practices in star hotels. The correlation analysis is carried out to examine relation among perception of customers towards customer relationship management practices in star hotels and their satisfaction.

6. RESULTS AND DISCUSSION

6.1. PROFILE OF CUSTOMERS OF STAR HOTELS

The profile of customers of star hotels is given in Table-1. The findings elucidate 58.67 per cent of customers of star hotels are males, whilst, 41.33 per cent of them are females and 33.00 per cent of customers of star hotels are falling under age category of 41 – 50 years, whilst, 16.00 per cent of them are falling under age category of 21 – 30 years.

The findings explicate 35.67 per cent of customers of star hotels are holding under graduation, whilst, 13.33 per cent of them are holding secondary education and 42.33 per cent of customers of star hotels are working in private sector, whilst, 24.00 per cent of them are working in Government sector. And 32.33 per cent of customers of star hotels are earning monthly income of Rs.40,001 – Rs.50,000, whilst, 17.33 per cent of them are having monthly income of Rs.20,001 – Rs.30,000.

Table-1: Profile of Customers of Star Hotels

Profile	Number of Customers	Percentage
Gender	300	
Male	176	58.67
Female	124	41.33
Age Category		
21 – 30 Years	48	16.00
31– 40 Years	93	31.00
41 – 50 Years	99	33.00
Above 50 Years	60	20.00
Education		
Secondary	40	13.33
Higher Secondary	59	19.67
Under Graduation	107	35.67

Post Graduation	94	31.33
Occupation		
Government Sector	72	24.00
Private Sector	127	42.33
Business	101	33.67
Monthly Income		
Rs.20,001 – Rs.30,000	52	17.33
Rs.30,001 – Rs.40,000	83	27.67
Rs.40,001 – Rs.50,000	97	32.33
Rs.50,001 – Rs.60,000	68	22.67

6.2. PERCEPTION OF CUSTOMERS TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The perception of customers towards customer relationship management practices in star hotels was examined and the results are given in Table-2.

Table-2: Perception of Customers towards Customer Relationship Management Practices in Star Hotels

Customer Relationship Management Practices in Star Hotels	Mean	Standard Deviation
Star hotel provides personalized services to customers	3.92	0.93
Star hotel puts efforts to identify needs of customers	3.30	0.80
Employees of star hotel are very keen to help customers	3.81	0.94
Employees of star hotels offer prompt service to customers	3.87	1.04
Employees of star hotel response very quickly to calls of customers	3.39	0.81
Star hotel maintains comprehensive data base of customers	3.96	0.88
Employees of star hotel behave decently with customers	3.76	0.85
Star hotel has professional approach for customers	3.79	1.05
Star hotel meets the requests of customers timely	3.88	1.01
Employees of star hotel address complaints of customers properly	3.36	1.03

The customers of star hotels are agreed with star hotel provides personalized services to customers, employees of star hotel are very keen to help customers, employees of star hotels offer prompt service to customers, star hotel maintains comprehensive data base of customers, employees of star hotel behave decently with customers, star hotel has professional approach for customers and star hotel meets the requests of customers timely, whilst, they are neutral with star hotel puts efforts to identify needs of customers, employees of star hotel response very quickly to calls of customers and employees of star hotel and employees of star hotel address complaints of customers properly.

6.3. PROFILE OF CUSTOMERS AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The distribution of customers on the basis of their perception towards customer relationship management practices in star hotels is given in Table-3. The perception towards customer relationship management practices in star hotels is segmented into low, moderate and high levels based on Mean ± SD. The mean and SD are 37.02 and 4.66 respectively.

Table-3: Distribution of Customers on the Basis of their Perception towards Customer Relationship Management Practices in Star Hotels

Level of Perception towards Customer Relationship Management Practices in Star Hotels	Number of Customers	Percentage
Low	77	25.67
Moderate	115	38.33
High	108	36.00
Total	300	100.00

Out of 300 customers of star hotels, 38.33 per cent of customers have moderate level of perception towards customer relationship management practices in star hotels then by high level (36.00 per cent) and low level (25.67 per cent).

6.3.1. GENDER AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The relation amongst gender of customers and perception towards customer relationship management practices in star hotels was examined and the results are given in Table-4.

Table-4: Gender and Perception towards Customer Relationship Management Practices in Star Hotels

Gender	Level of Perception towards Customer Relationship Management Practices in Star Hotels			Total	t-Value	Sig.
	Low	Moderate	High			
Male	45 (25.57)	59 (33.52)	72 (40.91)	176 (58.67)	5.084	.000
Female	32 (25.81)	56 (45.16)	36 (29.03)	124 (41.33)		
Total	77 (25.67)	115 (38.33)	108 (36.00)	300 (100.00)	-	-

(The figures in the parentheses are per cent to total)

Out of 176 male customers, 40.91 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 25.57 per cent of them have low level of it. Out of 124 female customers, 29.03 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 25.81 per cent of them have low level of it.

The t-value of 5.084 is disclosing significant difference is there in perception towards customer relationship management practices in star hotels among gender of customers at one per cent level. So, the null hypothesis is not accepted.

6.3.2. AGE CATEGORY AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The relation amongst age category of customers and perception towards customer relationship management practices in star hotels was examined and the results are given in Table-5.

Table-5: Age Category and Perception towards Customer Relationship Management Practices in Star Hotels

Age Category	Level of Perception towards Customer Relationship Management Practices in Star Hotels			Total	F-Value	Sig.
	Low	Moderate	High			
21 – 30 Years	19 (39.58)	23 (47.92)	6 (12.50)	48 (16.00)	7.688	.000
31– 40 Years	23 (24.73)	25 (26.88)	45 (48.39)	93 (31.00)		
41 – 50 Years	23 (23.23)	36 (36.36)	40 (40.41)	99 (33.00)		
Above 50 Years	12 (20.00)	31 (51.67)	17 (28.33)	60 (20.00)		
Total	77 (25.67)	115 (38.33)	108 (36.00)	300 (100.00)	-	-

(The figures in the parentheses are per cent to total)

Out of 48 customers falling under age category of 21 – 30 years, 12.50 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 39.58 per cent of them have low level of it. Out of 93 customers falling under age category of 31 – 40 years, 48.39 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 24.73 per cent of them have low level of it.

Out of 99 customers falling under age category of 41 – 50 years, 40.41 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 23.23 per cent of them have low level of it. Out of 60 customers falling under age category of above 50 years, 28.33 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 20.00 per cent of them have low level of it.

The F-value of 7.688 is disclosing significant difference is there in perception towards customer relationship management practices in star hotels among age category of customers at one per cent level. So, the null hypothesis is not accepted.

6.3.3. EDUCATION AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The relation amongst education of customers and perception towards customer relationship management practices in star hotels was examined and the results are given in Table-6.

Table-6: Education and Perception towards Customer Relationship Management Practices in Star Hotels

Education	Level of Perception towards Customer Relationship Management Practices in Star Hotels			Total	F-Value	Sig.
	Low	Moderate	High			
Secondary	8 (20.00)	11 (27.50)	21 (52.50)	40 (13.33)	6.410	.000
Higher Secondary	14 (23.73)	19 (32.20)	26 (44.07)	59 (19.67)		
Under Graduation	25 (23.37)	44 (41.12)	38 (35.51)	107 (35.67)		
Post Graduation	30 (31.91)	41 (43.62)	23 (24.47)	94 (31.33)		
Total	77 (25.67)	115 (38.33)	108 (36.00)	300 (100.00)	-	-

(The figures in the parentheses are per cent to total)

Out of 40 customers holding secondary education, 52.50 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 20.00 per cent of them have low level of it. Out of 59 customers holding higher secondary education, 44.07 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 23.73 per cent of them have low level of it.

Out of 107 customers holding under graduation, 35.51 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 23.37 per cent of them have low level of it. Out of 94 customers holding post graduation, 24.47 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 31.91 per cent of them have low level of it.

The F-value of 6.410 is disclosing significant difference is there in perception towards customer relationship management practices in star hotels among education of customers at one per cent level. So, the null hypothesis is not accepted.

6.3.4. OCCUPATION AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The relation amongst occupation of customers and perception towards customer relationship management practices in star hotels was examined and the results are given in Table-7.

Table-7: Occupation and Perception towards Customer Relationship Management Practices in Star Hotels

Occupation	Level of Perception towards Customer Relationship Management Practices in Star Hotels			Total	F-Value	Sig.
	Low	Moderate	High			
Government Sector	19 (26.39)	23 (31.94)	30 (41.67)	72 (24.00)	7.312	.000
Private Sector	29 (22.83)	48 (37.80)	50 (39.37)	127 (42.33)		
Business	29 (28.71)	44 (43.57)	28 (27.72)	101 (33.67)		
Total	77 (25.67)	115 (38.33)	108 (36.00)	300 (100.00)	-	-

(The figures in the parentheses are per cent to total)

Out of 72 customers working in Government sector, 41.67 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 26.39 per cent of them have low level of it. Out of 127 customers working in private sector, 39.37 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 22.83 per cent of them have low level of it. Out of 101 customers doing business, 27.72 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 28.71 per cent of them have low level of it.

The F-value of 7.312 is disclosing significant difference is there in perception towards customer relationship management practices in star hotels among occupation of customers at one per cent level. So, the null hypothesis is not accepted.

6.3.5. MONTHLY INCOME AND PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS

The relation amongst monthly income of customers and perception towards customer relationship management practices in star hotels was examined and the results are given in Table-8.

Table-8: Monthly Income and Perception towards Customer Relationship Management Practices in Star Hotels

Monthly Income	Level of Perception towards Customer Relationship Management Practices in Star Hotels			Total	F-Value	Sig.
	Low	Moderate	High			
Rs.20,001 – Rs.30,000	16 (30.77)	22 (42.31)	14 (20.92)	52 (17.33)	8.758	.000
Rs.30,001 – Rs.40,000	23 (27.71)	32 (38.55)	28 (33.74)	83 (27.67)		
Rs.40,001 – Rs.50,000	21 (21.65)	40 (41.24)	36 (37.11)	97 (32.33)		
Rs.50,001 – Rs.60,000	17 (25.00)	21 (30.88)	30 (44.12)	68 (22.67)		
Total	77 (25.67)	115 (38.33)	108 (36.00)	300 (100.00)	-	-

(The figures in the parentheses are per cent to total)

Out of 52 customers earning monthly income of Rs.20,001 – Rs.30,000, 20.92 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 30.77 per cent of them have low level of it. Out of 83 customers earning monthly income of Rs.30,001 – Rs.40,000, 33.74 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 27.71 per cent of them have low level of it.

Out of 97 customers earning monthly income of Rs.40,001 – Rs.50,000, 37.11 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 21.65 per cent of them have low level of it. Out of 68 customers earning monthly income of Rs.50,001 – Rs.60,000, 44.12 per cent of them have high level of perception towards customer relationship management practices in star hotels, whilst, 25.00 per cent of them have low level of it.

The F-value of 8.758 is disclosing significant difference is there in perception towards customer relationship management practices in star hotels among monthly income of customers at one per cent level. So, the null hypothesis is not accepted.

6.4. RELATION AMONG PERCEPTION TOWARDS CUSTOMER RELATIONSHIP MANAGEMENT PRACTICES IN STAR HOTELS AND SATISFACTION OF CUSTOMERS

The relation among perception towards customer relationship management practices in star hotels and satisfaction of customers was examined through correlation analysis and the results are given in Table-9.

Table-9: Relation among Perception towards Customer Relationship Management Practices in Star Hotels and Satisfaction of Customers

Particulars	Correlation Co-efficient
Perception towards Customer Relationship Management Practices in Star Hotels and Satisfaction of Customers	0.57**

(** indicates significant at one per cent level)

The results demonstrate the correlation coefficient between perception towards customer relationship management practices in star hotels and satisfaction of customers is 0.57, it is positively and moderately related with each other at one per cent level of significance. So, the null hypothesis is not accepted.

7. CONCLUSION

The above findings disclose that nearly two fifth of customers have moderate level of perception towards customer relationship management practices in star hotels. Significant difference prevails among perception of customers towards customer relationship management practices in star hotels and their profile. Perception of customers towards customer relationship management practices in star hotels has positive, moderate and significant relation with their satisfaction. To enhance customer relationship management practices in star hotels and satisfaction of customers, star hotel should make efforts to identify needs of customers and employees of star hotel must response to calls of customers immediately. Moreover, employees of star hotel should address complaints of customers properly and efficiently.

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A STUDY ON PERCEPTION OF ENTREPRENEURS ON ENTREPRENEURSHIP DEVELOPMENT AND EMPLOYMENT GENERATION IN MADURAI DISTRICT**Dr. R. Ganapathi**Assistant Professor, Department of Commerce, Directorate of Distance Education, Alagappa University, Karaikudi

ABSTRACT

The development of entrepreneurship and creation of employment are continuously getting high degree of attention among all states and districts in India because it reduces problem of unemployment and poverty and enhances economic growth. Significant difference is prevailing in perception of entrepreneurs on entrepreneurship development among profile of entrepreneurs. Perception of entrepreneurs on entrepreneurship development has positive, high and significant relation with their perception on employment generation. To enhance entrepreneurship development, micro credits should be given adequately to entrepreneurs and Government must enact and execute business friendly rules and regulations for developing entrepreneurship. Besides, Government should ensure rights of labour in developing entrepreneurship and it must give tax benefits to starting all kinds of new entrepreneurial activities. Furthermore, entrepreneurship development should generate adequate number of employment through efficient vertical and horizontal extension of entrepreneurial activities and it must give more concentration on creating employment opportunities in trading business.

Keywords: Entrepreneurs, Entrepreneurship Development, Employment Generation

1. INTRODUCTION

The social and economic development of any nation is highly depending on vibrant and strong development of entrepreneurship capabilities (Onyebueke and Ochongo, 2002). Entrepreneurship development is the continuous procedure to amalgamate all kinds of entrepreneurial qualities namely hard work, flexibility, self-confidence, diligence, self-determination, versatility, initiatives, leadership, innovations, perspectives, commitment, creativity and profit orientation (Amit, 2014). Entrepreneurship development assists in starting new industrial enterprises and simultaneously it also helps to increase industrial production (Carland and Carland, 2004).

Entrepreneurship development also facilitate efficient utilization of scarce and limited resources and trigger the growth of industrial units that are very essential for development of economy, creation of jobs and reduction of poverty. As soon as new entrepreneurial activities are initiated, they increase production capabilities, opportunities for employment and it helps for regional and national development (Jindal and Bhardwaj, 2016). The development of entrepreneurship and creation of employment are continuously getting high degree of attention among all states and districts in India because it reduces problem of unemployment and poverty and enhances economic growth. Hence, it is important to study perception of entrepreneurs on entrepreneurship development and employment generation in Madurai district.

2. REVIEW OF LITERATURE

Adam et al (2011) found that employment development programmes assisted for development of entrepreneurship and it was positively related with generation of employment for youngsters. Sorokhaibam and Thaimai (2012) concluded that entrepreneurship development had increased employment opportunities, but it showed fluctuations in Assam over the time periods and it was very low in Manipur because of poor execution of entrepreneurship development programmes.

Sackey et al (2013) revealed that significant relation was there among entrepreneurship training and use of financial resources and entrepreneurship development and also significant relation exist among entrepreneurship an generation of employment in informal and formal sectors. Baba et al (2014) indicated that programmes for small enterprises helped development of entrepreneurship through enhancing skills and knowledge on entrepreneurship and it generated considerable amount of employment for rural people.

Ugoani and Ibeenwo (2015) showed that programmes for development of entrepreneurial activities generated considerable amount of employment and entrepreneurship development had positive, very high and significant association with generation of employment. Gaudel (2016) found that entrepreneurship development generated considerable quantum of employment and both were significantly and positively related. Number of entrepreneurship activities, amount of capital investment, policy for industrial development and infrastructural facilities were determining generation of employment.

Sheila and Arinze (2017) revealed that development of entrepreneurship created employment and both were positively related with each other and also it in turn enhanced standard of living of people. Uju and Racheal (2018) concluded that successful development of entrepreneurship decreased issue of unemployment, at the same time, lack of skills, financial assistance, trainings and networking were affecting development of entrepreneurship.

3. OBJECTIVES OF THE STUDY

1. To examine perception of entrepreneurs on entrepreneurship development and employment generation.
2. To scrutinize difference among profile of entrepreneurs and their perception on entrepreneurship development.
3. To study relation among perception of entrepreneurs on entrepreneurship development and employment generation.

4. HYPOTHESES OF THE STUDY

1. There is no significant difference in perception of entrepreneurs on entrepreneurship development among their profile.
2. There is no significant relation among perception of entrepreneurs on entrepreneurship development and employment generation.

5. METHODOLOGY

The present study is conducted in Madurai district. Entrepreneurs are chosen through simple random sampling method and structured questionnaire is used to collect data from 320 entrepreneurs. Percentages are worked out to understand profile of entrepreneurs and mean and standard deviation are calculated to know perception of entrepreneurs on entrepreneurship development and employment generation. t-test and F-test are done to scrutinize difference among profile of entrepreneurs and their perception on entrepreneurship development. Simple correlation analysis is carried out to study relation among perception of entrepreneurs on entrepreneurship development and employment generation.

6. RESULTS AND DISCUSSION

6.1. PROFILE OF ENTREPRENEURS

The profile of entrepreneurs is given in Table-1. The findings clarify that 62.81 per cent of entrepreneurs are males, while, 37.19 per cent of them are females and 28.13 per cent of them are falling under age category of 36 – 40 years, while, 7.81 per cent of them are falling under age category of less than 25 years. The findings explicate that 33.44 per cent of them are possessing under graduation while, 11.25 per cent of them are possessing secondary education and 36.56 per cent of them are doing entrepreneurial activities related to manufacturing, while, 30.63 per cent of them are doing entrepreneurial activities related to service. The findings display that 35.94 per cent of them are bearing 9 – 12 years of experience in entrepreneurial activities, while, 12.81 per cent of them are bearing below four years of experience in entrepreneurial activities and 34.37 per cent of them are having annual turn over of Rs. 10,00,001– Rs. 20,00,000, while, 17.19 per cent of them are having annual turn over of more than Rs. 30,000,00.

Table-1: Profile of Entrepreneurs

Profile	Number of Entrepreneurs	Percentage
Gender		
Male	201	62.81
Female	119	37.19
Age Category		
Less than 25 years	25	7.81
26 – 30 years	73	22.81
31 – 35 years	85	26.56
36 – 40 years	90	28.13
More than 40 years	47	14.69
Education		
Secondary	36	11.25
Higher Secondary	45	14.06
Diploma	61	19.06
Under Graduation	107	33.44
Post Graduation	71	22.19

Kind of Entrepreneurship		
Manufacturing	117	36.56
Trading	105	32.81
Service	98	30.63
Experience		
Below 4 years	41	12.81
5 – 8 years	101	31.56
9 – 12 years	115	35.94
Above 12 years	63	19.69
Annual Turn Over		
Less than Rs. 10,00,000	60	18.75
Rs. 10,00,001– Rs. 20,00,000	110	34.37
Rs.20,00,001– Rs. 30,00,000	95	29.69
More than Rs. 30,000,00	55	17.19

6.2. PERCEPTION OF ENTREPRENEURS ON ENTREPRENEURSHIP DEVELOPMENT

The perception of entrepreneurs on entrepreneurship development was studied and the results are given in Table-2.

Table-2: Perception of Entrepreneurs on Entrepreneurship Development

Perception on Entrepreneurship Development	Mean	Standard Deviation
Industrial houses and Government give very clear information for development of entrepreneurship	3.92	0.93
Government gives sufficient financial support for development of entrepreneurship	3.85	0.99
Training organizations provide enough trainings to enhance abilities and skills of entrepreneurs	3.95	0.91
Micro credits are given to entrepreneurs adequately	3.33	1.08
Government provides all type of infrastructural facilities for development of entrepreneurship	3.90	1.02
Government has business friendly rules and regulations for developing entrepreneurship	3.37	1.03
Networking encourages development of entrepreneurship	3.88	1.01
Government assures rights of labour in developing entrepreneurship	3.35	1.07
Industrial environment is conducive for entrepreneurship development	3.82	1.09
Tax benefits are given to starting all kinds of new entrepreneurial activities	3.30	1.13

The entrepreneurs are agreed with industrial houses and Government give very clear information for development of entrepreneurship, Government gives sufficient financial support for development of entrepreneurship, training organizations provide enough trainings to enhance abilities and skills of entrepreneurs, Government provides all type of infrastructural facilities for development of entrepreneurship, networking encourages development of entrepreneurship and industrial environment is conducive for entrepreneurship development, while, they are neutral with micro credits are given to entrepreneurs adequately, Government has business friendly rules and regulations for developing entrepreneurship, Government assures rights of labour in developing entrepreneurship and tax benefits are given to starting all kinds of new entrepreneurial activities

6.3. PROFILE OF ENTREPRENEURS AND THEIR PERCEPTION ON ENTREPRENEURSHIP DEVELOPMENT

To scrutinize difference among profile of entrepreneurs and their perception on entrepreneurship development, t-test and ANOVA (Analysis of Variance) test are used and the results are given in Table-3.

Table-3: Difference among Profile of Entrepreneurs and their Perception on Entrepreneurship Development

Particulars	t-Value / F-Value	Sig.
Gender and Entrepreneurship Development	5.748 ^{**} (t-value)	.000
Age Category and Entrepreneurship Development	9.590 ^{**} (F-value)	.000
Education and Entrepreneurship Development	10.165 ^{**} (F-value)	.000
Kind of Entrepreneurship and Entrepreneurship Development	7.926 ^{**} (F-value)	.000
Experience and Entrepreneurship Development	8.832 ^{**} (F-value)	.000
Annual Turn Over and Entrepreneurship Development	9.574 ^{**} (F-value)	.000

^{**} Significant at 1 % level

The t-value and F-values are demonstrating significant difference exists in perception on entrepreneurship development among profile of entrepreneurs at one per cent level. As an outcome, the null hypothesis is not accepted.

6.4. PERCEPTION OF ENTREPRENEURS ON EMPLOYMENT GENERATION

The perception of entrepreneurs on employment generation was studied and the results are given in Table-4.

Table-4: Perception of Entrepreneurs on Employment Generation

Perception on Employment Generation	Mean	Standard Deviation
Entrepreneurship development provides employment for skilled persons	3.89	1.01
Entrepreneurship development gives employment for unskilled persons	3.77	1.09
Entrepreneurship development generates more number of employment in manufacturing activities	3.80	0.97
Entrepreneurship development creates more number of employment in service activities	3.74	1.04
Entrepreneurship development gives more number of employment in trading activities	3.38	1.11

The entrepreneurs are agreed with entrepreneurship development provides employment for skilled persons, entrepreneurship development gives employment for unskilled persons, entrepreneurship development generates more number of employment in manufacturing activities and entrepreneurship development creates more number of employment in service activities, while, they are neutral with entrepreneurship development gives more number of employment in trading activities.

6.5. RELATION AMONG PERCEPTION OF ENTREPRENEURS ON ENTREPRENEURSHIP DEVELOPMENT AND EMPLOYMENT GENERATION

The relation among perception of entrepreneurs on entrepreneurship development and employment generation was studied by using correlation analysis and the results are given in Table-5.

Table-5: Relation among Perception of Entrepreneurs on Entrepreneurship Development and Employment Generation

Particulars	Correlation Co-efficient
Entrepreneurship Development and Employment Generation	0.66 ^{**}

^{**} Significant at one per cent level

The correlation co-efficient among perception of entrepreneurs on entrepreneurship development and employment generation is 0.66 and it explains that both are positively and highly related at one per cent level of significance. As a result, the null hypothesis is not accepted.

7. CONCLUSION

The above findings elucidate that significant difference is prevailing in perception of entrepreneurs on entrepreneurship development among profile of entrepreneurs. Perception of entrepreneurs on entrepreneurship development has positive, high and significant relation with their perception on employment generation. To enhance entrepreneurship development, micro credits should be given adequately to entrepreneurs and Government must enact and execute business friendly rules and regulations for developing entrepreneurship. Besides, Government should ensure rights of labour in developing entrepreneurship and it must give tax benefits to starting all kinds of new entrepreneurial activities. Furthermore, entrepreneurship development should generate adequate number of employment through efficient vertical and horizontal extension of entrepreneurial activities and it must give more concentration on creating employment opportunities in trading business.

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ANTICANCER ACTIVITIES OF CATHARANTHUS ROSEUS AND AZADIRACHTA INDICA: AN OVERVIEW

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ABSTRACT

There has been a long history of traditional medicine for serving living being all over the world. In the last few decades there has been an exponential growth in the field of herbal medicine in developing as well as in developed countries, because of their natural origin and minimum side effects. India is an agriculture based country crowned with numerous herbs and plants, the largest producer of medicinal herbs consequently called as botanical garden of the world. The phytochemicals present in the medicinal plants are vitamins, carotenoids, terpenoids, flavonoids, polyphenols, alkaloids, tannins, saponins, enzymes, minerals and many others. These phytochemicals possess antioxidant activities, which can be used in the treatment of many diseases, especially cancer. There are the several medicinal plants and herbs those have been utilizing traditionally for the prevention and treatment of cancer for the many decades. In the present communication efforts have been to overview the potential of Catharanthus roseus and Azadirachta indica in curing different types of carcinomas.

Keywords: Anticancer activity, Azadirachta indica, Cancer, Catharanthus roseus, Medicinal plants,

INTRODUCTION

Cancer is a one of the major public health problem throughout the world and only modest progress has been made in reducing the morbidity and mortality of this disease (Bhanot et. al. 2011). Every year, millions of people are diagnosed with cancer and reported to among the leading cause of death globally (Lawania and Mishra, 2013; Nigam and Rana, 2016). In its report, Indian Council of Medical Research (ICMR) reported that in 2016 the total number of new cancer cases is expected to be around 14.5 lakh and it may likely to reach nearly 17.3 lakh new cases in 2020. Over 7.36 lakh people are expected to succumb to the disease in 2016, while the figure is estimated to shoot up to 8.8 lakh by 2020. Data also revealed that only 12.5 per cent of patients come for treatment in early stages of the disease. According to report, among females, breast cancer topped the list and among males, mouth cancer is more prominent. ([http://www.midday.com/articles/over17 lakhs new cancer cases in India by 2020](http://www.midday.com/articles/over17_lakhs_new_cancer_cases_in_india_by_2020) ICMR; Khan et. al 2015; Safarzadeh et. al. 2014). Cancer is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells, which begins with mutation in DNA, which instruct the cells how to grow and divide. Normal cells have the ability to repair most of the mutations in the DNA. However, certain mutations which are not repaired, causing the cells to grow and becomes cancerous (Dixit and Ali 2010). If the spread is not controlled, it can result in death. Cancer is caused by both external factors, such as tobacco, infectious organisms, an unhealthy diet and internal factors, such as inherited genetic mutations, hormones, immune conditions. The environmental factors include smoking (active and passive tobacco smoking), exposures to toxic chemicals, different types of radiations at home and work places, toxic chemicals thorough our food as well as drinking water and pollution in air (Balchandran et al., 2005 Quazi and Molvi 2014). These factors may act together or in sequence to cause cancer. Ten or more years often pass between exposure to external factors and detectable cancer. Today human beings are suffering from numerous types of cancers such as cancer of blood, skin cancers, cancer of digestive system, cancers of urinary system, cancers specially related to women and many others (Paul et. al. 2011; Higgins and Baelga 2011, Sadeghnia et. al. 2014). Cancer continues to be a mysterious challenge for cancer biologists and medical practitioners. Several tantalizing claims for discovering a sure cure for cancer have been made by scientific community from time to time. However, a trustworthy cure against most of the cancer is still a challenge even nowadays. One of the key reasons for this is the multiple pathways of their survival adopted by the cancer cells. Blockings of few pathways of their survivals do not ensure their targeted eliminations. Complete removal of the cancer without damage of the rest part of the body is goal of the treatment. This can be achieved by the surgery, chemotherapy, radiation therapy and many other methods. Now-a-days solids tumors are surgically removed and patients received adjuvant radiation treatment and chemotherapy (American Cancer Society. Cancer Facts & Figures 2016, Atlanta: American Cancer Society; 2016). However these methods are tedious, costly and also lead to several side effects which ultimately change the quality of life. Furthermore, the toxicity of some treatments restricts their uses and effectiveness.

Nature bestowed large number of plants and herbs. The traditional systems of medicines - Ayurveda, Siddha and Unani are based on the experiences in the use of plant products in amelioration of common diseases. Majority of our population, particularly those living in villages depend largely on herbal remedies (Gupta,

1994). Traditionally medicinal plants have been in routine use in the treatment of several human diseases. This property is mainly due to the presence of phytochemicals which are classified as primary and secondary compounds. Chlorophyll, proteins and common sugars belong to primary compounds whereas terpenoids, alkaloids, cardiac glycosides and phenolic compounds fall under secondary compounds (Krishnaiah et. al. 2005). Alkaloids, coumarins, terpenoids and phenolic compounds, exhibit various important pharmacological properties i.e., anesthetic, anti-inflammatory, anticancer, anti-malarial, anti-viral and anti-bacterial properties (Mahato and Sen 1997; Thingujam et. al. 2015). According to World Health Organization (WHO) approximately 21,000 plants, are used for medicinal purposes around the world and among these 2500 species are richly found in India, out of which 150 species are used commercially on a fairly large scale. They are also promising source of anticancerous drugs with less side effect and lower cost. In present communication efforts have been made to overview the anti-cancerous properties of the phytochemical constituents of *Catharanthus roseus* and *Azadirachta indica*.

Catharanthus roseus

Catharanthus roseus is an evergreen herbaceous plant belongs to family Apocynaceae growing up to the height of one meter. It is largely grown in many tropical and sub-tropical region of the world. It is also cultivated as an ornamental plant in house garden domestically. The flower of this plant is from white to dark pink with dark red centre. *Catharanthus roseus* was investigated from the ancient time for phytochemical components and their therapeutic effect from different parts of the plant root, stem, leaves and flower are used in curing of different disease for long time. For example juice of leaves is used in treating indigestion and dyspepsia, decoction of flower is used in asthma, tuberculosis, extract of boiled plant is used to arrest bleeding. Apart from these crude leaf extracts and root has also been reported to have anticancer activity. Alkaloids are the major phytochemical constituent of the *Catharanthus roseus*. The alkaloids vinblastine and vincristine derived from stem and leaf of *Catharanthus roseus* reported for anticancer activity (chemical structures are illustrated in figure-1; Banskota, 2002; Wang et. al. 2004; Kaur 2011; Sandeep et. al. 2014, Aruna et. al. 2015; Das, 2017). These indole alkaloids have reported to have growth inhibition effects to human tumors. Vinblastine and vincristine are primarily used in combination with cancer chemotherapeutic drugs for the treatment of a various cancers such as lymphomas, leukemias, testicular cancer, breast cancer, Kaposi's sarcoma, chorio sarcoma etc. (Cragg and Newman 2005, Mohan et. al. 2012, Almagro et. a.; 2015). Methanolic crude extract has been reported to show the anticancer activity against many cell types in in-vitro condition especially found mark-ably active against multi drug resistance tumor types.

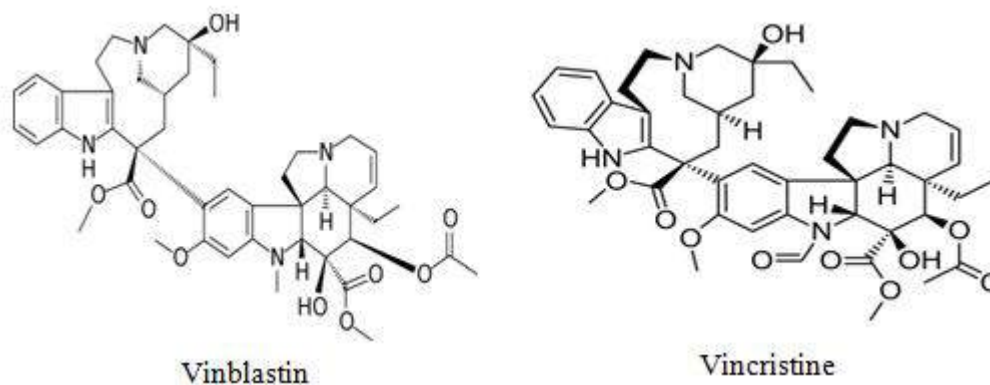


Fig-1: Chemical Structures of Vinblastin and Vincristine

Azadirachta indica

Azadirachta indica (Neem) is tropical evergreen tree belongs to family Meliaceae. The plant is abundantly available in all parts of India. Neem is the wonder tree and nature's drug store. Neem is among highly exploited medicinal plant of Indian origin. Due to its enormous domestic, agricultural, ethano medicinal and therapeutic significance, the Neem is also called village pharmacy (Biswas et. al. 2002). It is a fast growing plant and about 20 feet tall tree with a highly branched and stout solid stem. The extract of different parts of this plant has been used for several skin problems (Paul et. al. 2011). Numerous chemical compounds have been isolated and purified from this plant and are being used effectively as antiviral, antifungal, anti-inflammatory, anticancer agent and many others (Biswas et.al. 2002, Rao et al 1986; Khalid et.al. 1989). The compounds have been classified into two major groups; isoterpenoids and non-isoterpenoids. The isoterpenoid includes diterpenoids, triterpenoids, limonoids etc. The non-isoterpenoid includes proteins, polysaccharides, polyphenolic coumarin, aliphatic compound etc. (Subapriya and Nagini 2005). Different medicinal properties of neem leaves was reviewed by Sabapriya et al. Quercetin and kaemferol, the flavonoids present in neem leaf have been reported to

retard carcinogenesis at early and promotional phases of carcinogenesis by their radical scavenging characteristics (chemical structures are illustrated in figure-2, Shareef, 2018). Quercetin has been demonstrated to inhibit the growth of tumor cells in a number of malignant cell lines. The antioxidant activities of the root bark extract from the neem tree using the 1, 1-diphenyl-2-picryl hydrozyl (DPPH) scavenging assay was studied. Hydro-alcoholic extract of root bark of neem had antioxidant activity against DPPH radical and had significant antioxidant potential. Phytochemical screening by chemical tests and thin layer chromatography (TLC) showed that the root bark hydro-alcoholic extract have flavonoid quercetin (Kiranmai et. al. 2011, Pandey et. al. 2014). Studies reveal that pretreatment with neem is highly protective against cancer in animals. Neem leaf given to mice reduced chemically induced tumors up to significant levels and strengthening the impact on the immune system (Kiranmai et. al. 2011, Dixit and Ali 2010).

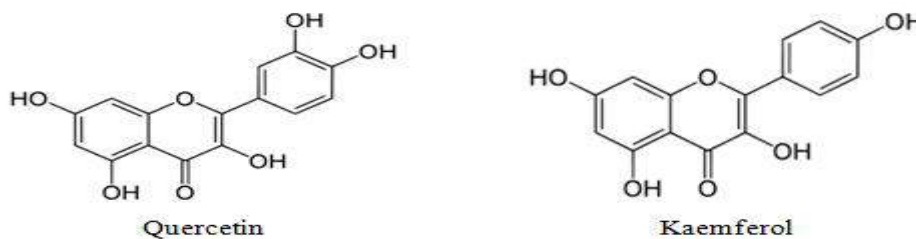


Fig-2. Chemical structures of Quercetin and kaemferol

CONCLUSION

Medicinal plants maintain the health and vitality of individual and also cure various diseases including cancer without causing toxicity. Natural products discovered from medicinal plants have played an important role in treatment of cancer. In the present article efforts have been made to overview the anti-cancerous properties of *Catharanthus roseus* and *Azadirachta indica*. The study revealed that compounds vinblastin and vincristine of *Catharanthus roseus* whereas Quercetin and kaemferol of *Azadirachta indica* are effective against various types cancer. These informations can be used to find out these constituents in other plants and herbs by simple technique like TLC to increase the stock and availability of herbal treatment where these plants are not found.

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**DIFFUSION OF SYSTEM OF RICE INTENSIFICATION (SRI) ACROSS TIRUNELVELI DISTRICT
IN TAMIL NADU**

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ABSTRACT

Rice is an important ingredient of household food basket, yet the yield level has been low and uncertain in India. The operational holding-size is shrinking, and land and water resources are being degraded. And therefore, some innovative rice production practice is needed to meet its growing demand due to population pressure. Under this scenario, the System of Rice Intensification (SRI) may be an appropriate practice to produce more food with less input. SRI is actually an amalgamation of refined and intensive management practices for rice production at farmers' fields. The conservation of land, water and biodiversity, and utilization of the hitherto ignored biological power of plant and solar energy, is the novelties of SRI. On account of its growing global acceptance, SRI has emerged as a movement among farmers. By SRI the annual income of the farmer increased. Due to increase in the income his family's standard of living also increased. SRI was diffused first to Tamil Nadu State in India during the year 1999. The study entitled "Diffusion of System of Rice Intensification (SRI) Across Tirunelveli District in Tamil Nadu." Aimed how SRI was diffused and adopted, gap between knowledge and adoption of SRI practices, important reason for non-adoption of SRI practices and find out reasons behind the slow adoption and diffusion of SRI practices. The study was conducted in Manur, Palayamkottai, Tenkasi and Vasudevanallur block of Tirunelveli district in Tamil Nadu. A total of 120 respondents were selected, and interviewed using a well structured, pretested interview schedule. In addition analysis to percentage analysis, cumulative frequency, correlation co-efficient and multiple regressions were the statistical tools employed.

Keywords: SRI; Diffusion; Adoption; Discontinuance; Non-adoption

INTRODUCTION

Rice is one of the prominent cereal crops in India. It is an important staple food about 50 per cent of the world's population that resides in Asia, where 90 per cent of the world's rice is grown and consumed. In Asia, India has the largest area under rice (41.66 million ha) accounting for 29.4 per cent of the global rice area (Thatchinamoorthy, C. 2017). SRI, the system of rice intensification is a system of production of rice. SRI is considered to be a intangible technological breakthrough in paddy cultivation. SRI involves the application of certain management practices, which together provide better growing conditions for rice plants, particularly in the root zone, than those for plants grown under traditional practices. This system seems to be promising to overcome the shortage of water in irrigated rice. It was developed in Madagascar in the early 1980s by Father Henride Laulanie, A Jesuit Priest, who spent over 30 years in that country working with farmers (Thatchinamoorthy, C and Rexlin Selvin. 2015).

Today, India has one of the largest numbers of SRI farmers in the world. Official record indicates that SRI diffused first to Tamil Nadu State, followed by Andhra Pradesh in India (Prasad, 2006). However, there is a need to study how SRI was diffused and adopted across the States of Tamil Nadu and Andhra Pradesh (Krishnan, 2008). Hence, the present study attempted to analyse the diffusion of SRI across Tirunelveli District in Tamil Nadu." Aimed how SRI was diffused and adopted, gap between knowledge and adoption of SRI practices, important reason for non-adoption of SRI practices and find out reasons behind the slow adoption and diffusion of SRI practices.

METHODOLOGY

Diffusion of System of Rice Intensification (SRI) was operationalised as a process by which SRI was communicated through certain channels over a certain period among the members of various States in India (Johnson, B and K.Vijayaragavan. 2011). The present study was conceived to analyse the diffusion of SRI across Tirunelveli District in Tamil Nadu. This district was purposively chosen for the study as the investigator hails from the same state. The familiarity of the place of investigation and local language would help the investigator in developing a quick rapport with the respondents which would result in meaningful and purposeful collection of appropriate data.

The ex-post facto research design was employed for the study. Data were collected by personal interview with respondents in their farm and home. The target population was farmers practicing SRI method of paddy cultivation. Hundred and twenty respondents were selected for the study. Tirunelveli district consists of eleven

taluks (Alangulam, Ambasamuthiram, Nanguneri, Palayamkottai, Radhapuram, Sankarankovil, Shenkottai, Sivagiri, Thenkasi, Tirunelveli and Veerakeramputhur).Sivakiri taluk was purposively selected because it shares major area under SRI cultivation. Sivakiri taluk has 23 blocks Vasudevanallur block was purposively, as it has larger area under paddy. Out of 26 panchayat villages in Vasudevanallur blk, 4 villages were randomly selected namely Vasudevanallur, Sivagiri, Rayagiri and Ullar. A list of farmers practicing System of Rice Intensification (SRI) was obtained from the Assistant Director of Agriculture office of Vasudevanallur Block. There were more than 100 farmers practicing System of Rice Intensification (SRI) in each villages of the block. By considering the sample size of the study, it has been decided to select 30 farmers from each of the four villages, where the highest number of farmers practicing System of Rice Intensification (SRI) extensively. Accordingly the sample has been fixed as 120 SRI farmers. The respondents were selected by employing simple random sampling technique in each village (Thatchinamoorthy. C and Rexlin Selvin. 2014).

The profile characteristics of SRI farmers were treated as independent variables while diffusion status, knowledge and adoption of SRI formed dependent variables. The data collected were analyzed with the help of statistical tools such as percentage analysis, cumulative frequency, mean and standard deviation were the statistical tools employed.

RESULTS AND DISCUSSION

Knowledge level of respondents on SRI cultivation technologies: Knowledge is an indispensable criterion for the adoption of any innovation, as it enables the farmers to understand completely and clearly the recommended technologies. The rate of adoption of an innovation is directly linked with level of knowledge of user about the same. Hence it was felt necessary to know the knowledge level of the farmers to understand all aspects of the technologies that were taught to them. In the present study, knowledge has been operationalised as the body of understood information possessed by the respondents on cultivation of paddy under SRI method. The overall knowledge level and technology-wise knowledge level of the respondents were studied and the findings were presented in this section.

The knowledge level of respondents in SRI cultivation technology was measured by using a teacher made knowledge test consisting of SRI techniques. The test included 16 items relating to various SRI techniques.

In order to assess the overall knowledge level of the respondents, necessary data were collected and they were categorized into three groups viz., low, medium and high using cumulative frequency method and the results are shown in Table 1.

Table-1: Distribution of respondents according to their knowledge level (n=120)

S. No	Category	Number (n=120)	Per cent
1	Low	12	10.00
2	Medium	62	51.70
3	High	46	38.30
	Total	120	100.00

A glance at the Table 1, revealed that around 51.70 per cent of the respondents had medium level of knowledge followed by 38.30 per cent and 10.00 per cent who had high and with low levels of knowledge in SRI cultivation method respectively. In general it could be concluded that there existed medium to high level of knowledge with majority (90.00 per cent) of the respondents. The appropriate reason for medium to higher level of knowledge on the recommended SRI cultivation practices might be due to their higher literacy, area under rice cultivation, medium level of credit orientation and medium to high level of economic motivation and scientific orientation. The respondents' ambition to increase their farm income; would have motivated them to gain more knowledge on SRI cultivation practices.

Extent of adoption of SRI technologies: Adoption is the process of making full use of the recommended technologies by the clients. The prime duty of extension functionaries is not only to spread improved farm technologies to the farming community but also to make the innovations adopted by the farmers in order to ensure higher productivity. Hence an attempt was made to assess the extent of adoption of SRI cultivation. The cumulative frequency distribution of adoption level obtained from the survey is presented in the Table 2.

Table-2: Distribution of respondents according to their adoption level (n=120)

S. No	Category	Number (n=120)	Per cent
1	Low	8	06.70

2	Medium	84	70.00
3	High	28	23.30
	Total	120	100.00

It could be observed from Table 2 that majority of the respondents (93.30 per cent) had medium to high level of adoption in the cultivation of paddy under SRI method and nearly seven percent of respondents had come under low level of adoption.

It could be understood that a vast majority of the respondents possessed medium to higher level of adoption. This might be due to their higher knowledge level on the recommended practices, better extension agency contact, higher risk orientation, higher scientific orientation, higher credit orientation and higher economic motivation. Further, Government of Tamil Nadu offer subsidies to buy the implements required for adopting SRI techniques. Those who avail subsidy facilities understood the efficiency of that implement through demonstrations and invariably adopted the technologies in their field.

Practice wise gap analysis from knowledge to adoption of SRI: Since there was adoption gap from knowing about SRI to adoption, reasons for delay in adoption of SRI practices was studied and presented in Table 3.

Table-3: Practice wise gap analysis from knowledge to adoption of SRI (n=120)

SI. No	Technologies	Knowledge		Adoption		Gap	
		Number	Per cent	Number	Percent	Number	Percent
1	Selection of right season.	120	100	120	100.00	0	0.00
2	Use of certified seeds.	120	100	120	100.00	0	0.00
3	Recommended seed rate.	113	94.16	112	93.33	1	0.83
4	Recommended size of nursery bed.	44	36.67	29	24.16	15	11.66
5	Recommended dose of DAP per bed.	96	80.00	90	75.00	6	70.00
6	Proper land leveling.	92	76.67	84	70.00	8	63.33
7	Recommended seedling age.	120	100.00	112	93.33	8	6.67
8	Square transplanting with recommended spacing.	120	100.00	110	91.66	10	8.34
9	Transplanting single seedling per hill	120	100.00	110	91.66	10	8.34
10	Alternate wetting and drying.	86	71.66	29	24.16	57	47.50
11	Use of leaf colour chart.	55	45.83	32	26.66	23	19.17
12	Weeding by Rotary / Cono weeders.	120	100.00	120	100.00	0	0.00
13	Use of recommended bio fertilizers.	42	35.00	73	60.83	31	25.83
14	Recommended dose of inorganic fertilizers in the main field.	75	62.50	120	100.00	45	37.50

It could be observed from above table that 47.50 per cent were not adopted alternate wetting and drying method irrigation technology. 37.50 per cent of respondents not adopted practices of recommended dose of inorganic fertilizers in the main field and 25.83 per cent of respondents not adopted practices of use of recommended bio fertilizers. Main reason for non adopted of SRI technology such as were risk involved in adopting new practices lack of awareness about SRI, shortage of agricultural labour, psychological fear of loss, poor economic condition of small and marginal farmers, not convinced with SRI performance in other fields.

Table-4: Time gap from knowledge to adoption of SRI (n=120)

SI. No	Time Period	Number	Per cent
1	Immediately	24	20.00
2	1-3 months	59	49.17
3	4-6 months	18	15.00
4	6-9 months	5	4.17
5	9-12 months	11	9.17
6	After one year	3	2.50
	Total	120	100

Only 20 per cent of respondents adopted SRI immediately after knowing SRI technology. 49.17 per cent respondents adopted SRI after one to three months period from knowing about SRI, 15.00 per cent of respondents adopted after knowing SRI technology, after six to nine months period from knowing SRI, 4.17 per cent respondents adopted. Since there was a time gap from knowing about SRI to adoption, reasons for delay in adoption of SRI practices, one of the major reason shortages of agricultural labour for timely operation and also risk in early transplanting with single seedling. Other reasons were to witness the SRI performance on other fields and to expertise in SRI practices.

CONCLUSION

The System of Rice Intensification (SRI) is a method of increasing the yield of rice produced in farming. SRI is considered to be a disembodied technological breakthrough in paddy cultivation. Today, India has one of the largest numbers of SRI farmers in the world. However, there is a need to study how SRI was diffused and adopted across the States of Tamil Nadu. Hence, the present study attempted to analyse the diffusion of SRI across Tirunelveli District in Tamil Nadu. Based on the findings, the implications of this present study may be useful for further development of SRI cultivation. It can be concluded around 50.00 per cent of the respondents had medium level of knowledge in SRI cultivation method respectively and 70.00 per cent of the respondents had medium level of adoption in SRI. Hence, intensive training with demonstrations on these above technologies may be given by the extension personnel of the State of Department Agriculture. Adopting appropriate extension strategies such as training, demonstration, exhibitions, etc., cent percent knowledge and adoption could be achieved among the SRI farmers.

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DOSIMETRIC COMPARISON OF IMRT PLANS OPTIMIZED WITH EQUIVALENT UNIFORM DOSE AND TARGET PENALTY ON TONGUE CANCER PATIENT

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ABSTRACT

Aim: The aim of this study is to compare the dosimetric parameters between Intensity Modulated Radiotherapy (IMRT) plans generated with Equivalent Uniform Dose (EUD) and Target Penalty and also investigate the usefulness of EUD for IMRT optimization.

Background: EUD for tumors is defined as the biologically equivalent dose that, if given uniformly, will lead to the same cell kill in the tumor volume as the actual nonuniform dose distribution.

Materials and Methods: For this study fifteen tongue patients were retrospectively selected. All the plans were generated in Monaco treatment planning system (TPS) version 5.11.02. A total dose of 66Gy for Planning Target Volume (PTV) and 50Gy for PTVnode were prescribed. Plan was done in two phases. Phase 1 was done for 50Gy in 25 fractions for combined PTV and PTVnode. Phase 2 was done for 16Gy in 8 fractions for PTV only.

Results: Both the plans were found to be clinically acceptable. Planning objectives were achieved with both the optimization techniques and organs at risk (OARs) were spared. But we found that, for the nearly same target coverage, EUD-based optimization is capable of improving the sparing of critical structures beyond the specified requirements.

Conclusions: It was observed that the IMRT plans optimized with target penalty had better dose uniformity in comparison to plans with target EUD but improved sparing of normal tissues were achieved by the EUD based optimization.

Keywords: IMRT, Biological optimization, Target EUD, Target Penalty, Treatment planning system.

1. BACKGROUND

Intensity modulated radiation therapy (IMRT) has replaced the three-dimensional conformal radiotherapy (3DCRT) techniques for head and neck cancer. It has been proved by many researchers that IMRT gives better dose coverage to the target and sparing of organ at risk (OAR) than 3DCRT^[1,2,3]. In spite of this, treatment planning of head and neck tumor are challenging due to the OARs adjacent to the target. We face the difficulty in sparing the OARs like parotids, spinal cord, planning organ at risk (PRV) for spinal cord and brainstem with good coverage and uniformity of dose to the tumor volumes. Some of the treatment planning system like CMS XiO treatment planning system optimize IMRT plan based on dose volume parameter in which we create a plan to achieve the target coverage and then lower the doses to OARs as a secondary process until the target coverage is compromised. But biological cost functions based planning system like Monaco prioritize OARs dose^[4,5]. Monaco uses biological as well as physical cost function for optimization. In Monaco planning system biological optimization is based on Target EUD. It accounts the response of tissues to dose as well as the volume effect of organs. On the other hand target penalty is the physical cost function and it is a quadratic penalty constraint which starts at the threshold dose^[5,6,7]. The concept of EUD for tumors was introduced by Niemierko^[8,9] originally as the biologically equivalent dose that, if given uniformly, would lead to the same cell kill in the tumor volume as the actual nonuniform dose distribution. Later, Niemierko extended the EUD concept to apply to normal tissues as well. The original definition of EUD was derived on the basis of mechanistic formulation using a linear-quadratic cell survival model. Niemierko suggested the phenomenologic form

$$EUD = \left(\frac{1}{N} \sum_i D_i^a \right)^{\frac{1}{a}}$$

for both tumors and normal tissues. In this expression, N is the number of voxels in the anatomic structure of interest, D_i is the dose in the i 'th voxel, and a is the tumor or normal tissue-specific parameter that describes the dose-volume effect. This formulation of EUD is based on the power law dependence of the response of a complex biologic system to a stimulus. The aim of the study is to investigate the performance of monaco planning system by comparing the plan generated by target EUD and target penalty.

2. MATERIALS AND METHODS

Fifteen advanced case of carcinoma of tongue operated before radiation were selected. All the patients were immobilized in the supine position by using head and neck thermoplastic mask in all in one board. Three millimeter slice thickness of contrast computed tomography (CT) scans were taken on 16 slice CT simulator (GE Medical System). CT images were transferred to TPS workstation for contouring. Clinical target volume (CTV) which is the volume of microscopic / subclinical disease were contoured which included both primary region and nodal region of high risk and CTV node delineated covering nodal area of low risk region according to the histopathological report and the natural spread of the disease. CTV and CTV node was added with 5mm margin in all dimensions to make the PTV and PTVnode to account for patient setup error and motion uncertainties by an experienced radiation oncologist with radiologist's support as per multidisciplinary protocol of the institution.

Dose Prescription

Maximum dose prescribed to PTV was 66GY in 33 fractions and for PTVnode is 50GY in 25 fractions. Plan was delivered in two phases. Phase 1 was done for 50Gy in 25 fractions for combined PTV and PTVnode. Phase 2 was done for 16Gy in 8 fractions for PTV.

Linear accelerator, Record System (MOSAIQ) and X-ray volume images (XVI) system

The entire fifteen patients were treated on Elekta synergy Linear accelerator. Clinically accepted plan was transferred via Digital Imaging and Communications in Medicine (DICOM) from the Monaco TPS to the mosaiq system. Mosaiq helps in delivering and recording of the plan. Patient positioning and target location were verified by the XVI system before the treatment.

Monaco planning system:

Monaco has three biological constraints such as Target EUD, parallel and serial and six physical constraints such as Target penalty, Quadratic Overdose, Overdose DVH, Underdose DVH, Maximum dose and Quadratic Underdose. Target EUD and Target penalty are two different cost functions which are used with quadratic overdose for the target cost function. EUD is a homogeneous dose that, when applied to an organ, has the same clinical effect as any given, inhomogeneous dose distribution^[10, 11]. Target penalty is the objective version of the Quadratic under dose constraint for targets. The isoeffect is a DVH based physical parameter. For some organs, high doses are harmful even if they are limited to small volumes. Serial cost function is applied for these organ. Some organ tolerate very high dose in small sub-volumes. These organs are considered as parallel organ and parallel cost function is used for that^[12]. The system optimizes the plan in two steps. In the first phase of optimization, the fluence distribution is calculated by pencil beam algorithm. In the second phase, calculation done by Monte carlo method^[13]. In this study we compared the plans optimized with target EUD and with target penalty.

Details of IMRT treatment planning

Two IMRT plans, one with target EUD and other with Target penalty were created with 9 coplanar 6MV photon beams for the entire fifteen patients. Beam started from 0° to 320° beam angels with internal space of 40°. Couch and collimator angles were kept as 0° for all plan. Calculation parameters such as grid spacing, fluence smoothing and statistical uncertainty were 0.3cm, medium and 1% per plan respectively. Plans were generated in dynamic mode. First plan was generated with target EUD combination with quadratic over dose. Second plan was generated with target penalty combination with quadratic overdose. OARs like brainstem, spinal cord and PRV for spinal cord, serial cost functions were selected and for parotid glands, parallel cost function was selected. Objective functions and parameters used in monaco for planning are given in [Table1]. Both the plan were created in such a way so as to achieve at least 95% of PTV volume receives 95% of prescribe dose and 2% of PTV volume receives not more than 105% of prescribed dose. Critical organ dose kept as low as possible at the same time does not exceed the tolerance dose [Table2].

Table-1: Objective functions and parameters used in Monaco

Monaco Treatment Planning System		
	Biological/Physical Cost Function	Cost function parameters
PTV/PTVnode	Target EUD	Prescription(cGy) Cell Sensitivity = 0.50
	Target Penalty	Prescription(cGy) Minimum volume = 95%
	Quadratic overdose	Maximum Dose(cGy) RMS Dose Excess = 50cGy

Brain stem/Spinal cord/PRV	Serial	Equivalent Uniform Dose(cGy) Power Law exponent = 12
RT /LT parotid	Parallel	Reference Dose(cGy) Mean Organ Damage (%) Power Law Exponent = 3
Patient	Quadratic Overdose	Maximum Dose(cGy) = prescribed dose RMS Dose Excess(cGY) = 10
	Quadratic Overdose	Maximum Dose(cGy) = 2/3*Prescribed dose RMS Dose Excess(cGY) =30
	Maximum Dose	Shrink Margin = 1.5
	Conformality	Maximum dose =108% of prescribed dose Optimize Over all voxels in volume Relative Isoconstraint = 0.70

PTV-Planning Target Volume, EUD - Equivalent Uniform Dose, PRV- Planning Risk Volume, RT/LT- Right/Left, RMS - Root Mean Square.

Table-2: Treatment planning objectives

Organ at Risk	Maximum Dose	Mean Dose	Dose Volume Parameter
Brainstem	54Gy		
Spinal cord	45Gy		
Parotid glands		26Gy	
PTV	110%		95% of prescribed dose > 95% of target volume

Plan evaluation parameters

Plan evaluation was performed in terms of quantitative analysis . The evaluation parameters are described as follows.

- Homogeneity Index (HI): $(D_{2\%} - D_{98\%} / D_{50\%})$ It is used to evaluate the dose homogeneity in PTV and to choose the best plans among the available plans. $D_{2\%}$, $D_{98\%}$ and $D_{50\%}$ were the dose delivered to 2%, 98% and 50% volume of the PTV respectively. HI zero indicates the dose distribution is homogeneous [14].
- Conformity Index (CI): (TV/PTV) defines how well the prescription dose conforms to the PTV. It evaluates a plan ability to spare normal tissue from the high dose delivered to the treatment volume. Where TV is the volume of the reference isodose (98% of the prescribed dose) and PTV is the volume of the target [15, 16].
- Target volume: $D_{95\%}$, $D_{100\%}$, and $D_{105\%}$ for PTV were analyzed. $D_{95\%}$, $D_{100\%}$, and $D_{105\%}$ were dose delivered to 95%, 100% and 105% volume of PTV respectively. Maximum dose (Dmax), dose in 0.1cc volume and mean dose (Dmean) to PTV were also analyzed.
- For OARs dose analysis was performed using DVH, serial OARs such as spinal cord, PRV for spinal cord and brain stem were analyzed by maximum dose and 0.1cc volume dose were also analyzed. Parallel OARs, left and right parotid mean dose were analyzed.
- Treatment efficiency was analyzed using Monitor Unit (MU).
- IMRT plan dose verification was performed using delta4 phantom. Quality Assurance (QA) plan was created in the Monaco TPS. All plans were delivered as pretreatment verification and dose was measured using delta⁴. TPS calculated dose fluence were compared with measured dose fluence using gamma evaluation method with critically acceptable criteria 3mm Distance To Agreement (DTA) and 3% Dose Difference (DD).
- Statistical analysis: p value was calculated for 0.05 significance level.

RESULTS

Clinically acceptable IMRT plans by oncologist showed very less dose distribution difference in PTVs between EUD and penalty based optimization technique for all the cases. Combined Dose Volume Histogram (DVH) results for PTV and OARs are shown in figure1. The results of the analysis of DVH were given in Table3. The comparative isofill distributions of two plans are shown in figure 2.

We were able to achieve good dose coverage and OARs sparing in both the plan. Comparison of $D_{95\%}$, $D_{100\%}$, $D_{105\%}$, D_{max} , D_{mean} , HI and CI for PTVs showed insignificant difference [Table3]. From this study we found that average of the all plans 95% of prescribed dose was covered by the 97% volume of the PTVs with target EUD based IMRT plan and in case of target penalty, 95% of the prescribed dose was covered with 98% volume of the PTVs.

The planning objective was met in both the plans. Combined maximum dose and dose in 0.1cc volume for spinal cord, PRV (for spinal cord) and brainstem were analyzed. For spinal cord dose in 0.1cc volume was 22.3 ± 0.3 in target penalty plans and 21.05 ± 0.5 in target EUD based plans. For PRV dose in 0.1 cc volume was 36.5 ± 1.3 in target penalty based plans and 36.29 ± 0.2 in target EUD plans. Similarly for brainstem dose in 0.1 cc volume was 17.4 ± 0.4 in target penalty plans and 16.2 ± 0.3 in target EUD plans.

In case of parotid right and left, mean Dose was less than the tolerance mean dose in both the plans. The mean dose of right parotid was 24.4 ± 0.6 in target penalty and 23.19 ± 1.3 in the target EUD based plans. Similarly for left parotid mean dose was 22.4 ± 1.2 in target penalty based plan and it was 21.05 ± 1.3 in the EUD based plans.

Delivery efficiency was compared with MUs required to deliver the plans. EUD based optimization technique showed more MUs required to create clinically acceptable plans generated with target penalty based optimization technique Table3.

2. DISCUSSION

This study compares the dosimetric parameters for EUD and target penalty based optimization. For all the cases, both the techniques generate clinically acceptable IMRT plans and have their own advantages and disadvantages. Penalty based IMRT plans showed slightly better result in terms of homogeneous dose distribution within the target volume as compare to target EUD based plan. But EUD based optimization provides significantly better protection of critical structures. The maximum dose to the spinal cord was reduced from 24.2 Gy in the target penalty plan to 23.1 Gy in the EUD plan, a 4% reduction. Similarly, the maximum dose to the brainstem was reduced from 19.2 Gy to 18.6 Gy, a 3% reduction. Considering that both the cord and brainstem are considered serial organs, meaning that the degree of the complications is determined by the maximum dose, this was an important improvement. Mean doses for right parotid mean dose was 24.4Gy in target penalty reduced to 23.2 Gy in target EUD, a 5% reduction and in left parotid mean dose was 22.4 Gy in target penalty reduced to 21.05 Gy in target EUD, a 6% reduction. Also target penalty based optimization plans requires more segments to archive clinically acceptable plans and due to this increase in MUs. More number of MUs increases the treatment time. Reduction in treatment time would increase patient comfort as well as decreases uncertainty due to patient movement.

3. CONCLUSIONS

We have compared twenty cases of target EUD and target penalty based IMRT plans of tongue cancers. In both the plans, we were able to achieve good target coverage and normal tissue sparing. But with target EUD based plan one can achieve slightly better normal tissue sparing as compared to target penalty based plans. We can conclude that EUD based optimization provide the same coverage of the target as compare with target penalty based optimization and also it provides significantly better protection of critical structures with lesser monitor unit.

Parameters	IMRT with Target EUD	IMRT With Target Penalty
PTV (Phase 2)	Mean value \pm SD	Mean value \pm SD
D95%(Gy)	15.40 \pm 0.14	15.45 \pm 0.058
D98%(Gy)	14.97 \pm 0.13	15.02 \pm 0.12
D50%(Gy)	16.35 \pm 0.034	16.36 \pm 0.028
D5%(Gy)	16.69 \pm 0.014	16.77 \pm 0.013
D2%(Gy)	16.79 \pm 0.023	16.86 \pm 0.024
Dmax(Gy)	17.48 \pm 0.02	17.53 \pm 0.075

Dmax in 0.1cc(Gy)	17.19 ± 0.04	17.15 ± 0.054
Dmean(Gy)	16.27 ± 0.012	16.28 ± 0.011
HI	1.07 ± 0.004	1.07 ± 0.005
CI	0.98 ± 0.002	0.98 ± 0.0002
MUs	522 ± 52	580 ± 60
PTV + PTVnode (Phase 1)		
D95%(Gy)	48.4 ± 0.36	48.7 ± 0.049
D98%(Gy)	47.63 ± 0.31	47.91 ± 0.19
D50%(Gy)	50.44 ± 0.076	50.42 ± 0.077
D5%(Gy)	51.94 ± 0.08	51.77 ± 0.071
D2%(Gy)	52.29 ± 0.05	52.20 ± 0.075
Dmax(Gy)	54.68 ± 0.3	54.71 ± 0.008
Dmax in 0.1cc(Gy)	53.53 ± 0.05	53.59 ± 0.009
Dmean(Gy)	50.24 ± 0.31	50.34 ± 0.055
HI	1.08 ± 0.0006	1.063 ± 0.0007
CI	0.98 ± 0.0002	0.98 ± 0.0002
MUs	882.89 ± 50	999 ± 73
OARs (total dose)		
Spinal cord		
Dmax(Gy)	23.1 ± 0.5	24.2 ± 0.4
Dmax in 0.1cc(Gy)	21.05 ± 0.5	22.3 ± 0.3
Brain Stem		
Dmax(Gy)	18.6 ± 0.4	19.2 ± 0.5
Dmax in 0.1cc(Gy)	16.2 ± 0.3	17.4 ± 0.4
PRV for spinal cord		
Dmax(Gy)	39.19 ± 0.2	40 ± 0.4
Dmax in 0.1cc(Gy)	36.29 ± 0.2	36.5 ± 0.3
Parotid RT		
Mean dose(Gy)	23.19 ± 1.3	24.4 ± 0.6
Parotid LT		
Mean dose(Gy)	21.05 ± 1.3	22.4 ± 1.2

Table-3: Dosimetric comparison of Target EUD and Target Penalty

IMRT: Intensity Modulated Radiation Therapy, PTV: Planning Target Volume, HI: Homogeneity Index, CI: Conformity Index, RT: Right, LT: Left, MUs: Monitor Unit, SD: Standard Deviation.

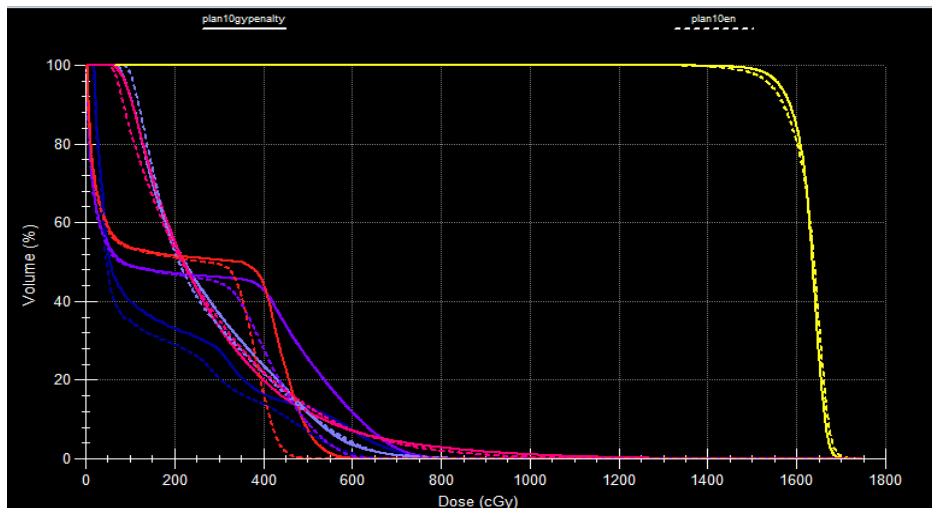


Figure-1: DVH comparison of PTV (yellow), Spinal cord (Red), Brainstem (Dark Blue), PRV (Purple), Right Parotid (Pink), Left Parotid (Light Blue), Solid Lines: Target EUD; Dashed lines: Target penalty

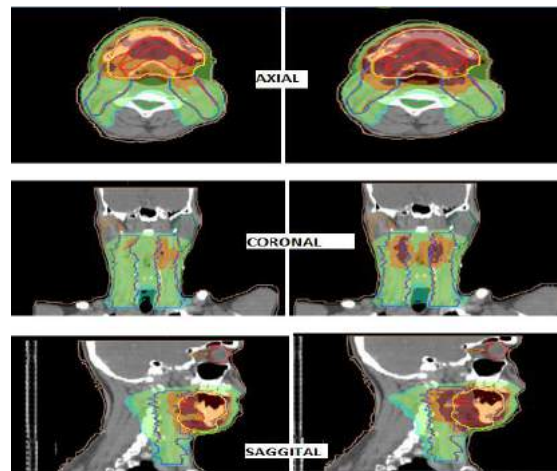


Figure-2: Isofill comparison of IMRT with Target EUD and Target Penalty

One base of tongue case. Dark Brown: 66Gy; Light brown: 62Gy

Light green: 50Gy; light blue: 47.5Gy

4. Financial support and sponsorship

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5. Conflicts of interest

There are no conflicts of interest

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EFFECT OF PHONON EXCITATION IN FUSION OF $^{40}\text{Ca} + ^{40}\text{Ca}$ REACTIONNisha Chauhan¹ and S. S. Godre²Ph.D. Scholar¹ and Professor², Department of Physics, Veer Narmad South Gujarat University, Surat**ABSTRACT**

Fusion reaction $^{40}\text{Ca} + ^{40}\text{Ca}$ at sub-barrier energies with coupled-channels framework is investigated in detail. The coupled channel calculations are studied using the CCFULL code. In particular, the effect of octupole vibrational excitation of doubly magic spherical nucleus of ^{40}Ca on fusion cross section and fusion barrier distribution is studied. The present coupled channel calculations well account for the experimental data of the fusion cross section and barrier distributions. Present study indicates that the octupole phonon state of ^{40}Ca is much stronger than the quadrupole phonon state.

Keywords: Coupled channel calculations, Heavy-Ion fusion reactions, Phonon excitations

1. INTRODUCTION

It is now well established that the experimental cross section of heavy-ion fusion reactions between two medium nuclei at energies below the Coulomb barrier are several of magnitudes larger than the prediction of a potential model calculation [1]. This enhancement can be attributed to the coupling of translational motion with additional degrees of freedom such as nuclear surface vibration, rotation and nucleon transfer and/or neck formation between two colliding nuclei [2]. Recent study in low-energy heavy-ion reactions has been focused towards an understanding of the reaction mechanism in the framework of the coupled-channel formalism [3]. A complete understanding of the role of various reaction channels in enhancing the sub-barrier fusion cross section has not yet been achieved, even though in some systems the effect of coupling to a few specific channels has been identified.

Coupled channel formalisms have been extensively used for the heavy-ion fusion cross section calculations. Standard coupled channel calculation code CCFULL [4] uses Woods-Saxon potential, which is a deep attractive nuclear potential, as a nuclear part of the potential. In this code, the depth, range and the surface diffuseness parameters of the potential have been determined often by fitting the experimental fusion cross section at high energies.

The fusion barrier distribution (BD) analysis is a valuable tool to understand the fusion mechanism of two heavy nuclei and the role of their internal degrees of freedom leading to fusion. The fusion BD has been shown to be sensitive to the data related to the nuclear structure, such as the nuclear shapes, the multiple excitations and the anharmonicity of nuclear surface vibrations etc. For this purpose, high precision measurements of the fusion cross section data are required and have been reported for many systems [5]. Fusion BD analyses of these data provided motivation to understanding of the fusion mechanism and generated a widespread interest in the study [6]. The coupling of various channels with each other results in the splitting of the barrier and hence, the fusion cross sections are substantially enhanced in the sub-barrier region as compared to the predictions of one dimensional barrier penetration model [7]. Coupled-channels calculations as well as experimental data shows that the effect of nuclear intrinsic degrees of freedom can be studied in more detail through the fusion barrier distributions [8].

It is important to provide a clear understanding of some fundamental test cases. One such case is the fusion between two magic nuclei. The best studied example is $^{16}\text{O} + ^{208}\text{Pb}$, whose detailed theoretical description, however, still remains elusive [9]. Other systems of great interest are the combinations of magic calcium nucleus, namely $^{40}\text{Ca} + ^{40}\text{Ca}$. The closed-shell structure of ^{40}Ca immediately attracted the interest of both experimentalists and theoreticians. Fusion of $^{40}\text{Ca} + ^{40}\text{Ca}$ was investigated again later on with the goal of extracting fusion barrier distributions from accurate measurements of the excitation functions [10, 11].

In order to study the role of important degrees of freedom of doubly magic spherical nucleus in the fusion mechanism, we have calculated the fusion cross section (CS) and fusion barrier distribution (BD) for $^{40}\text{Ca} + ^{40}\text{Ca}$ system.

This paper is organized as follows. Section II gives the detailed of the coupled channel calculations. Section III explains the coupled-channel calculations employed to analyse the data and the last section gives conclusions.

2. COUPLED-CHANNELS FORMALISM FOR HEAVY-ION FUSION REACTIONS

In this section, the coupled-channels formalism for heavy-ion fusion reactions which includes the effects of the vibrational excitations of the target nucleus is briefly discussed. The nuclear structure effects can be taken into

account in a more quantal way using the coupled-channels method, consider a collision between two nuclei in the presence of the coupling of the relative motion to a nuclear intrinsic motion ξ . The total Hamiltonian of the system as given in [3] is given below,

$$H(r, \xi) = -\frac{\hbar^2}{2\mu} \nabla^2 + V_N^0(r) + \frac{Z_P Z_T e^2}{r} + H_0(\xi) + V_{coup}(r, \xi) \tag{1}$$

where r is the coordinate of the relative motion between the target and projectile nuclei, μ is the reduced mass, ξ represents the vibrational coordinate in the target nucleus, $H_0(\xi)$ and $V_{coup}(r, \xi)$ are the intrinsic and the coupling Hamiltonians respectively. $V_N(r)$ is the nucleus potential which is the standard Woods-Saxon Potential form,

$$V_N(r) = -\frac{V_0}{1 + \exp[(r - R_0)/a]} \tag{2}$$

where V_0 is the potential depth, a is the diffuseness parameter and radius parameter $R_0 = r_0 (A_p^{1/3} + A_t^{1/3})$

In general, the intrinsic degree of freedom ξ has a finite spin. Therefore the coupling Hamiltonian is expanded in multipoles as,

$$V_{coup}(\hat{r}, \xi) = \sum_{\lambda > 0} f_\lambda(r) Y_\lambda(\hat{r}) \cdot T_\lambda(\xi) \tag{3}$$

Here $Y_\lambda(\hat{r})$ are the spherical harmonics and $T_\lambda(\xi)$ are spherical tensors constructed from the intrinsic coordinate.

The coupled-channels equations for $u_{nl}^J(r)$ read,

$$\left[-\frac{\hbar^2}{2\mu} \frac{d^2}{dr^2} + \frac{l(l+1)\hbar^2}{2\mu r^2} + V(r) - E + \varepsilon_n \right] u_{nl}^J(r) + \sum_{n', l', I'} V_{nl; n', l', I'}^J(r) u_{n', l', I'}^J(r) = 0 \tag{4}$$

where ε_n is the eigenvalue of the operator H_0 for the n th channel and the coupling matrix elements $V_{nl; n', l', I'}^J(r)$ are given as

$$\begin{aligned} V_{nl; n', l', I'}^J(r) &= \langle JM(nI) | V_{coup}(\hat{r}, \xi) | (n' l' I') JM \rangle \\ &= \sum_{\lambda} (-)^{I-l+i'+J} f_\lambda(r) \langle l || Y_\lambda || l' \rangle \langle nI || T_\lambda || n'I' \rangle \times \sqrt{(2l+1)(2I+1)} \begin{Bmatrix} I' & l' & J \\ l & I & \lambda \end{Bmatrix} \end{aligned} \tag{5}$$

and the coupling form factors are written as

$$f^N(r) = -R_p \frac{d}{dR} \left[\frac{-V_0}{1 + \exp(r - R_0)/a_0} \right], f^C(r) = \frac{3Z_P Z_T e^2}{2\lambda + 1} \frac{R_p^2}{R^{\lambda+1}} \tag{6}$$

Notice that these matrix elements are independent of M . For simplicity of the notation, a simplified notation is introduced, $n = \{a, l, I\}$, and suppress the index J , the coupled-channels Eq. (4) then reads,

$$\left[-\frac{\hbar^2}{2\mu} \frac{d^2}{dr^2} + \frac{l(l+1)\hbar^2}{2\mu r^2} + V(r) - E + \varepsilon_n \right] u_n(r) + \sum_{n'; l', I'} V_{n; n'}(r) u_{n'}(r) = 0 \tag{7}$$

These coupled-channels equations are solved with the incoming wave boundary conditions of,

$$\begin{aligned} u_n(r) &: \sqrt{\frac{k_{n_i}}{k_n(r)}} \mathfrak{S}_{nn_i}^J \exp\left(-i \int_{r_{abs}}^r k_n(r') dr'\right), r \leq r_{abs} \\ &\rightarrow \frac{i}{2} \left(H_J^{(-)}(k_{nl} r) \delta_{n, n_i} - \sqrt{\frac{k_{n_i}}{k_{nl}}} S_I^J H_J^{(+)}(k_{nl} r) \right), r \rightarrow \infty \end{aligned} \tag{8}$$

where n_i denotes the entrance channel. The local wave number $k_n(r)$ is defined by,

$$k_n(r) = \sqrt{\frac{2\mu}{\hbar^2} \left(E - \varepsilon_n - \frac{l(l+1)\hbar^2}{2\mu r^2} - V(r) \right)} \quad (9)$$

where $k_n = k_n(r = \infty)$.

Once the transmission coefficients \mathcal{T}_l are obtained, the inclusive penetrability $P_l(E)$ of the Coulomb potential barrier is given by

$$P_l(E) = 1 - |S_l|^2 = \frac{k_l(r_{abs})}{k} |T_l|^2 \quad (10)$$

where $k = \sqrt{2\mu E_{cm} / \hbar^2}$. The fusion cross section is then given by,

$$\sigma_{fus}(E) = \frac{\pi}{k^2} \sum_l (2l+1) P_l(E) \quad (11)$$

The fusion cross section enhancements observed at sub barrier energies expected from the one dimensional barrier penetration calculation require the appropriate couplings between reaction channels and elastic channel. These couplings give rise to a distribution of fusion barriers instead of a single barrier. The concept of barrier distribution directly extracted from measured fusion cross section (σ_{fus}), by taking the second derivative of the product ($E\sigma_{fus}$) with respect to center-of-mass energy (E_{cm}), as described by Rowley *et al.* [8] is a useful tool in order to study the structural effects. The fusion barrier distribution (BD) is calculated using a three point difference formula, at energy $(E_1 + 2E_2 + E_3) / 4$, is given as

$$BD = \frac{d^2(E\sigma)}{dE^2} = 2 \left[\frac{(E\sigma)_3 - (E\sigma)_2}{E_3 - E_2} - \frac{(E\sigma)_2 - (E\sigma)_1}{E_2 - E_1} \right] \times \frac{1}{(E_3 - E_1)} \quad (12)$$

In the present study, the fusion barrier distribution is calculated with $\Delta E_{cm} = E_3 - E_2 = E_2 - E_1 = 1.5$ MeV. In the present study, BD is normalized to πR_b^2 and R_b is the barrier radius resulting from the Woods-Saxon potential.

3. RESULT AND DISCUSSION

In this section, the detailed coupled-channels analyses for heavy-ion fusion data of $^{40}\text{Ca} + ^{40}\text{Ca}$ is investigated. The results of coupled-channels calculations are performed using the CCFULL code [3]. The experimental data is taken from the ref. [11, 12]. In the calculations, the parameters of the nuclear potential are chosen in such a way that the calculated cross section fit well with the experimental fusion cross section data at the highest energies for this reaction. The optimum value for V_0 , r_0 and a parameters are summarized in Table I. The deformation parameters values are taken from the literature [13] and are given in Table II.

Table-I: The potential parameters such as depth parameter (V_0), radius parameter (r_0) and diffuseness parameter (a_0) for different reaction used in the coupled-channel calculations.

System	V_0 (MeV)	r_0 (fm)	a_0 (fm)
$^{40}\text{Ca} + ^{40}\text{Ca}$	196	1.01	0.709

Table-II: The deformation parameters (β_λ), excitation energies (E_λ) and the multipolarities (λ) of the state of nuclei used in the coupled-channel calculations [13].

Nuclei	λ^π	E_λ (MeV)	β_λ
^{40}Ca	3^-	3.737	0.41
	2^+	3.905	0.123
	5^-	4.497	0.25

In performing the coupled channel calculations for $^{40}\text{Ca} + ^{40}\text{Ca}$ system, the low-lying vibrational state of doubly magic spherical nucleus ^{40}Ca *i.e.* 3^- , 2^+ and 5^- states are included. The results of coupled channel calculations are compared with the experimental data in Fig. 1. Figure 1(a) and 1(b) show the fusion cross sections and the fusion barrier distributions, respectively. The result when the projectile and the target are assumed to be inert *i.e.* no excitation level is included is denoted by dotted line in Fig. 1. This calculation underestimates the experimental data of fusion cross section and gives a single peak structure of fusion barrier distribution in Fig.

1(b). The result of coupled channel calculations taking into account the coupling to single quadrupole (2^+) excitation of target ^{40}Ca is shown in Fig. 1 by dashed line. This calculation underestimates the experimental fusion cross section as well as barrier distribution.

The calculations including the coupling to single 5^- excitation in addition to single quadrupole excitation (2^+) of target is denoted by dashed-dotted line. But the inclusion of this coupling fails to reproduce the experimental data which indicates that more coupling are required to study this reaction. Then the calculations including the coupling to single octupole excitation of projectile ^{40}Ca in addition with the coupling of 2^+ and 5^- states of target nucleus is shown by the solid line in Fig. 1. This calculation give an overall better agreement taking into account the coupling of octupole vibrational excitation with experimental fusion cross section as well as fusion barrier distribution. From the present calculations for this reaction $^{40}\text{Ca} + ^{40}\text{Ca}$ system, it can be conclude that the octupole phonon state of ^{40}Ca is much stronger than the quadrupole phonon state.

4. CONCLUSION

The detailed coupled-channels analysis for heavy-ion fusion reactions of the $^{40}\text{Ca} + ^{40}\text{Ca}$ system is investigated using CCFULL code. In particular, the effect of octupole vibrational excitation of doubly magic spherical nucleus of ^{40}Ca on fusion cross section and fusion barrier distribution is studied. The present coupled channel calculations well account for the experimental data of the fusion cross section and barrier distributions. Present study indicates that the octupole phonon state of ^{40}Ca is much stronger than the quadrupole phonon state.

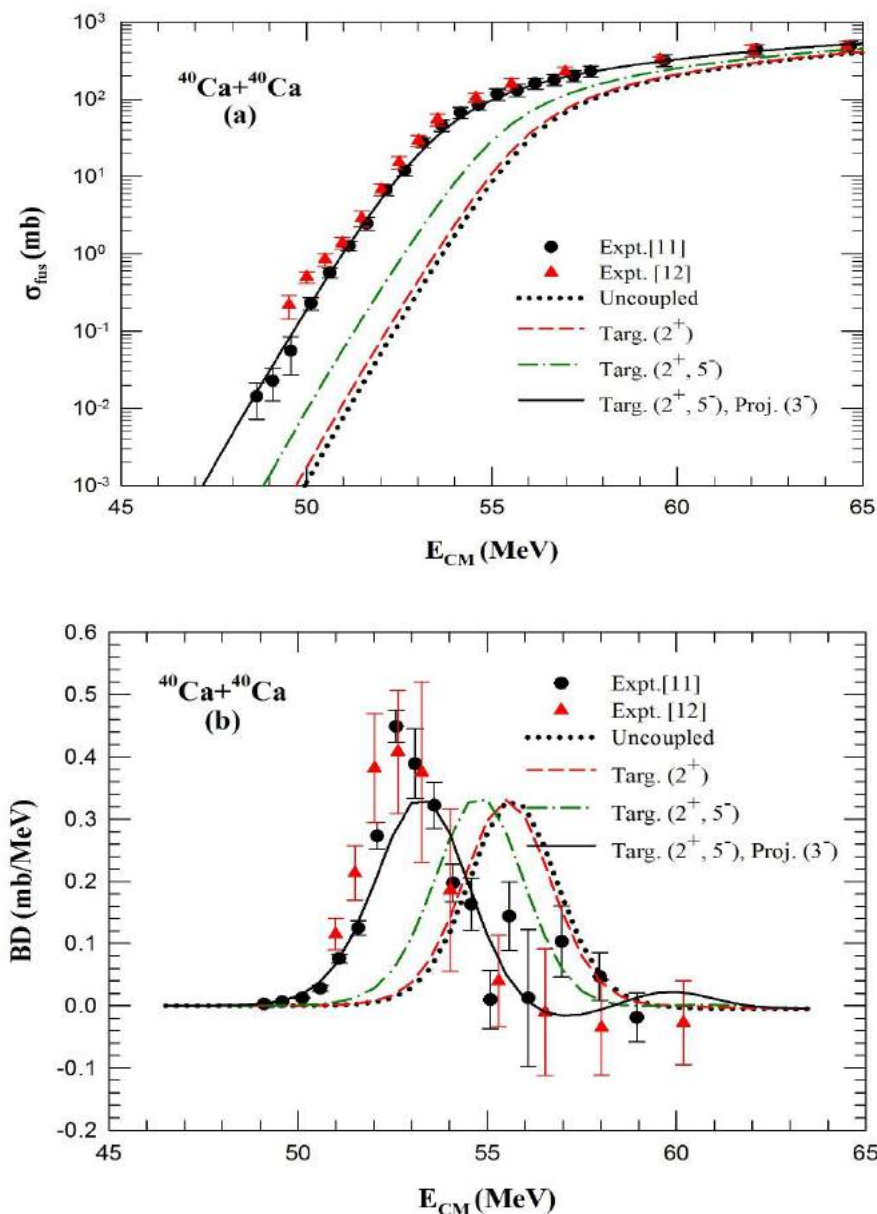


Fig-1: Comparison of coupled channel calculations with experimental data for (a) fusion cross section and (b) fusion barrier distribution for $^{40}\text{Ca} + ^{40}\text{Ca}$.

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IMPACT OF GANDHIAN VALUE BASED TEACHER EDUCATION ON MORALE VALUES OF B.ED. STUDENTS

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ABSTRACT

The modern materialistic India, which in the path of development, raises our standard of living but declines our standard of life i.e. the value of life. On account of population explosion, knowledge explosion (science and technology) and material explosion man has started moving towards the wrong path by considering material comforts of the world as real happiness. At present political, economic, social and moral rights as well as values are downgrading and exploiting. In the course of development, we have to think of these problems and try to find out the solutions best suited to our needs. It is the Gandhian Value System which can be used to re-invent idealistic and humane values among school students, but first these values must be inculcated in the teachers who are teaching them. The basic idea behind the value based education is that the education should not only enable a learner to earn more and but also to build his character. Similarly, value based teacher education aims at inculcating values in teachers in addition to merely concentrating on teaching skills and subject matter. This research paper aims To assess the attained understanding of B.Ed. Students about Gandhian Thoughts and values by giving them intervention in form of participation in Gandhi Vichar Sanskar Pareeksha-2018 and also to analyze the influence of GSVP exam on moral values of participants of the exam. Statistical analyses revealed significant influence of intervention on morality scale of students

INTRODUCTION

The 21st century is commonly known as "The Era of development". India being riding in the ship of development faces all the challenges of the same. While walking on the path of development, India have covered a quite a significant distance. During this course, along with its inherent problems viz. rapid growth of population, unemployment, poverty, racial discrimination, economic inequality, social injustice, corruption, India have infected itself with greater infirmities. At present political, economic, social and moral rights as well as values are downgrading and exploiting. In the course of development, we have to think of these problems and try to find out the solutions best suited to our needs.

The above said problems are not superficial but it has started impairing the young India studying in the classrooms. Observations from the Pearson Voice of Teacher Survey 2016 which was conducted across the country in July-August 2016, revealed that about 42 percent of teachers feel that students who don't give importance to values and ethics is increasing by the day while 38 percent teachers feel discipline has become a major issue to tackle with.

The reasons could be partly subjected to several social and economic factors. In today's cut throat economy, many families have become disoriented, disorganised and confused and failed to play this vital role of inculcating values and morals among their children. Not just family, the other major agency of society i.e. our school and other educational institutions are lacking behind in flourishing a good human, they rather focused on making a successful economic man, who is selfish and will do anything to satisfy his cravings and desires.

The Pearson Voice of Teacher Survey 2016 also revealed that teachers agreed that they don't get adequate training. About 49 percent respondents revealed that they prefer better training. Adequacy of teacher training is perceived to be much higher among school teachers (70 percent) than higher education teachers (30 percent), the survey claimed.

This result seems to be in sync with speculations of the analysts and educationists of the country have high lightened the importance of inculcating value-based education in their recent policy recommendations like - the Ishwarbhai Patel's; Ramamurthy commission; Prof. Yashpal's commission and the present focus on the same issues through the National curriculum framework. All these commissions, reports and recommendations have one thing in Common and that is, Changing Curriculum at different levels for capacity building among teachers. Further, recent studies revealed that teachers have responsibility of teaching a whole child developing values assumed importance in recent years. But what exactly is value based teacher education (VBTE). Teacher education trains an individual in teaching-learning process; VBTE gives him to connect with his students, his profession and whole environment in general at a deeper level. Teacher education creates a well-trained teacher, whereas VBTE creates a leader who will lead the whole society.

GANDHIAN VALUE BASED TEACHER EDUCATION

The problem of today's society is that it leaves us without absolute foundations for determining absolute truths and values about thinking and living wisely on earth. While we are moving ahead for the peak of scientific and economic success, we need to be grounded with our roots of moral value to have mental peace and feeling content in present moment. Our history is filled with scripture, great philosophers, guide-men who have propounded and followed idealist ideologies which are still relevant in modern times.

Mohandas Karamchand Gandhi was a man considered one of the great sages and prophets. Indians called him the 'Father of the Nation'. Gandhi's exposure to realities of life in South Africa taught him about life much more than what he had learnt in formal institutions of learning. It is this understanding of life which gave shape to his views on the nature of education that a free India needed. To solve problem of deteriorating value system of Indian society, it is very important for us to re-visit his ideas on education and role of teacher.

By education, Gandhi means an all-round drawing out of the best in the child and man – body, mind and spirit. Here the “best” is nothing else but the inner voice or truth. Education which draws out the best or truth consist the development of the mind and body with a corresponding awakening of the soul. The system of basic education proposed by Gandhi leads to the development of the mind, body and soul whereas the ordinary system of education cares only for the mind.

Gandhi's philosophy of education comprises all essential elements which any good or adequate philosophy of education should possess. He advocates the concept of value education, which is based on morality. According to Gandhi moral and ethical knowledge is the first point of any good philosophy of education. Any education system that lacks moral and ethical knowledge cannot be termed as good. The underlying meaning behind this thought is that, without morality or ethical knowledge no student in the real sense can be considered to be healthy-both mentally and physically. A person, who lacks the knowledge of morality, who does not differentiate between right and wrong, who has no control on himself, cannot be called educated in the true sense. For Gandhi morality and righteousness should always be considered as an essential part of an education, so that every student would be able to gain in terms of knowledge and spirituality. Every student should gain education under the strict regimen of high morals, self-control and right thinking. On the other hand, they would also be expected to provide service to the society in general. This implies their respect towards society and social traditions and constant awareness towards their duties and responsibilities.

Gandhi also put forth expectation from teachers also. He thought that only the right type of teachers could help in achieving the objectives of education. He should be a lover of truth and non-violence and he should possess a sound base of knowledge, skill, enthusiasm, patriotism, dedication, love for children and labour, respect for the dignity of individuals and special training in the basic education.

The Teacher should be a man of action, not a man of slogan and should have a good moral character and a social bent of mind. He should lead a pure and simple life and be a man of ideals and a saga of examples.

Gandhian thoughts about education still holds a promise for a better tomorrow in the modern scenario of rapid scientific and technological advances.

RATIONALE OF STUDY

The modern materialistic India, which in the path of development, raises our standard of living but declines our standard of life i.e. the value of life. On account of population explosion, knowledge explosion (science and technology) and material explosion man has started moving towards the wrong path by considering material comforts of the world as real happiness. In the present society due to the spread of greed, self-aggrandizement, gross injustice, abuse of human rights, pervasion of power, insensitivity, dishonesty, thefts, bribery, smuggling, corruption, exploitation man are wallowing in the low and dark dimensions of his consciousness. Moral values are being throttled and the power of man is being misused. The growing influence of the negative aspects of Western culture in younger generation is stranded on the crossroads. To make youth conscious about such evils education based on moral and ethical values should be provided to them so that they become rational human beings and to know what is good, love 'good' and do 'good'.

It is the Gandhian Value System which can be used to re-invent idealistic and humane values among school students, but first these values must be inculcated in the teachers who are teaching them. The basic idea behind the value based education is that the education should not only enable a learner to earn more and but also to build his character. Similarly, value based teacher education aims at inculcating values in teachers in addition to merely concentrating on teaching skills and subject matter. It is evident from recent researches (Smith (2007), Curtner-Smith & Meek, 2000, Ram, A. R. S. 2001) that many approaches are being adapted to value orientation of teacher education i.e. meditation, yoga, religious education, social service etc.

With the above thought in vision, researchers made use of their position at oriental College of Education, and motivated students to participate in **Gandhi Vichar Sanskar Priksha-2018**, organized by Gandhi Research Foundation, Jalgaon, Maharashtra.

Following the guideline provided by Gandhi research foundation, the exam was conducted on 17th November, 2018 at 2:00 P.M. for B.Ed. students of both the years i.e. first year (FY) and second year (SY). Students were provided with literature on Gandhian philosophy prescribed by the foundation.

There were 25 students from F.Y. B.Ed and 8 students from S.Y. B.Ed. who enrolled for the GSVP-2018. But due to college change as per counselling schedules of Mumbai University, few students did not appear in the exam. 18 students from F.Y. B.Ed and 7 students from S.Y. B.Ed. appeared for the exam on 17th November, 2018.

In order to take a step further into this aim of finding the understanding level of Gandhian thoughts among our students, conducted pre-test and post-test on moral values, for which we used self-prepared 11-point scale of Multidimensional Morality containing 40 items measuring morality on 9 dimensions.

OBJECTIVES

1. To assess the attained understanding of B.Ed. Students about Gandhian Thoughts and values.
2. To analyze the influence of GSVP exam on moral values of participants of the exam.

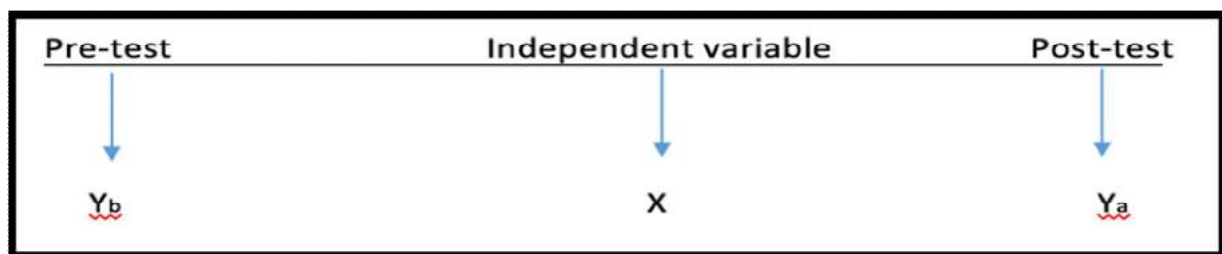
HYPOTHESES

For objective 2:

H_0 : there will no significant difference between the means of pretest and posttest on multidimensional morality.

RESEARCH DESIGN AND METHODOLOGY

The present study employed a simple research design without involvement of a control group. In this design the dependent variable i.e. multidimensional Morality (Y_b , pre-test) was measured before introduction of the independent variable i.e. influence of Gandhi Sanskar Vichar Preeksha (X) and again measured multidimensional Morality (Y_a , post-test) afterwards. The difference if any, between the two measurements (Y_b and Y_a) is computed and is ascribed to the manipulation of X .



First of all a pre-test was conducted on all the enrolled students i.e. 33 B.Ed students by administering Multidimensional Morality Scale.

After pretest the received books on Gandhian thoughts prescribed by Gandhi research foundation. Along with that, students were encouraged to read the material and discuss among themselves.

After giving them a good time i.e. 15 days for the said tasks, the GSVP exam was conducted on 17th November, 2018.

At last stage, after giving a gap of 20 days post-test was conducted on the same Multidimensional Morality Scale.

Sample

Sample for the study is volunteering. Students were asked to participate in the study on volunteer bases, which resulted in 33 B.Ed. students enrolled for GSVP but only 25 appeared for exam. Hence, only 25 students' data was used for the study.

Tool

1. Self-Prepared Multidimensional Morality Scale

11-point scale of Multidimensional Morality containing 40 items measuring morality on 9 dimensions. These dimensions are inspired and based on Gandhian philosophy.

Dimensions included in the scale:

S. No.	Dimension	Items
1.	Non-violence	1,2,3,4,7
2.	Self-discipline	17,22,23,30,31
3.	Truth	14,15,27,28,29
4.	Hording	19
5.	Dignity of labour	24,25,26
6.	Fearlessness	5,10,11
7.	Equality	6,8,12,13,18,33,34,35
8.	Patriotism and local goods	9,20,21,32
9.	Rural Development	36,37,38,39,40

2. Gandhi Sanskar Vichar Preeksha Question papers for B.Ed. F.Y. and B.Ed. S.Y. by Gandhi Research Foundation.

ANALYSES AND INTERPRETATION

To provide comprehensive and easy grasp, the collected data is procured to tabular forms this is followed by analyses and interpreting in a systematic manner. The whole report is in sync with the set objectives of the study.

Objective-1: To assess the attained understanding of B.Ed. Students about Gandhian Thoughts and value

Percentage analysis

The scores obtained on the GSVP examination was subjected to percentage analysis.

Table-1: Percentage Analyses of the Data

Range	Score on GSVP	No of students	Total Students	Percentage
Poor	0-10	00	25	0%
Below Average	10-20	02	25	8%
Average	20-40	10	25	40%
Above Average	30-40	08	25	32%
Good	40-50	07	25	28%
Very Good	50-60	01	25	4%
Excellent	60-70	00	25	0%

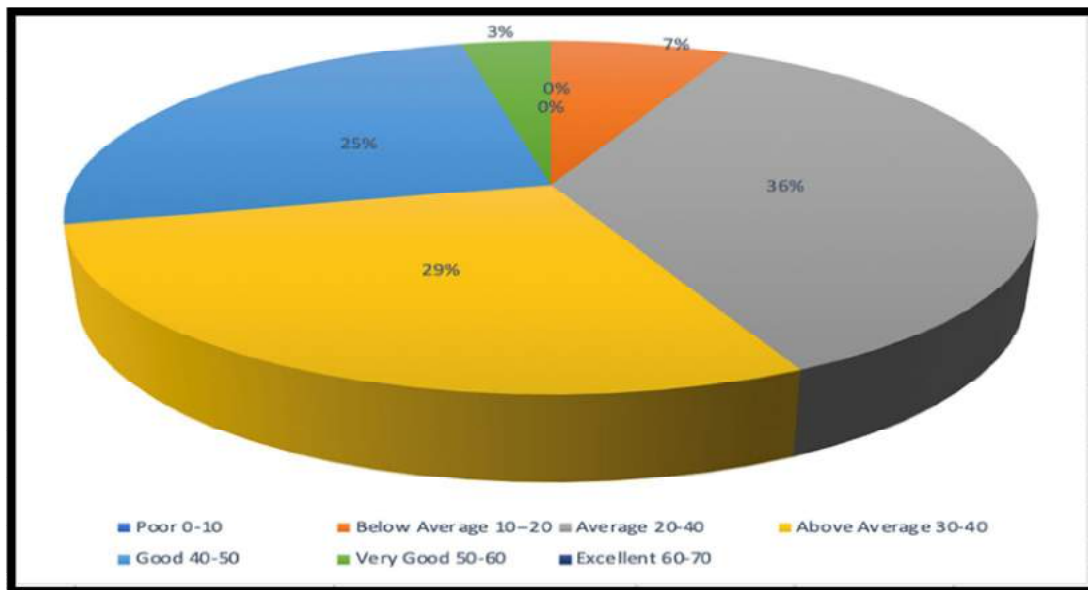


Table 1 and Pie-chart reveal that 0 out of 25 students i.e. 0% lies under poor range of score on GSVP Exam. 02 out of 25 student teacher i.e. 8% lie under below average range. Whereas 10 out of the 25 of student teachers i.e. 40% lies average category. 32 % of students i.e. 08 out of 25 students performed above average. 28 % students i.e. 07 out of 25 students performed good. Whereas only 01 (4%) student performed very good. And 0 student gained excellent marks.

Objective-2: To analyze the influence of GSVP exam on moral values of participants of the exam.

To find significance of difference between mean on pretest on multidimensional morality and mean of posttest on multidimensional morality.

Hypothesis Analyses

H_0 : there will no significant difference between the means of pretest and posttest on multidimensional morality.

In order determine significance of difference between pre-test mean and post-test mean, single sample correlated t-value was calculated.

N	Pretest Mean (Y_b)	Posttest Mean (Y_a)	Degree of Freedom	T-value	Calculated p-value
25	252.96	277.52	24	5.47	0.0001

The above table shows that t-value is 5.47 and found to be greater than critical value of t i.e. 2.797 at 0.01 level of significance with $df = 24$. So, the null hypothesis i.e. There is no significant difference between the means of pretest and posttest on multidimensional morality, is Rejected.

Therefore, it can be concluded from the given analysis that there is a statistically significant difference between pre-test mean and post-test mean. The difference can be subjected to the experimental treatment given to the sample group in form of Gandhi Sanskar Vichar Preeksha.

RESULT AND DISCUSSION

The percentage analyses of the scores obtained by B.Ed. students of First year and Second year revealed that almost none of the student performed at excellent end of the range. This may be subject to lack of presence of content related to Gandhian philosophy in academic curriculum and daily practices of young Indians. However, the pre-test and post-test revealed that there is significant influence of Gandhi Sanskar Vichar Preeksha and its study material on morality scale of students. It suggests that if students study life experiences of Gandhi ji's life and try to practice his values in their life then moral values of students of 21st century can be improved.

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INTERESTING PROPERTIES RELATED WITH THE CLASS OF GENERALIZED LUCAS SEQUENCES

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ABSTRACT

Lucas sequence $\{L_n\}_{n=0}^{\infty}$ is defined by the recurrence relation $L_n = L_{n-1} + L_{n-2}; n \geq 2$ with initial condition $L_0 = 2, L_1 = 1$. One of the generalizations of the Lucas sequence is the class of sequences

$\{L_n^{L(a,b)}\}_{n=0}^{\infty}$ generated by the recurrence relation

$$L_n^{L(a,b)} = \begin{cases} aL_{n-1}^{L(a,b)} + L_{n-2}^{L(a,b)} ; \text{when } n \text{ is odd} \\ bL_{n-1}^{L(a,b)} + L_{n-2}^{L(a,b)} ; \text{when } n \text{ is even} \end{cases} \quad (n \geq 2)$$

with initial condition $L_0^{L(a,b)} = 2, L_1^{L(a,b)} = 1$ and a, b are positive integers. The Lucas sequence is a special case of these sequences with $a = b = 1$. We define $\{F_n^{L(a,b)}\}_{n=0}^{\infty}$ to be the sequence of generalized Fibonacci numbers with the similar recurrence relation to that of $L_n^{L(a,b)}$ with the initial condition $F_0^{L(a,b)} = 0, F_1^{L(a,b)} = 1$. In this paper we obtain relation between extended Binet's formula for $\{L_n^{L(a,b)}\}_{n=0}^{\infty}$ and extended Binet's formula for $\{F_n^{L(a,b)}\}_{n=0}^{\infty}$. We also derive some interesting properties of this Generalized Lucas sequence.

Keywords: Lucas sequence, Generalized Lucas sequence, Binet formula.

I. INTRODUCTION

In recent years, many interesting properties of classic Fibonacci numbers, classic Lucas number and their generalizations have been studied by researchers which are applied to almost every field of science and art. Cennet, Ahmet, Hasan [1], Kenan, Adem [9] and Shah, Shah [13] defined new generalizations of Lucas sequence and gave various identities along with extended Binet formula for the concerned new generalizations. For the rich and related applications of Lucas numbers, one can refer to the nature and different areas of the science [2, 5, 6, 7, 8, 10]. The classic Lucas sequence $\{L_n\}$ is defined as

$$L_0 = 2, L_1 = 1 \text{ and } L_n = L_{n-1} + L_{n-2}; \text{ for } n \geq 2.$$

The first few terms of the Lucas sequence are: 2, 1, 3, 4, 7, 11, 18, 29, 47, 76, 123, 199, 322, 521, (Koshy [9]) We define a new generalization of the Fibonacci (Lucas) sequence and call it the *generalized Fibonacci (Lucas) sequence*.

Definition: For any two positive numbers a and b , the *generalized Fibonacci sequence* $\{F_n^{L(a,b)}\} (= \{F_n^L\})$ is defined by the recurrence relation $F_n^L = a^{\chi(n)} b^{1-\chi(n)} F_{n-1}^L + F_{n-2}^L$, where $F_0^L = 0, F_1^L = 1; a, b$ are any two positive integers and $\chi(n) = \begin{cases} 1; \text{ if } n \text{ is odd} \\ 0; \text{ if } n \text{ is even} \end{cases}$.

This can be equivalently expressed as

$$F_n^{L(a,b)} = \begin{cases} aF_{n-1}^{L(a,b)} + F_{n-2}^{L(a,b)} ; \text{when } n \text{ is odd} \\ bF_{n-1}^{L(a,b)} + F_{n-2}^{L(a,b)} ; \text{when } n \text{ is even} \end{cases} \quad (n \geq 2) \text{ with } F_0^L = 0, F_1^L = 1 \quad (1.1)$$

Diwan, Shah [4] obtained the extended Binet Formula for F_n^L as

$$F_n^L = \frac{b^{1-\chi(n)}}{(ab)^{\lfloor n/2 \rfloor}} \left(\frac{\alpha^n - \beta^n}{\alpha - \beta} \right), \tag{1.2}$$

where $\alpha = \frac{ab + \sqrt{a^2b^2 + 4ab}}{2}$, $\beta = \frac{ab - \sqrt{a^2b^2 + 4ab}}{2}$. Here we note that $\frac{\alpha^2}{ab} = \alpha + 1$ and $\frac{\beta^2}{ab} = \beta + 1$.

Definition: For any two positive numbers a and b , the *generalized Lucas sequence* $\{L_n^{L(a,b)}\} (= \{L_n^L\})$ is defined by the recurrence relation

$$L_n^L = \alpha^{\chi(n)} b^{1-\chi(n)} L_{n-1}^L + L_{n-2}^L,$$

where $L_0^L = 2, L_1^L = 1$; a, b are any two positive integers and $\chi(n) = \begin{cases} 1; & \text{if } n \text{ is odd} \\ 0; & \text{if } n \text{ is even} \end{cases}$

This can be equivalently expressed as

$$L_n^L = \begin{cases} aL_{n-1}^L + L_{n-2}^L; & \text{if } n \text{ is odd} \\ bL_{n-1}^L + L_{n-2}^L; & \text{if } n \text{ is even} \end{cases} \quad (n \geq 2) \tag{1.3}$$

with $L_0^L = 2, L_1^L = 1$.

The Lucas sequence is a special case of these sequences with $a = b = 1$.

Diwan, Shah [3] obtained the extended Binet formula for L_n^L defined by

$$L_n^L = \frac{1}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma \alpha^n - \delta \beta^n}{\alpha - \beta} \right) \tag{1.4}$$

where $\alpha = \frac{ab + \sqrt{a^2b^2 + 4ab}}{2}$, $\beta = \frac{ab - \sqrt{a^2b^2 + 4ab}}{2}$, $\gamma = (b - 2ab + 2\alpha)$, $\delta = (b - 2ab + 2\beta)$.

In this paper we derive relation between extended Binet's formula for $\{L_n^{L(a,b)}\}_{n=0}^{\infty}$ and extended Binet's formula for $\{F_n^{L(a,b)}\}_{n=0}^{\infty}$. Also we derive some of its interesting properties.

2 Relation Between L_n^L and F_n^L

We express L_n^L in terms of F_n^L using the extended Binet's formulae (1.2) and (1.4).

Theorem 2.1: For $\alpha = \frac{ab + \sqrt{a^2b^2 + 4ab}}{2}$, $\beta = \frac{ab - \sqrt{a^2b^2 + 4ab}}{2}$, $\gamma = (b - 2ab + 2\alpha)$,

$\delta = (b - 2ab + 2\beta)$, the following holds: (a) $L_n^L = \frac{\gamma F_n^L}{b} + \frac{2\beta^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}}$

(b) $L_n^L = \frac{\delta F_n^L}{b} + \frac{2\alpha^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}}$.

Proof: From (1.2), we have $F_n^L = \frac{b^{1-\chi(n)}}{(ab)^{\lfloor n/2 \rfloor}} \left(\frac{\alpha^n - \beta^n}{\alpha - \beta} \right)$.

This gives $\alpha^n = \frac{F_n^L (\alpha - \beta) (ab)^{\lfloor n/2 \rfloor}}{b^{1-\chi(n)}} + \beta^n$ and $\beta^n = \alpha^n - \frac{F_n^L (\alpha - \beta) (ab)^{\lfloor n/2 \rfloor}}{b^{1-\chi(n)}}$.

Again by (2.2), we have $L_n^L = \frac{1}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma \alpha^n - \delta \beta^n}{\alpha - \beta} \right)$, where $\gamma = (b - 2ab + 2\alpha)$,

$\delta = (b - 2ab + 2\beta)$.

Substituting above value of α^n in L_n^L , we get

$$L_n^L = \frac{1}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma F_n^L(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor}}{b^{1-\chi(n)}} + \gamma\beta^n - \delta\beta^n \right)$$

$$= \frac{(\gamma-\delta)\beta^n}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} + \frac{\gamma F_n^L(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor}}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)+1-\chi(n)}}.$$

But $\gamma - \delta = b - 2ab + 2\alpha - 2\beta + 2ab - b = 2(\alpha - \beta)$.

Thus $L_n^L = \frac{2(\alpha-\beta)\beta^n}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} + \frac{\gamma F_n^L}{b}$ and hence $L_n^L = \frac{\gamma F_n^L}{b} + \frac{2\beta^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}}.$

Likewise substituting the value of β^n in L_n^L , we get

$$L_n^L = \frac{1}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\delta F_n^L(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor}}{b^{1-\chi(n)}} + \gamma\alpha^n - \delta\alpha^n \right)$$

$$= \frac{(\gamma-\delta)\alpha^n}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} + \frac{\delta F_n^L(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor}}{(\alpha-\beta)(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)+1-\chi(n)}}$$

Since $\gamma - \delta = b - 2ab + 2\alpha - 2\beta + 2ab - b = 2(\alpha - \beta)$, we finally get

$$L_n^L = \frac{\delta F_n^L}{b} + \frac{2\alpha^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}}.$$

Next we obtain one more result which gives the relation between L_n^L and F_n^L . We need the following results by to obtain this relation.

Lemma 2.2 : (Diwan, Shah [3])

(a) $L(x) = \frac{((2a-1)x^2 - (2ab+2-b)x + 2)}{(x^4 - (ab+2)x^2 + 1)}$

b) $L(x) = \frac{1}{(\alpha-\beta)} \left\{ \sum_{n=0}^{\infty} \left(\frac{(1-2a)(ab)^{n+1}(\beta^{2n+1} - \alpha^{2n+1})}{(-ab)^{2n+1}} + 2a \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} \right) x^{2n+1} \right\}$
 $+ \frac{1}{(\alpha-\beta)} \left\{ \sum_{n=0}^{\infty} \left((b - 2ab - 2) \frac{(\alpha^{2n} - \beta^{2n})}{(ab)^n} + 2 \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} \right) x^{2n} \right\}.$

Theorem 2.3 : $L_n^L = \frac{\gamma^{\chi(n)} \delta^{1-\chi(n)} F_n^L}{b^{1-\chi(n)}} + \frac{2\alpha^{\chi(n)}}{(ab)^{\lfloor n/2 \rfloor}} \left\{ \begin{aligned} &\frac{(ab)^{\lfloor n/2 \rfloor} F_{n+1}^L}{b^{1-\chi(n+1)}} \left(\frac{1-(-1)^n}{2} \right) \\ &+ \frac{(ab)^{\lfloor n/2 \rfloor} F_{n+2}^L}{b^{1-\chi(n+2)}} \left(\frac{1+(-1)^n}{2} \right) \end{aligned} \right\}.$

Proof: By above lemma we have

$$L(x) = \frac{1}{(\alpha-\beta)} \sum_{n=0}^{\infty} \left\{ \frac{(1-2a)(ab)^{n+1}(\beta^{2n+1} - \alpha^{2n+1})}{(-ab)^{2n+1}} + 2a \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} \right\} x^{2n+1}$$

$$+ \frac{1}{(\alpha-\beta)} \sum_{n=0}^{\infty} \left\{ (b - 2ab - 2) \frac{(\alpha^{2n} - \beta^{2n})}{(ab)^n} + 2 \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} \right\} x^{2n}$$

$$= \frac{1}{(\alpha-\beta)} \sum_{n=0}^{\infty} \left\{ \frac{(1-2a)(\alpha^{2n+1} - \beta^{2n+1})}{(ab)^n} x^{2n+1} + (b - 2ab - 2) \frac{(\alpha^{2n} - \beta^{2n})}{(ab)^n} x^{2n} \right\}$$

$$+ \frac{2}{\alpha-\beta} \sum_{n=0}^{\infty} \left\{ a \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} x^{2n+1} + \frac{(\alpha^{2n+2} - \beta^{2n+2})}{(ab)^{n+1}} x^{2n} \right\}.$$

$$\therefore L(x) = \sum_{n=0}^{\infty} \frac{\gamma^{\chi(n)} \delta^{1-\chi(n)}}{(ab)^{\lfloor n/2 \rfloor}} \left(\frac{\alpha^n - \beta^n}{\alpha - \beta} \right) x^n + 2 \sum_{n=0}^{\infty} \frac{\alpha^{\chi(n)}}{(ab)^{\lfloor n/2 \rfloor}} \left\{ \begin{aligned} &\left(\frac{\alpha^{n+1} - \beta^{n+1}}{\alpha - \beta} \right) \left(\frac{1-(-1)^n}{2} \right) \\ &+ \left(\frac{\alpha^{n+2} - \beta^{n+2}}{\alpha - \beta} \right) \left(\frac{1+(-1)^n}{2} \right) \end{aligned} \right\} x^n$$

$$\therefore L_n^L = \frac{\gamma^{\chi(n)} \delta^{1-\chi(n)}}{(ab)^{\lfloor \frac{n}{2} \rfloor}} \left(\frac{\alpha^n - \beta^n}{\alpha - \beta} \right) + \frac{2\alpha^{\chi(n)}}{(ab)^{\lfloor \frac{n+2}{2} \rfloor}} \left\{ \left(\frac{\alpha^{n+1} - \beta^{n+1}}{\alpha - \beta} \right) \left(\frac{1 - (-1)^n}{2} \right) \right. \\ \left. + \left(\frac{\alpha^{n+2} - \beta^{n+2}}{\alpha - \beta} \right) \left(\frac{1 + (-1)^n}{2} \right) \right\}$$

Since by 1.2, we have $F_n^L = \frac{b^{1-\chi(n)}}{(ab)^{\lfloor \frac{n}{2} \rfloor}} \left(\frac{\alpha^n - \beta^n}{\alpha - \beta} \right)$, we get

$$L_n^L = \frac{\gamma^{\chi(n)} \delta^{1-\chi(n)} F_n^L}{b^{1-\chi(n)}} + \frac{2\alpha^{\chi(n)}}{(ab)^{\lfloor \frac{n+2}{2} \rfloor}} \left\{ \frac{(ab)^{\lfloor \frac{n+1}{2} \rfloor} F_{n+1}^L}{b^{1-\chi(n+1)}} \left(\frac{1 - (-1)^n}{2} \right) \right. \\ \left. + \frac{(ab)^{\lfloor \frac{n+2}{2} \rfloor} F_{n+2}^L}{b^{1-\chi(n+2)}} \left(\frac{1 + (-1)^n}{2} \right) \right\}.$$

3. Sums Involving Binomial Coefficients

We use extended Binet’s formula for L_n^L and the binomial theorem to derive two identities which gives the value of L_{2n}^L and L_{2n+1}^L .

Theorem 3.1.1: For any non-negative integer n , the following holds:

- (a) $\sum_{k=0}^n \binom{n}{k} b^{\chi(k)} (ab)^{\lfloor \frac{k}{2} \rfloor} L_k^L = L_{2n}^L$
- (b) $\sum_{k=0}^n \binom{n}{k} b^{\chi(k+1)} (ab)^{\lfloor \frac{k+1}{2} \rfloor} L_{k+1}^L = bL_{2n+1}^L$.

Proof. (a) $\sum_{k=0}^n \binom{n}{k} b^{\chi(k)} (ab)^{\lfloor \frac{k}{2} \rfloor} L_k^L$
 $= \sum_{k=0}^n \binom{n}{k} b^{\chi(k)} (ab)^{\lfloor \frac{k}{2} \rfloor} \frac{1}{b^{\chi(k)} (ab)^{\lfloor \frac{k}{2} \rfloor}} \left(\frac{\gamma \alpha^k - \delta \beta^k}{\alpha - \beta} \right)$
 $= \frac{1}{\alpha - \beta} \sum_{k=0}^n \binom{n}{k} (\gamma \alpha^k - \delta \beta^k)$
 $= \frac{1}{\alpha - \beta} \left(\gamma \sum_{k=0}^n \binom{n}{k} \alpha^k - \delta \sum_{k=0}^n \binom{n}{k} \beta^k \right)$
 $= \frac{1}{\alpha - \beta} \{ \gamma (\alpha + 1)^n - \delta (\beta + 1)^n \}$
 $= \frac{1}{\alpha - \beta} \left\{ \gamma \left(\frac{\alpha^2}{ab} \right)^n - \delta \left(\frac{\beta^2}{ab} \right)^n \right\}$
 $= \frac{1}{\alpha - \beta} \left(\frac{\gamma \alpha^{2n} - \delta \beta^{2n}}{(ab)^n} \right)$
 $= \frac{(\alpha^{2n} - \beta^{2n})}{(\alpha - \beta) (ab)^{\lfloor \frac{2n}{2} \rfloor} b^{\chi(2n)}} = L_{2n}^L$

(b) $\sum_{k=0}^n \binom{n}{k} b^{\chi(k+1)} (ab)^{\lfloor \frac{k+1}{2} \rfloor} L_{k+1}^L = bL_{2n+1}^L$

L.H.S = $\sum_{k=0}^n \binom{n}{k} b^{\chi(k+1)} (ab)^{\lfloor \frac{k+1}{2} \rfloor} L_{k+1}^L$
 $= \sum_{k=0}^n \binom{n}{k} b^{\chi(k+1)} (ab)^{\lfloor \frac{k+1}{2} \rfloor} \frac{(\alpha^{k+1} - \beta^{k+1})}{b^{\chi(k+1)} (ab)^{\lfloor \frac{k+1}{2} \rfloor} (\alpha - \beta)}$
 $= \frac{1}{\alpha - \beta} \left\{ \sum_{k=0}^n \binom{n}{k} (\gamma \alpha^{k+1} - \delta \beta^{k+1}) \right\}$
 $= \frac{1}{\alpha - \beta} \left\{ \alpha \gamma \sum_{k=0}^n \binom{n}{k} \alpha^k - \beta \delta \sum_{k=0}^n \binom{n}{k} \beta^k \right\}$

$$\begin{aligned}
 &= \frac{1}{\alpha-\beta} \{ \alpha \gamma (\alpha + 1)^n - \beta \delta (\beta + 1)^n \} \\
 &= \frac{1}{\alpha-\beta} \left\{ \alpha \gamma \left(\frac{\alpha^2}{ab} \right)^n - \beta \delta \left(\frac{\beta^2}{ab} \right)^n \right\} \\
 &= \frac{1}{\alpha-\beta} \left\{ \frac{\gamma \alpha^{2n+1} - \delta \beta^{2n+1}}{(ab)^n} \right\} = \frac{b^{\chi(2n+1)}}{\alpha-\beta} \left\{ \frac{\gamma \alpha^{2n+1} - \delta \beta^{2n+1}}{(ab)^{\lfloor \frac{2n+1}{2} \rfloor} b^{\chi(2n+1)}} \right\} \\
 &= bL_{2n+1}^L.
 \end{aligned}$$

We now derive exponential generating function for $\frac{L_{nk}^L}{n!}$ as well as for $\frac{L_{nk}^L}{n!}$ and use it to derive an interesting result for L_{2n}^L .

Lemma 3.2: (a) $\frac{1}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma e^{\alpha x} - \delta e^{\beta x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} L_n^L \frac{x^n}{n!}$

(b) $\frac{1}{b^{\chi(nk)} (ab)^{\lfloor nk/2 \rfloor}} \left(\frac{\gamma e^{\alpha^k x} - \delta e^{\beta^k x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} L_{nk}^L \frac{x^n}{n!}$.

Proof: We have $e^t = \sum_{n=0}^{\infty} \frac{t^n}{n!}$. This gives $\frac{\gamma e^{\alpha x}}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)} (\alpha - \beta)} = \sum_{x=0}^{\infty} \frac{\gamma \alpha^n x^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)} (\alpha - \beta) n!}$ and

$$\frac{\delta e^{\beta x}}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)} (\alpha - \beta)} = \sum_{x=0}^{\infty} \frac{\delta \beta^n x^n}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)} (\alpha - \beta) n!}.$$

Thus

$$\frac{1}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma e^{\alpha x} - \delta e^{\beta x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} \frac{1}{(ab)^{\lfloor n/2 \rfloor} b^{\chi(n)}} \left(\frac{\gamma \alpha^n - \delta \beta^n}{\alpha - \beta} \right) \frac{x^n}{n!} = \sum_{n=0}^{\infty} L_n^L \frac{x^n}{n!}$$

and $\frac{1}{b^{\chi(nk)} (ab)^{\lfloor nk/2 \rfloor}} \left(\frac{\gamma e^{\alpha^k x} - \delta e^{\beta^k x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} \frac{1}{b^{\chi(nk)} (ab)^{\lfloor nk/2 \rfloor}} \left(\frac{\gamma \alpha^{nk} - \delta \beta^{nk}}{\alpha - \beta} \right) \frac{x^n}{n!} = \sum_{n=0}^{\infty} L_{nk}^L \frac{x^n}{n!}$, as required.

We use these results to prove the following interesting identity:

Theorem 3.3 : $L_{2n}^L = (ab)^n \sum_{k=0}^{\infty} \binom{n}{k} L_k^L$.

Proof: It is known that if $A(t) = \sum_{n=0}^{\infty} \frac{a_n t^n}{n!}$ and $B(t) = \sum_{n=0}^{\infty} \frac{b_n t^n}{n!}$, then

$$A(t)B(t) = \sum_{n=0}^{\infty} \left(\sum_{k=0}^n \binom{n}{k} a_k b_{n-k} \right) \frac{t^n}{n!}. \text{ (Koshy [9] p.p. 233)}$$

Now, in particular, if we take $A(x) = C \left(\frac{\gamma e^{\alpha x} - \delta e^{\beta x}}{\alpha - \beta} \right)$ and $B(x) = e^x$, where $C = \frac{1}{b^{\chi(nk)} (ab)^{\lfloor nk/2 \rfloor}}$, then

$$C \left(\frac{\gamma e^{\alpha x} - \delta e^{\beta x}}{\alpha - \beta} \right) e^x = C \left(\frac{\gamma e^{(\alpha+1)x} - \delta e^{(\beta+1)x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} \left(\sum_{k=0}^n \binom{n}{k} L_k^L \right) \frac{x^n}{n!}.$$

This gives

$$C \left(\frac{\gamma e^{(\alpha^2/ab)x} - \delta e^{(\beta^2/ab)x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} \left(\sum_{k=0}^n \binom{n}{k} L_k^L \right) \frac{x^n}{n!}. \tag{3.1}$$

But $C \left(\frac{\gamma e^{(\alpha^2/ab)x} - \delta e^{(\beta^2/ab)x}}{\alpha - \beta} \right) = \sum_{n=0}^{\infty} C \left(\frac{\gamma ((\alpha^2/ab))^n - \delta ((\beta^2/ab))^n}{\alpha - \beta} \right) \frac{x^n}{n!}$

$$= \sum_{n=0}^{\infty} C \left(\frac{1}{ab} \right)^n \left(\frac{\gamma \alpha^{2n} - \delta \beta^{2n}}{\alpha - \beta} \right) \frac{x^n}{n!}$$

$$= \sum_{n=0}^{\infty} \left(\frac{1}{ab}\right)^n L_{2n}^L \frac{x^n}{n!} \tag{3.2}$$

Thus by (3.1) and (3.2), we have $\sum_{n=0}^{\infty} \left(\sum_{k=0}^n \binom{n}{k} L_k^L\right) \frac{x^n}{n!} = \sum_{n=0}^{\infty} \left(\frac{1}{ab}\right)^n L_{2n}^L \frac{x^n}{n!}$.

This finally gives $L_{2n}^L = (ab)^n \sum_{k=0}^n \binom{n}{k} L_k^L$.

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PHOTOLUMINESCENCE PROPERTIES OF $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}:\text{Eu}^{3+}$ RED EMITTING PHOSPHORB. V. Tupte¹, D. H. Gahane² and S. V. Moharil³¹Department of Physics, S.G.M. College Kurkheda²Department of Physics, N. H. College, Bramhapuri³Ex-Head Department of Physics RTM Nagpur University, Nagpur

ABSTRACT

Novel $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}:\text{Eu}^{3+}$ phosphor ($x=0.01, 0.03, 0.07$ and 0.09 mole %) molybdate red phosphors had been synthesized via using a combustion Method at as temperature 750°C . The phase formation of the samples was investigated by way of X-ray diffraction measurements. The excitation and emission spectra indicated that this phosphor could be excited successfully by the visible light, and then emitted red light with the peaks positioned at 617nm . Upon 393 nm near – UV excitation, this phosphor show characteristic fluorescence ${}^5\text{D}_0 \rightarrow {}^7\text{F}_j$ ($J = 0, 1, 2, 3, 4$) of the Eu^{3+} ions. The electronic transition located at 617 nm corresponding to ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ of Eu^{3+} ions, which is superior than the magnetic dipole transition located at 593 nm corresponding to ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$ of Eu^{3+} ions. Different pathways concerned in emission process have been studied. Concentration quenching has been observed for Eu^{3+} concentration 7%. Eu^{3+} doped $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}$ is a promising phosphor for applications in displays and optical devices.

Keywords: Combustion Method, Crystal Structure, Molybdates, Photoluminescence, Phosphor,

1. INTRODUCTION

White LEDs, the next generation of solid state lighting, have got much deliberate attention recently due to their leverage over conventional light sources such as, high efficiency, long life time, energy saving, stability, environmental friendly, no pollutant and have potential applications in many fields such as devices like indicators, back lights, automobile headlights and general illumination, etc. [1-4]. Now-a-days, special attention is focused on discovering a novel red phosphor which is thermally and chemically more stable and also shows better luminous efficiency than the conventional ($\text{Y}_2\text{O}_2\text{S}:\text{Eu}^{3+}$) sulphide based red phosphors. To obtain a red emitting phosphor among many rare earth ions, Eu^{3+} is the best choice as an activator ion because it can be effectively excited by near-UV and blue light and then emit stronger red fluorescence ascribed to ${}^5\text{D}_0 - {}^7\text{F}_j$ ($J = 0, 1, 2, 3$) transitions [5,6].

In this study, we have designed $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($0.01, 0.03, 0.07$ & 0.09 mole) phosphors by combustion synthesis process. In addition, the influences of the doping Eu^{3+} ions concentration on the microstructures and luminescent properties of the obtained $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ red-emitting phosphors have been discussed in detail. The red emission intensity of the combustion synthesis prepared sample has been compared with that of the commercially used $\text{Y}_2\text{O}_2\text{S}:\text{Eu}^{3+}$ red phosphors to elucidate the advantage of combustion synthesis. Our results may provide new insights into the research and applications of the $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ phosphor materials.

2. EXPERIMENTAL

The Eu^{3+} activated $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ (where $x = 0.01, 0.03, 0.07$ & 0.09 mole) phosphors were prepared by the combustion synthesis. The starting AR grade materials (99.99% purity) were taken as strontium nitrate ($\text{Sr}(\text{NO}_3)_2$), magnesium nitrate ($\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$), ammonium molybdate ($(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$), Lanthanum Oxide (La_2O_3), Eu oxide (Eu_2O_3) & Urea (NH_2CONH_2) was used as fuel.

In the present investigation, materials were prepared according to the chemical formula $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ (where $x = 0.01, 0.03, 0.07$ & 0.09 mole). The mixture of reagents was grind together to obtain a homogeneous powder. La^{3+} and Eu^{3+} ions were introduced as a $\text{La}(\text{NO}_3)_3$ and $\text{Eu}(\text{NO}_3)_3$ solution by dissolving La_2O_3 and Eu_2O_3 into a dil. HNO_3 solution. The molar ratio of the rare earth was varied in $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ (where $x = 0.01, 0.03, 0.07$ & 0.09 mole) phosphors relative to the Sr/La/Mg/Mo ions. For various compositions of the metal nitrates (oxidizers), the amount of urea (fuel) was calculated maintaining total oxidizing and reducing valences of the components equal to unity, so that the heat liberated during combustion is a maximum [7]. After stirring for about 30 min, the precursor solution was transferred to a furnace which was preheated to 750°C . Porous products were obtained. Rare-earth ion doped $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ (where $x = 0.01, 0.03, 0.07$ & 0.09 mole) phosphors were prepared by introducing Eu ion as $\text{Eu}(\text{NO}_3)_3$ solutions with different concentrations, respectively, and the processes were repeated as explained above.

3. RESULTS AND DISCUSSION

3.1 XRD and Size Distribution Characterization

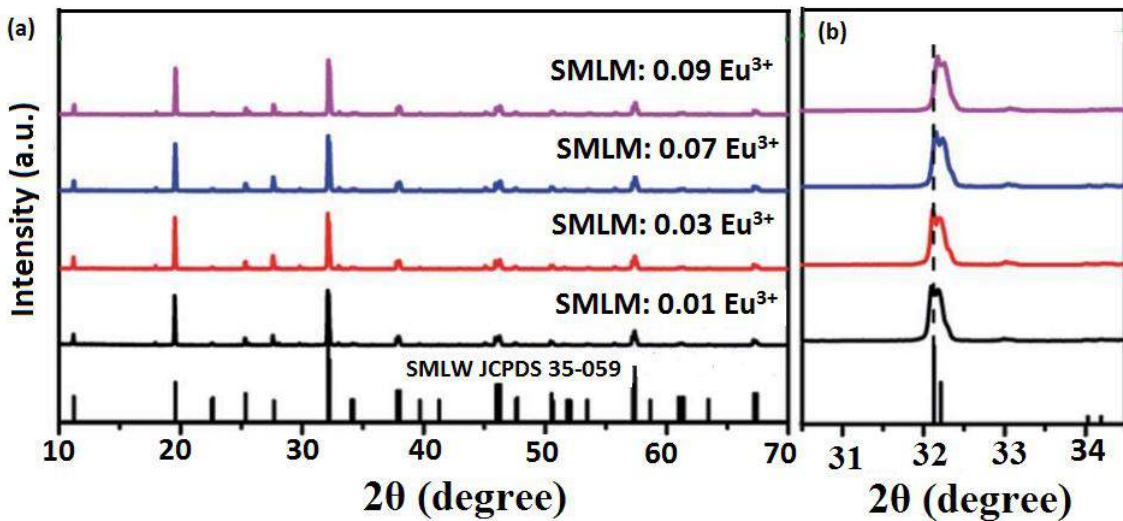


Fig-1: (a) The XRD patterns of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:x\text{Eu}^{3+}$ ($x = 0.01, 0.03, 0.07$ & 0.09 mole) phosphors and the standard PDF card SMLW (JCPDS # 35-0259). (b) The local XRD patterns in the 2θ range from 30.5 to 34.5 degree.

Fig. 1 (a) shows the XRD patterns of the as-prepared $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:x\text{Eu}^{3+}$ (SMLM: $x\text{Eu}^{3+}$) ($x = 0.01, 0.03, 0.07$ & 0.09 mole) and the standard PDF card of SMLW (JCPDS # 35-0259). The XRD patterns of the samples matched well with the standard data of SMLW (JCPDS # 35-0259) except that there were two weak impurity peaks due to the SrWO_4 (JCPDS # 08-0490). This result indicated that doping Eu^{3+} into SMLM did not make significant changes to the host crystal structure. According to the local XRD patterns in the 2θ range of 30.5 – 34.5 degree shown in Fig. 1. (b), we can find that the XRD diffraction peaks slightly shifted to the larger angle in comparison with the standard data when the Eu^{3+} doping concentration was increased for the reason that the smaller ions Eu^{3+} ($r = 0.53 \text{ \AA}$) substituted larger ions Mo^{6+} ($r = 0.62 \text{ \AA}$) in the SMLM host which resulted in the expansion of the lattice on the basis of Bragg equation ($2d\sin\theta = \lambda$, where d , θ , and λ refer to crystal surface spacing, diffraction angle, and X-ray wavelength, respectively). The results further confirmed the above conclusion that Eu^{3+} ions can occupy the sites of Mo^{6+} ions

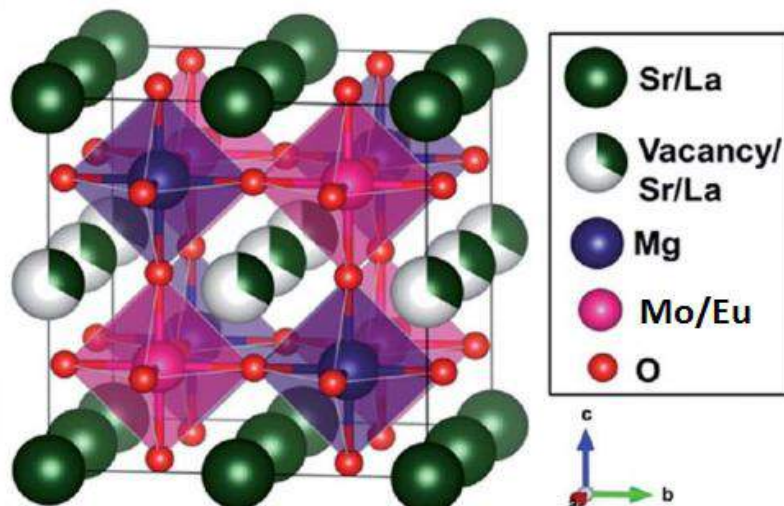


Fig-2: The crystal structure of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\% \text{Eu}^{3+}$ phosphors

According to the refinement results, we can find that the crystal structure of SMLM:0.07 Eu^{3+} belongs to orthorhombic crystal system with the P222 space group, and the cell parameters were calculated to be $a = 7.8465 \text{ \AA}$, $b = 7.8627 \text{ \AA}$, $c = 7.9014 \text{ \AA}$, $a=90$, $b= 90$, $g= 90$, and $V = 487.47 \text{ \AA}^3$. The crystal structure of SMLM: 0.07 Eu^{3+} included $[\text{MgO}_6]$ and $[\text{MoO}_6]$ octahedrons formed by Mg and Mo atoms coordinated with six oxygen atoms around respectively, as can be seen in Fig. 2. As well-known, Eu^{3+} ions can occupy the cation sites of octahedrons.[8] In this work, Eu^{3+} ions were more likely to occupy the site of Mo^{6+} because the radius of Eu^{3+} ion (0.53 \AA) is much closer to that of Mo^{6+} ion (0.62 \AA) than Mg^{2+} ion (0.72 \AA). [9,10]

3.2 Photoluminescence Properties of $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}:\text{Eu}^{3+}$

Fig. 3 shows the excitation spectra of the obtained $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($x=0.07$ mole) phosphors monitored with 617 nm emission. One can see that all the $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ phosphors exhibit the similar excitation spectra with the various intensities. There are excitation peak located at 393nm, which are assigned to ${}^7\text{F}_0 \rightarrow {}^5\text{L}_6$ transition come from 4f orbital of Eu^{3+} ions, respectively. Moreover, each excitation spectrum also has a strongest charge transition band from 250 to 400 nm centered at around 340 nm, which is attributed to the intense charge transition from 2p orbital of O^{2-} ions to the 4d orbital of Mo^{6+} ions.

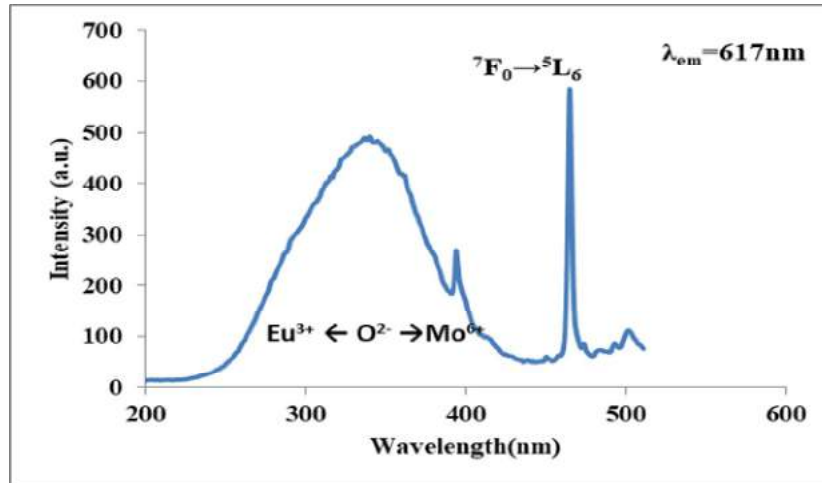


Fig-3: PLE spectra of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($x=0.07$ mole%) phosphors monitored at 617 nm.

Clearly, all the obtained $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($x=0.03$) phosphors have strongest charge transition band (CTB) at 340 nm, indicating that the near ultraviolet absorbed energy by the $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ phosphors can efficiently transfer to the luminescent center. And it means that the as-fabricated phosphors can be effectively excited from near ultraviolet (NUV) to blue light, suggesting that they can be used as the promising red-emitting luminescence materials for WLEDs.

Fig. 4 depicts the emission spectra of the obtained $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($x = 0.01, 0.03, 0.07$ and 0.09 mol) phosphors under excitation of 395 nm NUV light respectively. As can be seen, the emission spectra obtained at two excitation wavelengths both exhibit the two characteristic emission peaks located at 594 and 617 nm, which are assigned to ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$ transition and ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transition of Eu^{3+} ion, respectively. As well known, the ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$ transition located at around 594 nm is magnetic dipole transition and the ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transition around at 617 nm is electrical dipole transition of Eu^{3+} ions.

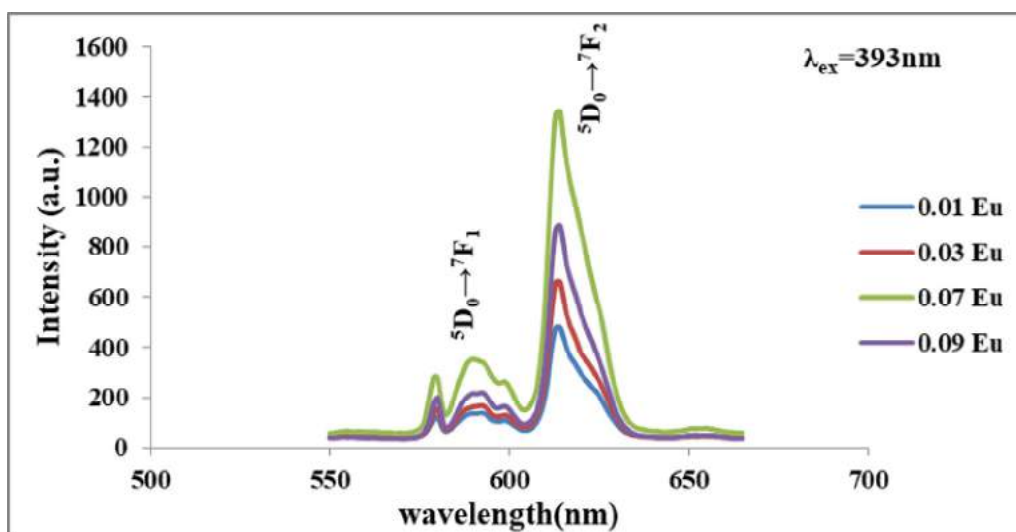


Fig-4: Photoluminescence emission spectrum of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:\text{xEu}^{3+}$ ($x = 0.01, 0.03, 0.07$ and 0.09 mol) phosphors under 393 nm excitation.

The magnetic dipole transition (${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$) is insensitive to the site symmetry, whereas the electric dipole transition (${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$) is a hypersensitive transition. Generally, the intensities of ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$ and ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transition depend on the local symmetry of the crystal field of Eu^{3+} ion. When the doped- Eu^{3+} ions are situated in the crystal lattice without inversion symmetry, the ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ hypersensitive electric dipole transition will dominate.

Oppositely, if the doped-Eu³⁺ ions are situated at a site with inversion symmetry, the ⁵D₀→⁷F₁ magnetic dipole transition will be dominant. Clearly, the ⁵D₀→⁷F₂ emission peaks are much stronger than the ⁵D₀→⁷F₁ emission peaks in all the obtained Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ (x = 0.01, 0.03, 0.07 & 0.09 mole) phosphors, suggesting that the Eu³⁺ ion locates in the sites without inversion symmetry in the host crystal lattice [11–12].

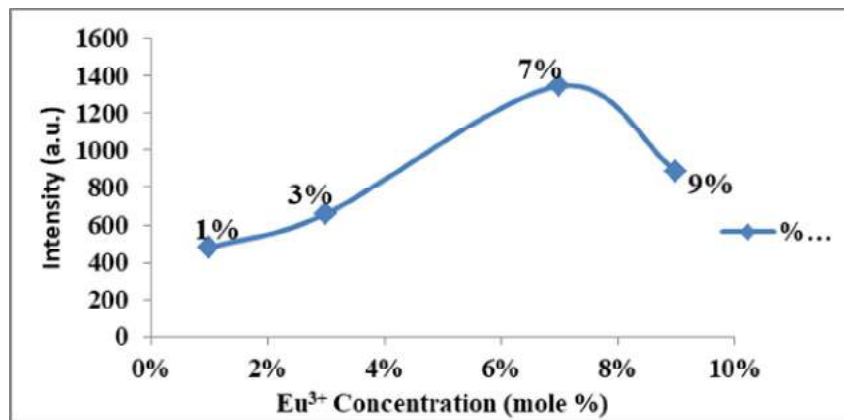


Fig-5: Luminescence intensity of Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ (x = 0.01,0.03,0.07 & 0.09 mole) as function of Eu³⁺ concentration.

Furthermore, the emission intensities of Eu³⁺ for the obtained Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ phosphors are dependent on the doping Eu³⁺ ion concentration, and the dependence of excitation intensity (395 nm) and emission intensity (617 nm) on x are given in fig. 5. It is observed that from fig.6.5, the intensities of the ⁷F₀→⁵D₂ excitation peak (395 nm) of the obtained Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ phosphors initially increase and then sharply decrease with the increasing x, giving the maximum at x=0.07 mole. These results indicate that there is a non-radiative energy migration between Eu³⁺ ion with different sites, which would result in concentration quenching effect. Concentration quenching may occur because the excitation energy migrates about a large number of centers before being emitted [13].

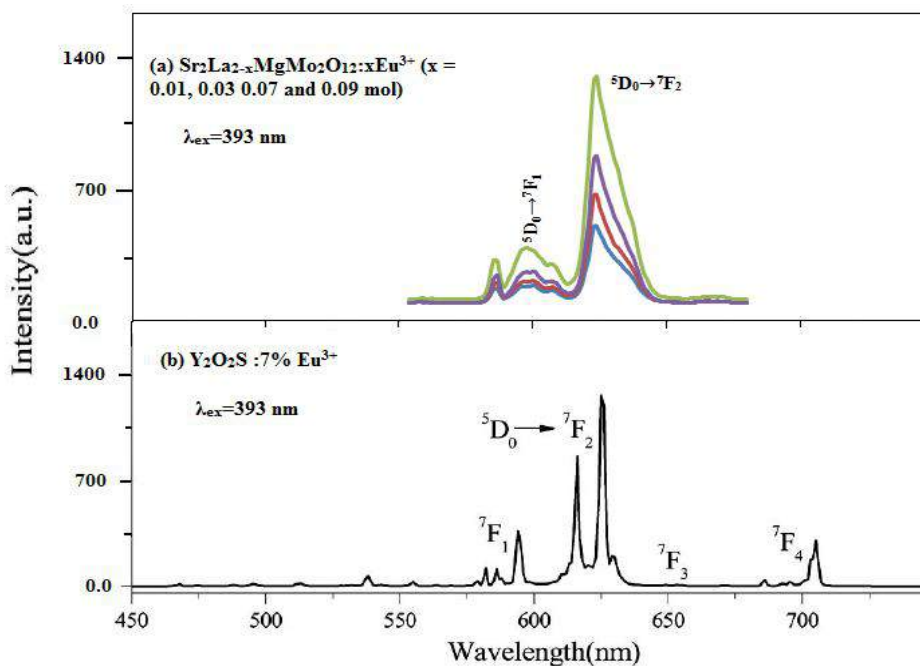


Fig-6: (Color online) Emission spectra of (a) Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ (x = 0.01, 0.03, 0.07 & 0.09 mole) and (b) Y₂O₂S:5%Eu³⁺ under 393nm excitation.

The emission spectra of the optimized Sr₂La_{2-x}MgMo₂O₁₂:xEu³⁺ (x = 0.01, 0.03, 0.07 & 0.09 mole) sample and commercial Y₂O₂S:Eu³⁺ under 393nm light excitation are shown in Fig.6. Both spectra show the characteristic emission of Eu³⁺ ions. However, the spectral distributions of the emission spectra are quite different as a result of different site symmetry for the Eu³⁺ ions in the host lattice [14, 15]. The main emission peaks of Y₂O₂S:Eu³⁺ are located in the red region, and the strongest line is at 627 nm. Comparing the two emission spectra, integrated emission intensity of Sr₂La₂MgMo₂O₁₂:Eu³⁺ under 393nm light excitation is about 2.3 times higher than that of Y₂O₂S:Eu³⁺.

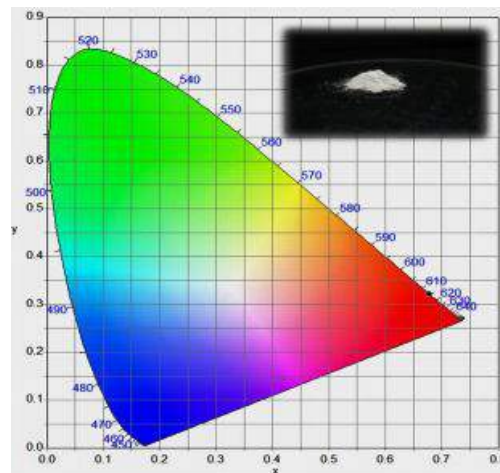


Fig-7: CIE chromaticity diagram for $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ phosphor ($\lambda_{\text{ex}}=393$ nm).

Fig.7. shows the CIE chromaticity diagram for the emission spectra of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ phosphor. The CIE chromaticity coordinates (x, y) of the $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ phosphor upon 393 nm excitation wavelength lie at $x = 0.678$ and $y = 0.322$ which are very close to the standard chromaticity coordinate values of NTSC ($x = 0.670$, $y = 0.330$). Hence, the CIE diagram illustrates that the obtained phosphor particles show red emissions when excited by a single wavelength ($\lambda_{\text{ex}}=393$ nm) and thus the obtained results confirm that the combustion method prepared $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ phosphor is a promising red emitting components for near-UV InGaN-based white LED.

4. CONCLUSION

Well crystalline Eu^{3+} activated $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}$ phosphor powders of scheelite-type have been successfully prepared by combustion synthesis route at room temperature. Upon 393 nm near – UV excitation, the $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ phosphor showed strong red emission lines at 617 nm corresponding to forced electric dipole transitions. The optimum doping concentration of Eu^{3+} content in $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}$ for the enhanced red emission is found to be 7 mol%. The intensity of emission spectra of $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ excited at 393 nm is remarkably stronger than that of the same phosphor excited at 462 nm and this suggests that $\text{Sr}_2\text{La}_{2-x}\text{MgMo}_2\text{O}_{12}:0.07\text{Eu}^{3+}$ particles are suitable red emitting phosphor in near –UV based White LEDs than blue GaN based White LEDs. The emission intensity of the optimized $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}:\text{Eu}^{3+}$ under 393 nm light excitation is 2.3 times higher than that of the commercial phosphor for use in a white LED, and it also has a better color purity. $\text{Sr}_2\text{La}_2\text{MgMo}_2\text{O}_{12}:\text{Eu}^{3+}$ could be a promising candidate with red emission for NUV excited white LEDs.

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PHYSICO-CHEMICAL EVALUATION OF INDUSTRIAL CREEKS' EFFLUENT TO BE FOUND AROUND SURAT CITY, GUJARAT**Alpa Varsani¹ and Kapila Manoj²**Faculty¹ and HOD², Department of Aquatic Biology, Veer Narmad South Gujarat University, Surat

ABSTRACT

There are many major and minor industries located in or around Surat city which are the biggest consumers of water supply and they produce large amount of effluent in treated or untreated form which drained directly into different creeks nearer to those industries. Besides these public sewer and storm water is also drained through creeks which ultimately reach to the Mindhola river. The contaminants which are found may pose a high risk to the water body on a large scale and hence needed to be monitored at regular intervals. The day by day increasing tremendous industrial pollution has prompted us to carry the systematic and detail study of physico-chemical properties of industrial creeks' effluent. For the assessment water samples were collected monthly from three sampling sites for the period of six months during April-2013 to Sep-2013. The physico-chemical parameters selected for the study were pH, Temperature, Silicate, Phosphate, Nitrate and Nitrite. Intensive assessment of water clearly indicates that the collected water from selected creeks is strongly affected by the industrial effluent and sewage waste water. So, it is point out that there is a need of regular monitoring of water resources and further improvements in the industrial waste water treatment methods.

Keywords: creeks, effluent, industries, pollution, sewage.

INTRODUCTION

Nowadays water has become very essential for the development of industries and agriculture in short for the overall development of the country. The same water resources are also utilized for the disposal of industrial effluent and sewage, leading to water pollution. The pollution of rivers and streams by industrial waste and domestic sewage has increased tremendously and producing the most polluted condition in water body (Kumar, 2002). Worldwide water bodies become the primary dump sites for the disposal of waste, especially from industries that are nearer to them. These effluents from industries have a great toxic influence on the water body as they can alter the physical, chemical, and biological nature of the receiving water body (Ewa *et al.*, 2011). Industrial activities, agricultural chemicals and improper disposal of waste give origin to many pollutants which moves into surface water as well as groundwater which change its physical, chemical and biological property.

Surat is one of the most important growing city of the Gujarat on the industrial map of the country with many large industries developed over here. The economic base of Surat consists of textile manufacturing, trade, diamond cutting and polishing industries, intricate jari works, chemical industries and the petrochemical and natural gas based industries. All these major and minor industries are located in or around Surat city. They are biggest consumers of water supply and produce large amount of effluent in treated or untreated form which drained into different creeks nearer to those industries. Beside these public sewer and storm water is also drain through creeks which reach to the Mindhola river.

Mindhola river originates from Jan Khadi of Doswada (Songadh) near Palsana in Surat city and meets Arabian Sea near Danti after merging with Unn-Sonari creek near Magdalla. Mindhola is a state river flowing within state boundary of Gujarat and considerable part of its catchment area lies in Surat city. The Mindhola river system within Surat city comprises of 7 natural tributaries (creeks) namely Koyali, Mithi, Kankara, Khajod, Bhedwad, Sonari and Varachha. Due to urban migration, slums have developed near some of these tributaries which resulted in the encroachment in the water body, thus reducing the water way of stream. More over villages, colonies, slums also discharge their wastewater and refuge directly in these creeks. The major devastation of its ecological health happens as it reaches the southern part of Surat city which drains its storm drainage through Mithi, Kankara, Khajod, Koyali, Bhedwad, Sonari and Varachha creek which ultimately drains into Mindhola river (Jariwala and Samtani, 2012).

These may cause contaminants which may pose a high risk to the water body on a large scale and hence needed to be monitored at regular intervals. The day by day increasing tremendous industrial pollution has prompted us to carry the systematic and detail study of physico-chemical properties of industrial creeks' effluent. The present study was focused to gather data about the state of water quality in creeks of Surat city and make recommendations based on finding for measures to prevent pollution by industries.

MATERIALS AND METHODS**Area of Study**

Geographical location of Surat district is 21.0⁰ to 21.23⁰ N latitude and 72.38⁰ to 74.23⁰ E longitude. Surat is a city which drains its storm drainage through Mithi, Kankara, Khajod, Koyali, Bhedwad, Sonari and Varachcha creek into Mindhola river. The Creek receives domestic raw sewage as well as industrial effluent from surrounding habitation and nearby industrial belt. There are many creeks flow through Surat city from which three sites were selected viz. Site-1 Bhedwad Khadi (Bamroli), Site-2 Mithi Khadi (Udhana) and Site-3 Saniya Hamed (Saroli).

Physico-chemical Analysis

Water samples were collected monthly from three sampling sites for the period of six months during April-2013 to Sep-2013 as described in APHA and transported to the laboratory for analysis. Temperature was measured at site and collected samples were brought to the laboratory for further analysis. The physico-chemical parameters selected for study were pH, Temperature, Silicate, Phosphate, Nitrate and Nitrite. For the physico-chemical analysis standard methods were followed as described in APHA and IS-3025.

RESULTS AND DISCUSSION

The physicochemical properties of water samples collected from different sampling stations illustrated in Table-1. Maximum water temperature was found 33 °C at Site-1 during May and June-2013 and minimum water temperature 28°C at Site-2 during July and September-2013 throughout the study period (Figure 1). This variation depends on seasonal fluctuation in temperature as well as other factors like industrial effluent discharge and sewage discharge which ultimately determines which species will live and thrive in a water body.

pH was found maximum 7.85 at Site-3 during April-13 and minimum pH was found 6.72 at Site-1 during June-13 and Aug-13 (Figure 2). Variation in pH increase solubility of minerals, nutrients and heavy metals (Alpa and Kapila, 2015; Alpa and Kapila, 2016).

Table-1: Physico-chemical properties of water samples collected from different sampling stations

Month	Site	Temperature (°C)	pH	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Silicate (mg/l)
April-13	1	30	7.50	ND	1.30	5.56	54.83
	2	30	7.71	0.04	0.73	4.37	36.55
	3	31	7.85	0.04	0.14	4.62	33.42
May-13	1	33	6.92	0.02	0.92	3.26	50.70
	2	32	7.10	0.01	0.83	2.15	30.13
	3	32	7.15	0.01	0.75	2.30	29.15
June-13	1	33	6.72	0.93	1.38	2.78	58.29
	2	32	7.28	0.05	1.03	1.38	43.82
	3	31	7.36	0.07	1.20	1.52	49.63
July-13	1	30	6.91	0.03	0.72	1.63	62.12
	2	28	7.48	0.02	0.56	0.92	53.26
	3	29	7.52	0.01	0.43	0.90	52.10
Aug-13	1	31	6.72	0.07	1.78	1.20	79.13
	2	30	7.34	0.06	0.98	0.83	68.92
	3	29	7.41	0.07	0.86	0.80	65.28
Sep-13	1	29	6.92	0.15	4.62	2.40	59.20
	2	28	7.40	0.10	1.70	1.96	42.13
	3	30	7.31	0.13	1.43	1.75	40.65

ND- Not Detected

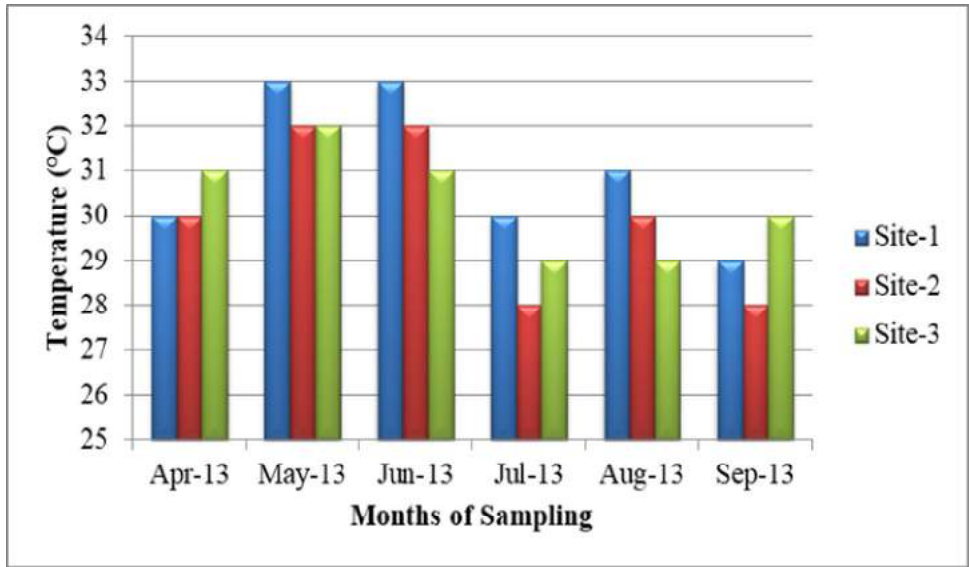


Figure-1: Monthly variation in Temperature at different Sites

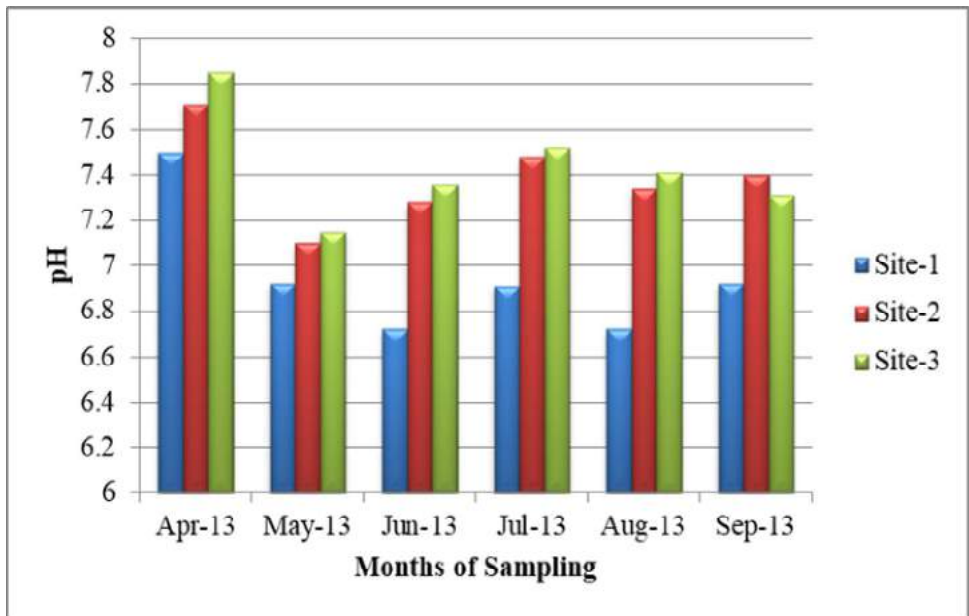


Figure-2: Monthly variation in pH at different Sites

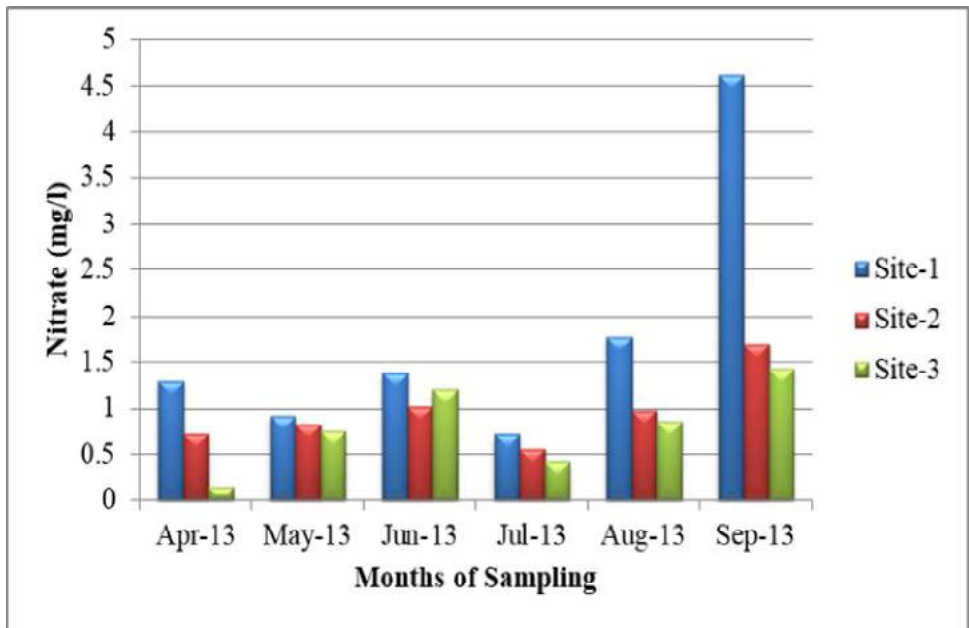


Figure-3: Monthly variation in Nitrate at different Sites

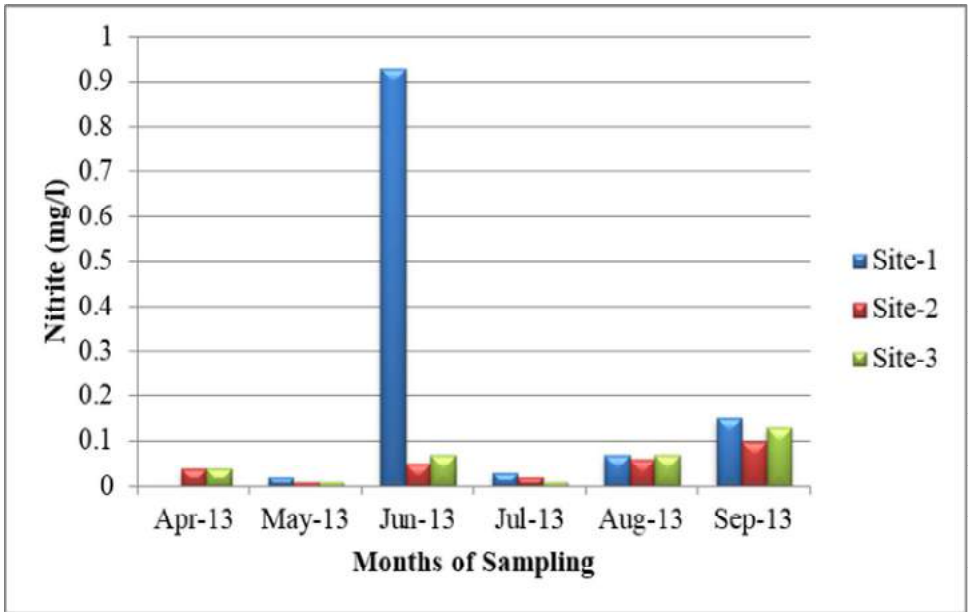


Figure-4: Monthly variation in Nitrite at different Sites

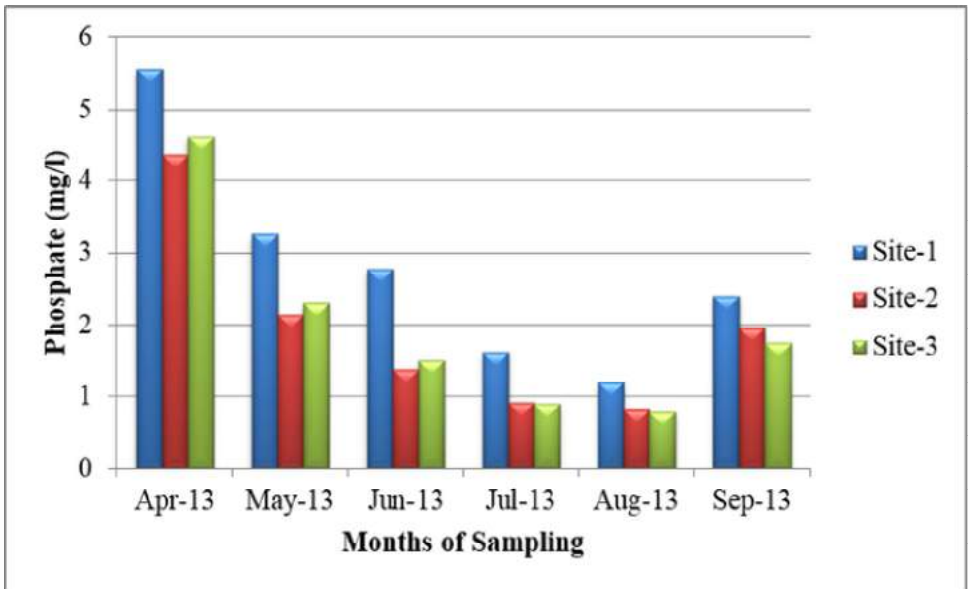


Figure-5: Monthly variation in Phosphate at different Sites

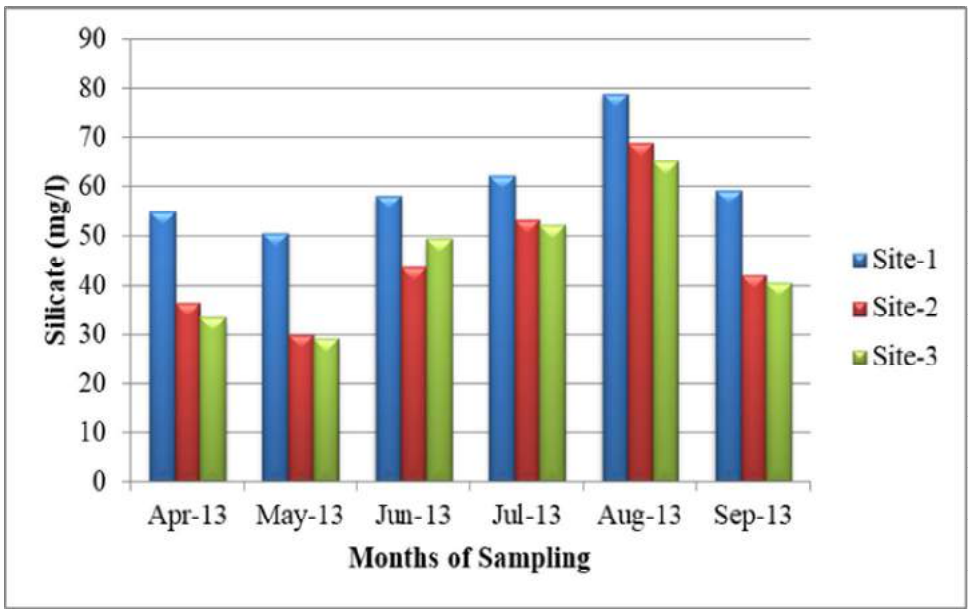


Figure-6: Monthly variation in Silicate at different Sites

Nitrate is considered important to assess organic load in water. Even at low concentrations (<1mg/l) nitrate accelerate the growth of algae and cause eutrophication (Mook et al., 2012; Ragheb, 2013). Maximum concentration of nitrate was found 4.62 mg/l at Site-1 during Sep-13 and minimum 0.14 mg/l at Site-3 during April-13 (Figure 3) where as Nitrite was found maximum 0.93 mg/l at site-1 during June-13 and minimum ND at site-1 during April-13 (Figure 4). Nitrate present in water may be the end product of oxidation of nitrogenous matter carried out by microorganisms during the nitrification and denitrification activities and its concentration may depend on the rate of these activities. Ravindra and Arvind (2015) was also suggested this.

Phosphate was found maximum 5.56 mg/l at Site-1 during April-13 and minimum 0.80 mg/l at Site-3 during Aug-13 (Figure-5). The key sources of Phosphate is various industries at different levels as well as domestic usage which are indirectly releasing it into creeks this may be reason for high concentration of phosphate found. This was also supported by (Singh and Choudhary, 2013; El-Amier *et al.*, 2015). High concentrations of nutrients can cause acidification, eutrophication and spoiled the water quality to survive aquatic organisms (Taha *et al.*, 2004; Camargo and Alonso, 2006).

Maximum concentration of silicate was found 79.13 mg/l at Site-1 during Aug-13 and minimum was found 29.15 mg/l at Site-3 during May-13 throughout the study (Figure 6). Silicon oils are applied for textile impregnation. Alkali silicones are added to cleansing agents, glue and bleaching agents for textiles. Zeolites are silicones that are applied as foam regulators in detergents. These directly influence water quality. Other silicon compounds may be applied as absorbents (<https://www.lenntech.com/periodic/water/silicon/silicon-and-water.htm#ixzz5i8yoInoy>). Higher concentration of silicate was found during the study may be because of these reasons. Industrial effluent is the main source for high level of silicate in water was observed by (Alpa and Kapila, 2016; Maguire and Fulweiler, 2017).

CONCLUSION

Intensive assessment of water clearly indicates that the collected water from selected creeks is strongly affected by the industrial effluent and sewage waste water as higher concentration of silicate, phosphate and nitrate was found. The study concludes that the water quality of the creek is severely depreciated and will affect the aquatic organism where the water of these creeks is dump near Danti in Arabian sea. So, it is pointed out that there is a need of regular monitoring of water resources and further improvements in the industrial waste water treatment methods.

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POLL PREDICTION BASING ON SENTIMENT USING NAÏVE BAYES AND DICTIONARY BASED CLASSIFIERS

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ABSTRACT

Opinion is a view or judgment formed about something or someone. General Elections are the ultimate measure of public's opinion in any democratic nation. Being curious about people's judgment in an Election, many conduct different forms of surveys to forecast the opinion of public. The surveys used to be in person-to-person mostly conducted by the print and electronic media organizations. Previously the surveys are constrained to limited and available people around offices and local areas. None of the surveys are considered to be reliable as the source of information may or may not be legitimate. The rapid advancement of technology and transformation into digital nations enabled most of the people to have an access to the social networking sites almost anywhere and everywhere. People now tend to express their views on micro-blogging sites likes twitter, facebook etc. In this paper we collect such data representing the views of public to depict the inclination of people towards a particular political party. We use machine learning classifiers viz. Naïve Bayes approach and Dictionary based approach to extract and analyze the sentiment from collected data. We hence deduce through our findings that the above mentioned algorithms in combination work with more accuracy.

Keywords: Dictionary based approach, Machine learning classifiers, Naïve Bayes approach, Opinion of public, Sentiment.

1. INTRODUCTION

Sentiment analysis is the process of determining the emotions of people and categorizing opinions that are expressed in social media or micro-blogging sites on a certain topic. It has become an effective tool to gather the opinion of public. Stock market, Business Intelligence, Law/Decision making, Political science and many such applications in which there is a huge scope for sentiment analysis.

Election poling is one of the influential applications of survey research. Polling is the process of discernment of an individual or a political body. Polls help us to understand what is really important in election, opinion of people. Earlier, Election polls were conducted through some banal survey methods such as using telecommunication like television or news paper and by finding out the opinion of a person on a political party in person-to-person. But now the scenario has changed with an advent in technology and usage of internet as a source of voicing their opinion. Hence surveying methods became smart by collecting the user data directly available on the micro-blogging sites and performing the required operations on the data to conclude the public's inclination.

In this paper, we selected three main political parties in regard of 2019 General Elections. Then we manually collected the official pages of these political parties form twitter, facebook and youtube. Regular expressions are used to clean the collected data. After a lot of research we came to a conclusion that Naïve Bayes algorithm and Dictionary Based classification algorithms work efficiently to classify textual data.

The rest of the paper will be organized as follows. Section-II deals with a few notable works on sentiment analysis. In Section-III our design is introduced along with the proposed method. Section-IV deals with the experimental process. Results are provided in Section-V. Finally we draw conclusions in section-VI.

2. RELATED WORK

There is a lot of research done in the field of research using Sentiment Analysis. Many researchers used Sentiment Analysis to extract the opinion of public in the form of reviews on various services, products etc. from micro-blogging sites like Twitter and Facebook.

In this paper [1], the author designed a system that helps the non-Japanese learners to learn Japanese in a very easy and efficient way. In the previous approaches the system was able to deliver the translation of a sentence into English along with an example sentence. In some cases the system was unable to provide an example sentence. The drawback with this system was that the given examples are context free although a word may have several meanings. To overcome this and provide a more reliable system for non-Japanese, the authors designed a Word Sense Disambiguation classifier that could translate the sentence into English along with bilingual usage i.e. it gives examples both in Japanese and English. If the sentence has more than one meaning

then it checks the context of the sentence from the dictionary and outputs the example sentence which has more similarity with the given input sentence.

The author of paper [2] was successful in improving the efficiency of Naive Byes classifier. The dataset they considered for training and testing the classifier is a movie dataset collected from Internet Movie Database. To improve its accuracy they included the concept of Negation Handling which handles the negative sense of words efficiently. The paper also dealt with Feature Selection which removes the noise. The authors also assigned a small probabilistic value to a word that did not occur in the training datasets. Their work also includes bigrams and trigrams to correctly classify complex adjectives and adverbs. All of this resulted in improving the classifier's accuracy to eighty eight percent.

In the paper [3] it was proposed that instead of using the machine learning classifiers individually to classify the tweets, it would be better if they are used together which is said to be a hybrid classifier. The authors used k-nearest neighbors and support vector machine algorithms and used them together. This work involves three phases where pr-processing, feature extraction and tweet polarity classification are performed respectively. The results showed that their model performed better than the individually used algorithms. The performance is calculated on the basis of factors, f-measure and recall.

Author, Ajay Deshwal in his paper [4] , the author mainly focused on getting highly accurate classifier results by using the machine learning algorithms. There was no system that could analyze which algorithm is the best for classification. So in this paper, the author used six machine learning classifiers to analyze the dataset collected from Sanders from Twitter. The author also included various features like emoticons, punctuations, exclamatory marks and unigrams which resulted in getting better results. The work resulted that Naive Bayes and SMO algorithms outperformed the other classifiers. One of the major applications of Sentiment Analysis is Politics.

In the paper [5] the author collected the tweets from Twitter on five National political parties to predict the 2016 general elections. The tweets were collected only in Hindi language. He used three approaches to classify the tweets which are dictionary based approach, Naive Bayes and Support Vector Machine. They considered the results of SVM as it has the highest accuracy of seventy eight percent compared to Naive Byes and dictionary based classifier. They predicted that BJP would win the election which was proved to be true.

Another research was done by the authors in the paper[6] where they proposed a sentiment analysis method which combines Lexicon-based and learn-based techniques to analyze the cross-domain sentiment of Chinese product reviews . They first built three domain specific corpora from which are hotels, books and electronics . Later they used four categories of features to build six classifiers. They conducted experiments to evaluate the proposed method. The experimental result showed that the domain Lexicons outperformed other classifiers in the field of Books and Hotels but was not so efficient in Electronics.

In the paper [7] the author collected the data of a television show from Twitter. In general the tweets are classifier based on how the classifier is trained. But a training dataset is applicable only to its corresponding domain and not to other domains. But, training the classifier every time for different purposes becomes difficult. So, the author proposed a system that can develop a generalized training dataset that can be used for classification irrespective of the domain. Sentiment Analysis is widely applied on reviews of public on the products which helps them to understand their customers better.

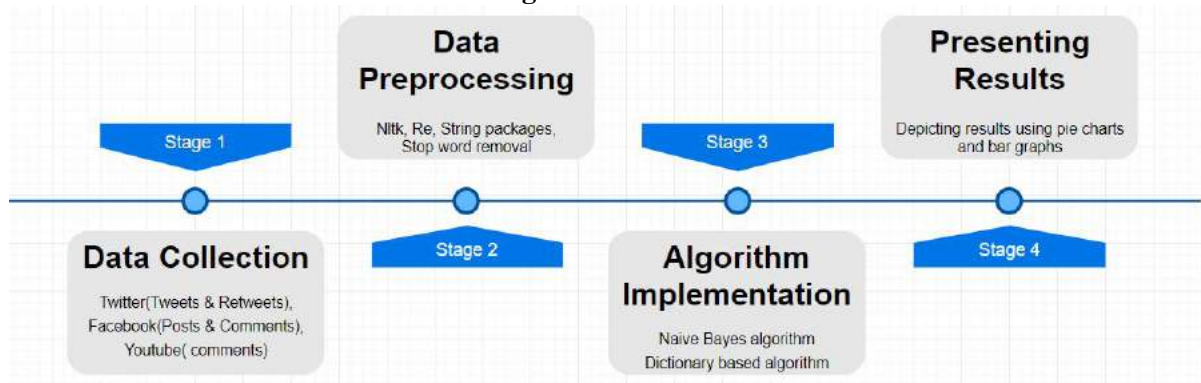
In this paper [8] the authors collected the data from Twitter, Blog spots and Facebook. The domains of his work include electronic products like mobile phones, tablet and laptops. Twitter Sentiment Analysis becomes difficult when compared to the other analyses because it contains slang words and spellings which are not correct or misspelled. Also, Twitter allows only upto 140 characters per tweet which is quite insufficient to express their opinions. To eliminate this ambiguity, the authors proposed a new feature vector before classification. Knowledge based approach and Machine Learning Approach are the two approaches used for analyzing the sentiment polarity of the tweets. The results showed that almost all the algorithms have the same accuracy for this feature vector.

In the paper [9] the author concentrated on the Political Analysis. He collected the data of Donald Trump and Hillary Clinton from Twitter to predict the United States presidential elections. He used a two phase approach to classify the tweets. He first collected the data and pre-processed it. Then, he found out the sentence polarity of each tweet and classified them accordingly. The results showed that Donald Trump has more positive opinion in public rather than Hillary Clinton and predicted that Donald might win the run which came out to be true. Sentiment Analysis is also applied on the policies implemented by the Government.

3. METHODOLOGY

Our work consists of following stages which are shown in fig.1:

Fig-1: Work Flow



3.1 Data Collection

The first step of our project is to decide from where the data to be analyzed should be collected. We decided to collect the data from three major social-networking sites viz. facebook, twitter and youtube. Any political party is having their official accounts in these social media platforms. We have collected the data belonging to party X, party Y and party Z from their social media accounts. During feature selection we selected “text” as it is more reliable and extractable, So the “text” data which are present in different forms like tweets, facebook comments and youtube comments are collected.

To extract tweets from twitter, create a Twitter user account and log in with your Twitter user account. Then visit the Developers account of Twitter while staying logged on in your account. Then, click “Create New App” and fill out the form, like name of the application, purpose of the research etc. and click “Create your Twitter application”. Then, the API key is generated which needs to be copied and pasted on the next page for access tokens. Scroll down and click “Create my access token which further generates the access tokens and access secret token which are necessary to access the tweets from Twitter.

To extract comments from Facebook, Open Facebook and go to any page and copy the URL. Paste the URL in the browser to generate the ID of the post. Open Facepager tool and in the Facebook page click the Login with facebook button and login to get a valid access token. Then, in Facepager, click on "New Database" in the toolbar to create a new database for a party. Then, Click on “Add Node” and paste the generated ID. Select the node in the view and click “Fetch data” resulting in all the posts in that page .Select all the posts and click on “Fetch Data” to extract the comments.

To extract comments on the politically related videos on YouTube, Open YouTube and go to the related video and copy the video URL. Open any open-sourced YouTube comment scrapper which will ask you for the URL of the YouTube video. Paste the available URL here and hit scrap which will result in the extraction of comments present on the particular video into a CSV file.

The extracted tweets and comments are maintained in separate datasets in accordance to the party.

3.2 Preprocessing

Real-world data is very incomplete and is likely to contain noise which needs to be reduced. Data pre-processing is a technique that involves converting the raw data into an understandable format by removing the unwanted data. The extracted tweets and comments are pre-processed by importing nltk, re, string packages in python.

In this section, we will discuss the implementation of the two algorithms namely Naive Bayes algorithm and Dictionary Based approach.

3.3.1 Naive Bayes Algorithm

We have implemented the Naive Bayes algorithm. The inputs for the classifier are the datasets after pre-processing. The working of Naive Bayes classifier is as follows:

Start

Step 1: Load the dictionaries (positive & negative) and assign the probabilistic value to them.

Step 2: Find the number of words both in positive and negative files along with its frequency of occurrence, vocabulary size becomes the summation of the total number of words.

Step 3: To classify the tweets, load the test data set or pre-processed tweets of a party and split them into individual tweets.

Step 4: Find the probability of a word in the positive file as well as the negative file. If the word is not found in the file even then, it is assigned a small amount of probability without neglecting it.

Step 5: If the probabilistic value of a word in the positive file is greater than the negative file, then the word is said to be positive. Else, the word is said to be negative.

Step 6: Repeat the same for all the tweets and count the number of positive tweets and negative tweets.

Step 7: Calculate the percentage of positivity and negativity in the tweets of a party.

Step 8: Repeat the Steps 3 to 7 for the remaining two parties.

Stop

3.3.1 Dictionary based Approach

To implement the proposed algorithm, the prerequisites are positive word list (English and Telugu) and negative word list (English and Telugu) which are our word corpora. The sequential steps involved in the algorithm are:

Start

Step 1: Load the dictionaries for training the classifier.

Step 2: Load the dataset of a party to classify the tweets which is the test data.

Step 3: Read the file and split the file into individual lines.

Step 4: For each line, split the line into words and compare each word with the dictionaries.

Step 5: If the word is occurred in positive word list, then $\text{positive_word} = \text{positive_word} + 1$; If the word is present in the negative word list, then $\text{negative_word} = \text{negative_word} + 1$;

Step 6: Count the number of positive and negative words in a sentence. If $\text{positive} > \text{negative}$, then the polarity of a sentence is "Positive". $\text{positive_sentence} = \text{positive_sentence} + 1$ If $\text{negative} > \text{positive}$, then the polarity of a sentence is "Negative" $\text{negative_sentence} = \text{negative_sentence} + 1$

Step 7: Repeat Steps 4 to 6 until all the tweets in the dataset are classified.

Step 8: Calculate the percentage of support and disagreement for the party. $\text{Support percent} = (\text{positive_sentence} / \text{total no. of tweets}) * 100$ $\text{Disagreement percent} = (\text{negative_sentence} / \text{total no. of tweets}) * 100$

Step 9: Repeat the steps 2 to 8 for the remaining two parties.

Step 10: The party which scored the highest support percent is predicted to succeed in the upcoming elections.

Stop

4. EXPERIMENTAL WORK

Our work is mostly done using python language which provides rich collections of pre-defined packages. We made use of the following packages:

- Tweepy (for extraction of twitter data)
- RE (Regular expression for cleaning data)
- String (for data pre-processing)

4.1 Data Collection

Using tweepy package in python language we are able to collect a stream of tweets with a mention of particular keyword. The keywords used for streaming are the official account names of particular parties viz, party X, party Y and party Z. These are saved in .csv format for easier preprocessing.

Doing some manual analysis we have collected a set of facebook posts and youtube videos which are suitable for extracting comments from. So using facepager and YouTube comment scraper, data is collected and stored in .csv format.

4.2 Data pre-processing

Often the real world data is very noisy and inconsistent. So, there is a need to make the data consistent and understandable. We applied pre-processing techniques to clean the data. At first, we removed all the usernames

from the tweets and then we removed the URLs/links from them. We removed trends which are followed by # or @ and also removed special symbols and numbers from the text. Stop word removal is also applied to improve the search efficiency of algorithms. Finally, we normalized the text i.e. converting all the upper-case characters into lower-case.

5. FINDINGS

Naïve Bayes algorithm implementation

We have the collected and preprocessed data which is ready for classification. The Naïve Bayes algorithm is given a set of positive and negative words to train the algorithm. Python is the language selected by us for algorithm implementation. The code is hence in written in python(3.6.1) with negative_words.txt and positive_words.txt and Final_data.txt as inputs for the program. On successful compilation of the program, It shows the positive and negative percentage of sentiment of the data given. The output for each party will be as follows(Fig 2) on giving the individual data for each political party.

Fig-2: Naïve Bayes algorithm implementation results

```

Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
Python 3.6.1 (v3.6.1:69c0db5, Mar 21 2017, 18:41:36) [MSC v.1900 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party x are:
Positive percentage for test data is 64.4611383930656
Negative percentage for test data is 35.5388616069344
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party a are:
Positive percentage for test data is 37.44075829383886
Negative percentage for test data is 62.55924170616114
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party y are:
Positive percentage for test data is 25.349301397205586
Negative percentage for test data is 74.6506986027944
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party y are:
Positive percentage for test data is 67.29439059139944
Negative percentage for test data is 32.70560940860056
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party z are:
Positive percentage for test data is 99.9650976519215
Negative percentage for test data is 0.030502348578491562
>>>
===== RESTART: C:\project (Batch-9)\nbalg.py =====
Results for the party x are:
Positive percentage for test data is 77.21429164260493
Negative percentage for test data is 22.785768357505074
>>>

```

Dictionary-Based classification algorithm implementation:

We are not relying on the results of a single classifier algorithm and hence we decided to classify the collected data using Dictionary-based algorithm too. The collected data, positive words and negative words data set is given as input to program written in python to implement the Dictionary-Based classifying algorithm. The successful compilation of code gives the results in the following manner. The main difference between both the algorithms is that Dictionary Based classifier will have a third type named neutral where the data which does not available on the training data sets will be set to neutral.

Fig-3: Dictionary-Based classifier results

```

Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
Python 3.6.1 (v3.6.1:69c0db5, Mar 21 2017, 18:41:36) [MSC v.1900 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: C:\project (Batch-9)\dba.py =====
party x percentage is:
no of positive tweets 35
no of negative tweets 47
no of neutral tweets 762
subtotal tweets 844
positive percentage is: 4.1469194312796205
negative percentage is: 5.568720379146919
5.568720379146919 % People are negative
>>>
===== RESTART: C:\project (Batch-9)\dba.py =====
party x percentage is:
no of positive tweets 952
no of negative tweets 708
no of neutral tweets 1771
subtotal tweets 3461
positive percentage is: 28.373302513724358
negative percentage is: 20.45651545796013
28.373302513724358 % People are positive
>>>
===== RESTART: C:\project (Batch-9)\dba.py =====
party y percentage is:
no of positive tweets 121
no of negative tweets 44
no of neutral tweets 837
subtotal tweets 1002
positive percentage is: 12.075848303393213
negative percentage is: 4.35122766487026
12.075848303393213 % People are positive
>>>
===== RESTART: C:\project (Batch-9)\dba.py =====
party y percentage is:
no of positive tweets 1837
no of negative tweets 366
no of neutral tweets 2096
subtotal tweets 4299
positive percentage is: 43.644571157044425
negative percentage is: 8.69662173613043
43.644571157044425 % People are positive
>>>

```

Fig-4: Dictionary-Based classifier results

```

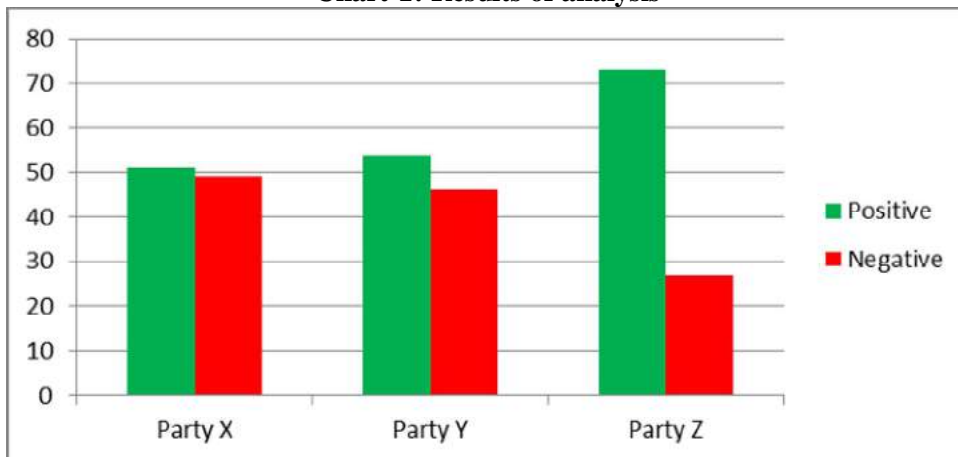
Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
C:\Python36\Python36-1\python.exe C:\project\batch-9\dict.py
>>>
===== RESTART: C:\project\batch-9\dict.py =====
party y percentage is:
no of positive tweets 121
no of negative tweets 44
no of neutral tweets 837
subtotal tweets 1002
positive percentage is: 12.07584830393213
negative percentage is: 4.39121756487026
12.07584830393213 % People are positive
>>>
===== RESTART: C:\project\batch-9\dict.py =====
party y percentage is:
no of positive tweets 1937
no of negative tweets 366
no of neutral tweets 2006
subtotal tweets 4209
positive percentage is: 43.64457115704425
negative percentage is: 8.695652173913043
43.64457115704425 % People are positive
>>>
===== RESTART: C:\project\batch-9\dict.py =====
party x percentage is:
no of positive tweets 317
no of negative tweets 76
no of neutral tweets 2263
subtotal tweets 3256
positive percentage is: 9.7504449931655
negative percentage is: 2.345794919633596
9.7504449931655 % People are positive
>>>
===== RESTART: C:\project\batch-9\dict.py =====
party z percentage is:
no of positive tweets 484
no of negative tweets 71
no of neutral tweets 506
subtotal tweets 1061
positive percentage is: 39.610908327025
negative percentage is: 6.37471612440373
39.610908327025 % People are positive
>>>
    
```

6. RESULTS

Table-1: Results of analysis

	Party X	Party Y	Party Z
Positive Sentiment	51%	54%	73%
Negative Sentiment	49%	46%	27%

Chart-1: Results of analysis



The above chart which is the result of our analysis is depicting the voters inclination towards the party Z than the other two. On a scale of 100 party X and Y almost have similar amount of positive and negative image in the social media. Whereas, party Z has got higher positive percentage than negative percentage.

CONCLUSION

We conclude that in this paper we have collected data from social media to fetch the public opinion, cleaned the data and made into suitable format to apply classifiers. Then we applied Naïve bayes and Dictionary Based classification algorithms and combine their results to obtain the mentioned statistics. The statistics are evident enough that Party Z has good positive vibe in the public and we predict the party’s win through our analysis.

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TALCUM POWDER FORMULATION OF ACTINOBACTERIAL ISOLATES AND ITS EFFECT ON SACCHARUM OFFICINARUM ON VARIETY CO-86032 NIRA: IN VITRO STUDY**¹Sakure Sunita Satish, ² Hamde Venkat ^b**Head¹, Department of Microbiology, S. B. B. Alias Appasaheb Jedhe CollegeHead² and Professor, Department of Microbiology, Yogeshwari Mahavidyalya, Ambejoagai**ABSTRACT**

Keeping in view the number of challenges faced by modern agriculture with respect to soil fertility, pathogen attack and role of ecofriendly approach; present study does involved the number of actinobacteria previously been isolated from rhizosphere soil samples and found to be potent for plant growth promoting properties involved in soil fertility have been investigated in plant species sugar cane (*Saccharum officinarum* on variety CO-86032 Nira) using 90 days pot trial. Talcum powder based Bioinoculum prepared from actinobacteria (A3, BF5, TU, D and consortium) when tested under pot assay, all these isolates best preformed to act as plant growth promoter when treatment was given to sugarcane. A highly significant with about 10 times increase in shoot weight (9.89gm) was recorded in consortium group to control with only 0.95gms. In a positive control group also treatment with NPK+IAA also helped to increase shoot weight to 10.1gms which showcase that probably consortium providing vital nutrients for sugarcane growth. As compared to control (0.201 gm) root weight Bf5 isolate found to be highest (0.657 gm) and comparable with positive control (NPK+IAA) with 1.089 gm of root weight. Isolate A3 also performed better for improvement of root and shoot length compared to control. In conclusion, systematic selection of potential actinobacteria and their further inoculation as consortium or individual certainly improved the growth of sugar cane and hence recommended to get involved in agricultural bioinoculant programs.

Keywords: Actinobacteria, Bioinoculum, Ecofriendly, Sugarcane, Talcum powder.

1 INTRODUCTION

As it is known that microbes in rhizosphere able to transmit number of plant growth promoting content via soil, which does assist in plant's greater yield. Actinomycetes are one of the members of the soil microbial population which can add nutrient content in soil (Halder et al., 1991; Elliot L.F. et al., 1995) along with many plant growth promoting capabilities (Merzaeva O.V. et al., 2006). It is noted that when actinomycetes grows in soil it produces number of important biomolecules such as lytic enzyme , PGP substances and antibiotics (Cattelan A. J. et al., 2000). Among number of actinomycetes *Streptomyces* spp dominates the soil as major microbe and assist in degradation of number of complex molecules to simple molecules which can improve plant yield and overall development (Petrosyan P et al., 2003; Ding C.H. et al., 2004).

Being an aerobe spore forming , Gram positive bacteria all actinomycetes are featured with substrate and aerial mycelium growth when added in the soil or when present naturally they play key roles in cycling of organic matter, plant pathogens inhibition, decomposition of complex material especially of dead plants, animals and fungal material by producing several vital enzymes. Besides that they improve nutrient content, minerals by producing metabolites and plant growth regulators (Bhatti A.A. et al., 2017).

Looking at today's scenario with intensive agricultural practices and cultivation, fertility of soil is decreasing at a faster rate which is making increasing crop loss for many instances. As per estimation with such improper practice about 30% of total world cultivated soil may get degraded by the year 2020. Here soil degradation is mainly related with loss of soil texture and fertility and that will lead to loss in crop productivity. Hence it is now taken as a priority to ensure ever increasing future food demand and supply. In requirement, treatment of soil with bacteria and fungi is strongly recommended to regain feature of the soil. These microbes does provide nitrogen fixation and mobilization of other nutrients such as phosphorus, potassium and iron which can be reached directly to the plant while also remediate soil structure by improving its aggregation and stability. Study also reported that co-inoculation of bacteria and fungi with or without organic fertilizer are also been beneficial for reinstating the soil fertility and organic matter content instead of single inoculum (Rashid M I et al., 2015).

Actinobacteria has been nominated as the plant growth bacteria and able to improve soil and plant health and it also remain the sustainable agricultural practices by looking at the high prices and destructive effect of chemical fertilizers especially in the countries of south-east Asia and Africa. Actinobacteria has also been recommended to use along with crop for better yield and to use along with crop for better pest control (Sathya A et al., 2017).

Saccharum officinarum on variety CO-86032 Nira is very popular for making Juice. This variety is released in 1996. This is hybrid having more sucrose content and also resistant to smut and wilt. Quality of this crop in market is mainly determined by shoot weight. Farmers use the IAA mainly to increase the yield. The actinobacterial isolates showing potential results for IAA production; Phosphate solubilization, antifungal activity and siderophore production were selected for Formulation using talc as carrier base. In the present study bioformulations are successfully tested for improvement of growth parameters of sugarcane in single inoculum or in consortium as compared to positive control organic fertilizer.

2 MATERIALS AND METHODS:

2.1 Biofertilizer preparation using Talcum powder as a binder

A3, Bf5, Tu and D were individually inoculated in 800ml of CSA broth in four 1000ml flasks. The flasks were kept on rotary shaker to get final concentration of each isolates as 10^8 CFU/ ml . 1 kilograms of talcum powder, 15 g of calcium carbonate and 10g carboxymethyl cellulose was allowed to mix in with 400ml fully grown bacterial inoculum. The shelf life of isolates in bio-formulation was calculated by a serial dilution technique and the samples were kept at room temperature ($28 \pm 2^\circ\text{C}$) for storage. Each of 1g of sample taken from each formulation at 1st, 2nd and 3rd month storage was mixed with 10 ml of sterile normal saline water and the number of colony forming unit (CFU) of bacteria was counted on CSA after 24 hours plating.

(Ei SL Lwin KM, Padamyar, Khaing HO and Yu SS 2017)

2.2 Pot assay

In a pot assay standard protocol was followed using sugarcane variety CO-86032 Nira as affector plant species. Treatment soil used in the study was recorded with the carbon content of 1.01% having initial pH of 7.12. The given soil was recorded for mineral content and found to be with, Phosphorous 67.2 kg/ha, Nitrogen 275.7 kg/ha and Potassium 268.8 kg/ha. In a control pot set, first control with only NPK addition and second control was IAA+NPK was used. In an experimental set, total five sets having set of A3, D, Bf5, Tu and consortia were used.

During experiment standard dose of 0.25 mg Of IAA per kg of soil was maintained in positive control. NPK proportion used was 120:60:60. After treatment to soil, affector plant sugarcane stem buds with one eye was planted. Experiment was carried out in triplicates. 2 ml of each talc-based carrier bio-formulation of each isolate and consortia was poured into the base of each plant to reach the root area in all sets except positive and negative control. After two weeks, 2 ml of each prepared treatment was poured into the base of each plant Every set was then labeled and periodic watering was maintained in the plastic pot used for treatment study All the pots were checked periodically for the Germination, shoot length, and root length, dry weight of root and shoot and overall change recorded up to 90 days of treatment Data was analyzed using single factor ANOVA.

3 RESULTS AND DISCUSSION

3.1 Talc based formulation were prepared as shown in the photograph below. TVC count was taken for three months .TVC count of each bioformulation revealed the presence of average about 10^6 CFU/ml after three months storage.

Figure-1: Talc based formulation of Actinobacterial isolates.

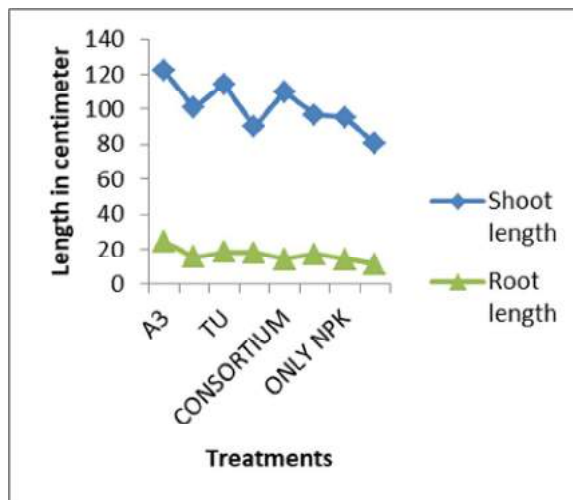


3.2 Pot assay

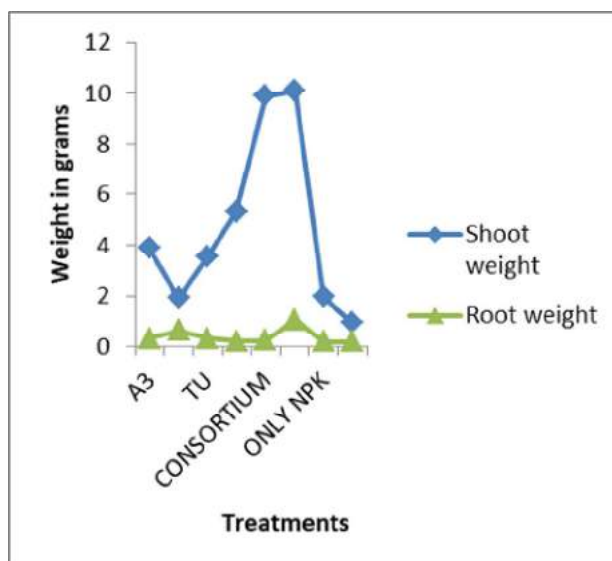
In a pot assay affector plant sugarcane (*Saccharum officinarum*) certainly found to be affected by the microbial consortium as well as by their individual treatment and results are comparable with positive control (NPK+IAA or NPK). The treatments showed overall increased growth as compared to control. Plant sugarcane (*Saccharum officinarum*) when tested under pot assay upto 90 days and firstly in control set its shoot and root length (cm) was recorded to be 80.5 cm and 11.5 cm, respectively which was improved significantly after inoculation of

almost all four actinobacteria in an individual inoculation and in consortium also. Among them, isolate A3 responded the best for the root length factor and about 24.5 cm length was recorded as compared to 11.5 cm in control. It is important to note the performance of isolate A3 which was better than (significant) positive control (NPK+IAA or NPK) which makes it the successor in further testing. Treatment Data when analyzed by ANOVA showed significance of treatments statically.

Figure-2: photograph of two sets of treatments trial (A3 and BF5) in triplicate and one control.



Graph-1: Effect of Treatments of talcum powder formulations on root and shoot length.



Graph-2: Effect of Treatments of talcum powder formulations on root and shoot length

A highly significant with about 10 times increase in shoot weight (gm) was recorded in consortium group as 9.89gm as compared to control with only 0.95gms. In a positive control group also treatment with NPK+IAA also helped to increase shoot weight to 10.1gms which showcase that probably consortium providing vital

nutrients for sugarcane growth. As compared to control (0.201 gm) root weight Bf5 isolate found to be highest (0.657 gm) and comparable with positive control (NPK+IAA) with 1.089 gm of root weight. Overall results suggested that consortium has better effect on sugarcane weight, they certainly transfer benefits to the growing sugarcane in all aspects as evidenced in present study.

4 CONCLUSION

Previously selected Actinobacterial isolates from PGPR properties have been proved to be efficient for pot trial. Talc based formulation has been also showing good effect on survival of Actinobacteria and Treatment on sugarcane proved their potential as bioinoculant.

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VISUAL MERCHANDISING: SCALE DEVELOPMENT AND CONSTITUENT FACTORS

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ABSTRACT

Introduction: Visual merchandising can be defined as the presentation of a store's merchandise to the customer through the integration of the store's advertising, display, special events, fashion coordination and merchandising departments to sell the products offered by the store (Mills et al., 1995). Due to increasing competition and the similarity of merchandise, retailers utilize visual merchandising to differentiate their offerings from others as well as to improve the desirability of products (Kim, 2003).

Purpose: The current study aims to develop and standardize a measure for evaluating visual merchandising and to explore the constituent factors of visual merchandising in the readymade branded apparel industry as perceived by the customers.

Methodology: Standardization of scale has been done by calculating reliability, validity, and ITC. The Principal Component Factor Analysis was applied with the varimax rotation to identify the underlying factors of visual merchandising.

Results: The 11 items of visual merchandising resulted in two factors as unplanned purchase and persuading.

Keywords: Visual Merchandising, Branded Apparel, Retailers, Customer.

INTRODUCTION

The essence of visual merchandising is to expose customers to attractive visual presentations of a retail outlet. The prospective buyers stop and look into the window of retail outlet, thereby witnessing the attractive visual presentations of products of that store. These presentations motivate them to come into the store and they are so attractive that even those customers with limited time stop to scan the offering and sometimes make unplanned purchases as well. Usually, it's not the uniqueness of the merchandise but the presentation in which the item appears, makes customers buy the product immediately. Fashion retailers use visual merchandising in their brick-and-mortar operation which acts as high attention seeking medium. It's the way of communication by which company's fashion value and the quality image are presented to prospective customers.

Various types of visual merchandising include floor merchandising, form or mannequin display, in-store display, signage, and window display. The objective of visual merchandising is to update the customers with the new offerings of the store in an attractive and unique way along with encouraging the sales of merchandise (Frings, 1999). Store image is built through visual presentations which attract shoppers and finally transform them into customers by developing brand loyalty and encouraging customers buying behaviours. Visual Merchandising educates and attracts the customers about the products and services offered and finally bend the customers from exploring to buying. It creates a platform to present merchandise in a unique and attractive environment thus creating a strong impact and product recall. Visual merchandising sets the context of the merchandise, establishes the linkage between fashions, product design, and marketing by keeping the focus on the product. Further, it draws the attention of the customers and helps them match their needs with the visually merchandised product.

According to Buttle (1988) visual merchandising was not given much weightage in the past as it involves cost creativity and space. Also space occupied by a product in the shelf display and its attractiveness is directly proportional to sales. Mehrabian and Russell (1974) stated that note that dominance, arousal and pleasantness are the store atmosphere factors and these can alter the consumer's response to buy a product. This response also influences the purchase behaviour. Also customers' forms a store image and implicitly shapes the product quality image in the minds of the customers. Social identity of the store is also shaped up by lightening, music and other store features. Greenwood (1998) argued that visual merchandising has been identified as a centralized professional function and require more concentration as compare to the traditional store display. Store managers use to ignore this in the past but now it is more systematized sophisticated and creative. The objective of visual merchandising is to build and communicate brand image, to create product differentiation, use of latest technological tools and communicating to customers in an integrated way. According to Bell and Ternus (2002), store displays trend has changed over a period of time. From the displays focusing on

promotional tools, now the objective is to enhance store image, communicate product information and support customers to make purchase decision, thus creating an overall shopping environment.

Kerfoot et al. (2003) investigated the impact of visual merchandising and its effects on purchase behaviour in context to branded female fashion offerings. The results of the study indicated a direct relationship between purchase intention with that of product display, product colour, presentation, props display, lightening effect and product texture. Sprott and Shimp (2004) conducted a study on product trial availability at the store, with that of perceived product quality. The result showed that perceived quality of store brand was enhanced and benefitted significantly when customers under the study tried these brands before judging their quality. But this was not the case with the national brand. The subject of shelf space allocation is of utmost consideration for designing the layout of the store. There exists little research that specifically focuses on the influence of store brand in shelf space management.

Nogales and Suarez (2005) conducted a study on the difference in the way the shelf space is managed by national and private label brands in the store. They found that space allocation to the private labels was much larger than that assigned to the whole of brands on average. According to Spangenberg et al. (2006), scent of a retail set up can change the consumer's view a lot. These effects are usually moderated by congruity between the scent and the retailer's product offering. Past research data does not document such studies highlighting congruity effects for products without scent and real world settings. The result concluded that scent congruity influence perceptions of the store, its merchandise, and actual sales. Results of the study conducted by Ha et al. (2007), argued that the application of offline visual merchandising features can be seen in an online context. Also, many of the visual merchandising features of online apparel stores do not have an offline parallel. The taxonomy of visual merchandising cues has been used by researchers to systematically study the effects of those cues. Consumer's perception, expectation and loyalty regarding a retailer are built through store retailers online and offline brand image. Another study by Kwon and Lennon (2009) reveal that offline brand image exerts significant effects on online brand image. It also support that online perceived risk and online customer loyalty is also significantly related.

A window display supports the stores selling strategies and its a direct connection between the inside store environment and customer's perspectives from the outside environment. Window displays is a selling strategies and it transfers the type and positioning of merchandize along with communicating the promotional strategies and corporate image. Somoon and Sahachaisaeree (2010) conducted a study on the use of window displays for clothing to examine patterns, selling strategies, merchandize types and target groups. They investigated the effect of store design on the customer response to configurations. The results of the study showed that displays with spotted light have effective impact. Lights focusing on the product and warm colour could bring about arousal and interest in merchandize along with enhancing its attractiveness. Certain store set up designs which includes props and the whole display seems to induce all range of perceptions. Results also showed that displays with fewer props are more effective as compare to huge and variety of props. The study also finds that design with focused light and unique props are the most important factors inducing the aspects of complexity, purchase willingness and shop attractiveness. On the other hand, design factors including the level of design's complexity and the existence of mannequin show no impact on a wide range of customer's perceptions. The realness of mannequin shows little impact on all aspects, except for the complexity. The design with disordered display shows minor effect on many buyers perceptions, besides the merchandize value and uniqueness.

METHODOLOGY AND DESIGN

The Study

The study is exploratory in nature and aims to examine the constituent factors of visual merchandising in readymade branded apparel industry as perceived by the customers. It also aims to develop and standardize a scale to measure visual merchandising.

The Sample

The sample included 300 customers of readymade branded apparels in Indore city. The population under the study comprised of all the customers of readymade branded apparel industry. The sampling element for the study was individual customer of readymade branded apparels. The customers visiting the store outlet during the data collection phase and those who have shopped earlier from the store were included in the sample frame for the study. The non-probability purposive technique of sampling was used to collect the data. Those customers who were at or who have been to stores like Pantaloons, Globus, Westside and Max within the last six months were asked to give responses for all 11 items of Visual Merchandising in the questionnaire.

Data Collection

Data was collected through self-designed questionnaire, comprised of total 11 items. All these 11 items were presented on a 5 point likert type of scale wherein 5 indicated strongly agree and 1 indicated strongly disagree. It was presented to a sample of 300 respondents. The collected data was also screened for the response error.

Data Analysis

To ensure the internal consistency of all the items of Visual Merchandising, item to total correlation was carried out. Pearson correlation was applied between the item scores and the total scores, for all the items of Visual Merchandising. The questionnaire was then checked for the Validity and Reliability. Cronbach’s Alpha and Guttman’s Split-half Reliability Coefficient measures were calculated.

After this Factor Analysis using principal component extraction method with varimax rotation was carried out so as to identify the factors of Visual Merchandising. Bartlett’s test for sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was also applied along with factor analysis.

RESULTS

Reliability Measure

The reliability of Visual Merchandising was computed using SPSS16 software. Cronbach Alpha’s and Split Half Reliability Coefficients were computed to calculate the reliability of all items in the questionnaire. It can be seen from the following statistics that the reliability measure for visual merchandising variables is higher than the standard value of 0.7. So it can be said that all the items in the questionnaire are highly reliable.

Table: Showing Cronbach’s Alpha Reliability Statistics for visual merchandising

Measure	Cronbach’s Alpha Reliability	Number of Items
Visual Merchandising	0.826	11

Table: Showing Guttman’s Split-half Reliability Coefficient Statistics for visual merchandising

Measure	Guttman’s Split-half Reliability Coefficient	Number of Items
Visual Merchandising	0.845	11

Consistency Measure for Visual Merchandising

The consistency of all the statements in the questionnaire of visual merchandising was checked through item to total co-relation. For this Pearson Correlation was applied. In this, co-relation of every item with total was measured and the computed value was compared with the standard value ($r_{300}=0.4$) (Nunnally, 1967). Since all the measures were having item to total correlation higher than the critical value so none of the item was declared as inconsistent or dropped from the questionnaire. This means that all the items in the scale contribute significantly to the Visual merchandising variable. All the items in the Visual Merchandising measure with their item to total co-relation are shown in the following table:

Table: Showing Item to Total Correlations for the Measure Visual Merchandising

S. No.	Items	Computed correlation value	Consistency	Accepted/ Dropped
1	Even if I have limited time, I stop and look into the window of retail shop to admire the offerings.	0.590452	Consistent	Accepted
2	I tend to enter a store when I am attracted by an eye-catching window display.	0.668429	Consistent	Accepted
3	It is not the uniqueness of the merchandise but the setting in which the item appears is attractive.	0.459426	Consistent	Accepted
4	Visual presentation often stimulate me to make unplanned purchase	0.642303	Consistent	Accepted
5	I get an idea of what I want to buy after looking through in-store form/mannequin display.	0.635049	Consistent	Accepted
6	When I see clothing that I like on in-store form/mannequin display, I tend to buy it.	0.620906	Consistent	Accepted
7	When I see clothing featuring a new style or design on display, I tend to buy it.	0.591752	Consistent	Accepted
8	I tend to try on clothing that catches my	0.656541	Consistent	Accepted

	eye when I walk along the isle.			
9	I tend to rely on store displays when I make a decision to purchase clothing.	0.551765	Consistent	Accepted
10	When I see a special promotion sign (reduced price, Sale/clearance signs etc.) in the store, I go to look at that clothing.	0.594881	Consistent	Accepted
11	I tend to choose which store to shop in depending on eye-catching window displays.	0.624257	Consistent	Accepted

Validity

The content validity was found good as the instrument contain a representative sample of the universe of subject matter. It adequately covered all the topics of the relevant dimensions. A high validity was ensured by a careful definition of the topic, right selection of items to be scaled, personally collecting data and consultation from a panel of judges.

Factor Analysis for the Items of Visual Merchandising

The Principal Component Factor Analysis was applied with Varimax Rotation so as to identify the underlying factors of visual merchandising.

Before proceeding for factor analysis, the raw data was checked for sampling adequacy and sphericity. The positive result shows application of factor analysis is appropriate. For visual merchandising scale the KMO measure was 0.868 which is more than 0.5 indicating that the sample is adequate for the application of factor analysis. The Bartlett's Test of Sphericity was tested through Chi-Square value 786.422 significant at 0% level of significance. Its associated probability is .000 and is less than 0.05 indicating that the data has low or no sphericity. Bartlett's Test of Sphericity is significant this means that the correlation matrix is not an identity matrix. Thus the data collected for the visual merchandising is suitable for undertaking factor analysis.

Table: Showing KMO and Bartlett’s Test Results for Visual Merchandising Variable

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.868
Bartlett's Test of Sphericity	Approx. Chi-Square	786.422
	df	55
	Sig.	.000

The Factor Analysis with Principal Component Method and Varimax Rotation was applied. The raw scores of the 11 items of the Visual Merchandising comprised of two factors namely unplanned purchase and persuading.

Factor 1: Unplanned Purchase: This factor is constituted of six variables. The variables being stimulate (.785), attracted (.721), attention (.658), inducing sale (.615), trials (.557) and admire (.489). This factor has 36.753 percent of variance.

Factor 2: Persuading: This factor is constituted of five variables. The variables being featuring (.736), idea (.673), store selection (.617), attractive setting (.615) and rely (.457). This factor has 9.790 percent of variance.

Table: Showing the Result of Factor Analysis for the Items of Visual Merchandising

Factor Name	Eigen values			Variables converged	Loading
	Total	% Variance	Cumulative variance		
Unplanned purchase	4.043	36.753	36.753	Visual presentation often stimulate me to make unplanned purchase	.785
				I tend to enter a store when I am attracted by an eye-catching window display.	.721

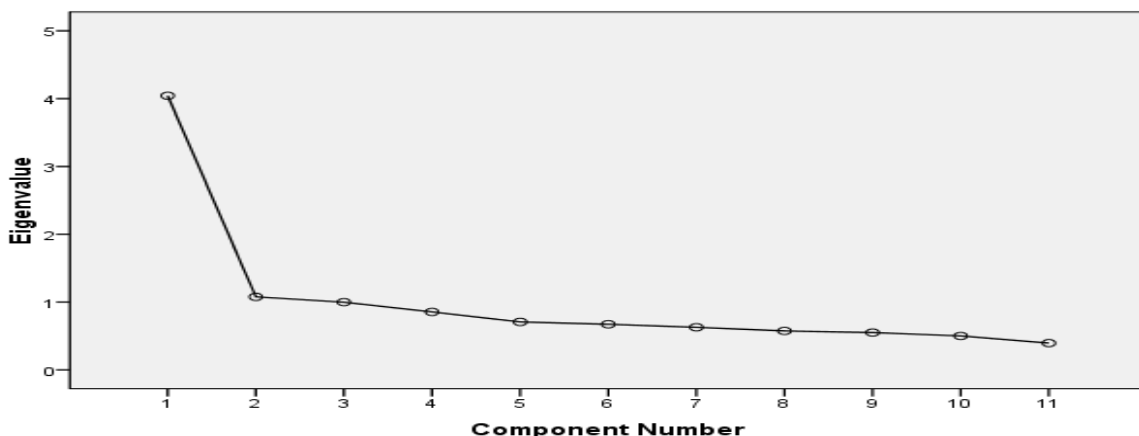
				When I see a special promotion sign (reduced price, Sale/clearance signs etc.) in the store, I go to look at that clothing.	.658
				When I see clothing that I like on in-store form/mannequin display, I tend to buy it.	.615
				I tend to try on clothing that catches my eye when I walk along the isle.	.557
				Even if I have limited time, I stop and look into the window of retail shop to admire the offerings.	.489
Persuading	1.077	9.790	46.543	When I see clothing featuring a new style or design on display, I tend to buy it.	.736
				I get an idea of what I want to buy after looking through in-store form/mannequin display.	.673
				I tend to choose which store to shop in depending on eye-catching window displays.	.617
				It is not the uniqueness of the merchandise but the setting in which the item appears is attractive.	.615
				I tend to rely on store displays when I make a decision to purchase clothing.	.457

Scree Plot for Visual Merchandising

The scree plot graphs the Eigen value against the factor number or component number. It tells the number of factors that can be retained for analysis. One rule is to consider only those with Eigen values over 1. Another rule is to plot all the Eigen values in their decreasing order. The plot looks like the side of a mountain. Scree graph plots all the Eigen values in the decreasing order of their magnitude. It helps to visualize the relative importance of the factors. A sharp drop in the plot signals that subsequent factors are ignorable. A scree graph is suitable to drawn when the sample size is 300 or above.

It can be seen from the following graph that the slop is falling till the second factor. From the second factor on, the line is almost flat, meaning the each successive factor is accounting for smaller and smaller amount of the total variance.

Figure-4.4: 3c Showing Scree Plot for the Factors of Visual Merchandising Variable
Scree Plot



REVIEW OF LITERATURE

Unplanned purchase and persuading has emerged as the two important factors of visual merchandising. From a psycho physiological point of view, arousal is a fundamental feature of behaviour. As reported in different empirical studies based on insights from theories of consumer behaviour, store atmosphere should evoke phasic arousal reactions to attract consumers. Majority of these empirical studies applied verbal scales in order to measure the sales motivation at the point-of-sale. Han et al (1991) stated that without having prior information of a new product or intention to purchase a certain item, a consumer is exposed to stimuli suggesting that a need can be satisfied through the purchase. The apparel store stimuli serve as a type of information aid for those who go to the store without any predetermination of what they need or buy. The more the store stimuli, such as visual merchandising which serves as a shopping aid, the more likely the possibility of a desire or need arising and finally creating an impulse purchase. The study was conducted on three samples female consumers, using four impulse buying dimensions and demographic characteristics. Predictor variable of impulse buying was also identified and it was found that non-student consumers were more planned buyers while students were most likely to be impulse buyers. Comparisons of the three groups of consumers on other shopping behaviours and demographic variables further supported the proposition that these groups constituted of varied market segments. Multiple regression analyses revealed that impulse buying behaviour could be predicted from other shopping behaviours and demographic variables, especially for the student groups. The results of the study provided a conceptual and empirical understanding of impulse buying variable.

Summers and Hebert (2001) studied the influence of display lighting as a component of store atmospherics on consumer approach and avoidance behaviour. For the purpose of the study, the authors used supplemental lighting which was temporarily installed and manipulated on merchandise displays in two retail stores to test the effect on consumer behaviour. The observations were made for the number of items touched and number of items picked up. Statistical analysis revealed that additional attractive had a positive effect on consumer behaviour, supported by good display. Interactions between lighting and display were found to be statistically significant. Thus store managers must include in-store lighting as an integral part of a store image development to attracting and retaining consumer. Window displays are the ubiquitous and prominent but under-researched element of retail strategy. Sen et al (2002) explored how the store and product category information communicated by a store's window displays are related to consumer's shopping decisions, such as store entry and product purchase. They also explored the relationships that vary for consumer segments that differ in terms of their knowledge of the retailer's product. The study was conducted in the context of clothing retailers. Results demonstrate that the store entry decision is related both directly as well as indirectly through acquisition of inferred, store-related information to the acquisition of observed, store-related information from window displays. Fashion related information and product self-fit contributed more to the product purchase decision rather than store related information like window display and store image. Further it was found that shoppers with least shopping experience were more influenced by unique and attractive window displays as compare to low or high level of shopping experience.

Backstrom and Johansson (2006) conducted a study to show how retailers as well as consumers relate to in-store experiences. The research results shows that retailers are using advanced techniques with the objective of creating persuasive store experience for their customers.

Store experiences were majorly influenced by employee's behaviours, comfortable product selection environment and store layout. Seock (2009) examined the influence of consumer's perceived importance of apparel retail store environmental cues and demographic characteristics on their apparel store patronage behaviour across various retail store formats. Three apparel retail store environmental cue dimensions were identified viz. customer service, convenience and physical atmosphere. Out of these three dimensions, customer service appeared as a significant determinant in the consumer's decision to shop at department stores, specialty stores, and mass merchant stores. In the context of speciality store, convenience emerged as an important factor. Physical atmosphere emerged as an important determinant for shopper's choice of a retail store. The image of retail store offers an important means for differentiation in highly competitive retail markets. Front displays at a store generally gather a lot of attention and increases that footfall at the store. Cornelius et al (2010) investigated perceived image differences among storefront displays and explored its relationship with store image formation. Innovative displays captures attention and enhances store image was another important finding of the study.

Somoon and Sahachaisaeree (2010) studied 11 designing factors for window displays viz. colour tone, diffused/spotted lighting, with graphical illustration/non-graphical illustration, text/ non-text, existence of prop/ non-prop, number of prop, level of complexity, existence of mannequin/ non- mannequin, abstract/ realistic mannequins, whole/partial perception, ordered/ disordered displays. The images of the display included stimuli

factor as complexity, interesting, arousal, attractiveness, merchandize uniqueness, value, shopping willingness and shop attractiveness. The results of the current study indicate that visual merchandising has positive significant impact in building apparel store image. This is in line with the results of the study conducted by Cornelius (2010) which reveal that different types of storefront displays carry different image potential and that innovativeness drives image valuation. These results also suggest that a store might benefit from using innovative storefront displays. Even those customers who were familiar with the store or had negative attitude toward storefront display, exhibited positive image from innovative displays. For consumers with less resistance i.e. low familiarity and positive attitudes toward storefront displays, the effects strengthen to include positive spill over effects on the overall store image. The findings therefore suggest that storefront displays represent an effective tool for transferring image components to a retail store. Compared with costly in-store reengineering or other marketing activities, storefront displays offer an attractive and cost-effective alternative means to improve retail store image. In addition, this mode of advertising is especially effective for new customers. This study show that people unfamiliar with the store are influenced in both image dimensions by a storefront display.

CONCLUSION AND RECOMMENDATIONS

The study has resulted into the development of a administrable scale for the measurement of visual merchandising for readymade branded apparels. The scale was standardized and then used for the study. The standardization procedure resulted into 11 items for visual merchandising. The study has resulted in the constituting factors for visual merchandising. The raw scores of the 11 items of visual merchandising revealed two factors viz. unplanned purchase and persuading.

To gain a competitive advantage, individual company wise study application should be done. Also one product category i.e. readymade branded apparel has been considered. The same study can be conducted for a particular brand of readymade apparel and many other product categories as well. There are various other demographic variables and psychographic variables which may affect the perception towards visual merchandising. Various combinations of these variables may generate better and newer results. This way visual merchandising can be understood and defined more effectively and precisely. Including bigger sample and more number of cities in the study will help generation of further precise findings. Efficiency of visual merchandising can be understood by the analysis of overall sales and financial performance. A logical extension of this research would be to investigate how visual merchandising influences other relevant store outcomes such as the number or frequency of visits or sales. The database that apparel retailers possess can be explored for further diagnosis and building future promotions.

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A STUDY ON APPROACHES OF B-SCHOOLS IN MODERN ERA

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ABSTRACT

Management Institute has an important role being played in a student's life. It can make their life whereas also demean the purpose of life hence it is very important to select the management institute carefully by the students and their guardians. Nowadays the education sector has also at the par of other organizations in respect to the marketing and advertising. Everything from rankings to placements to branding has become buzz word today and the importance which should be given to Learning, Innovation, Problem solving and Pedagogy etc. are disappearing. Management Institutes should emphasize on students preparation not on the current curriculum prevailing in the present organization but in advance on the basis of probability of organization changes. If students are really aided after studying the MBA Course and they are not able to get through campus placement but surely they will be able to crack many more interviews on their own, later in their life.

This paper highlights the understanding of Management Institute's priority and action plan which they design and the impact of it on to the students and their parents. The paper also highlights the marketing strategies' advantages and disadvantages to the institute.

Keywords: Management Institute, marketing, Development

INTRODUCTION

Management education is undergoing a rapid change. If we see the growth in the management education, it is enormous and expect to be same in future but with modifications into the operations and communication to the students and their parents. Management institute is a bridge between the present and future. Every courses, whether it is M.Com, MA, MSc. etc. produces not masters but managers. Management Institute is a network between organizations "customers" that is students, alumni, faculty members, and staff members. All are the pillars without which they cannot function. Here in an institute it is not only the dissemination of the knowledge which matters but also the way it is done that is with which technology and tools whether updated or outdated.

Another revolution in this area was done through ranking system initiated by Media which was first introduced in year 1988. After that all management institutes got engaged in various activities and focused on criteria's which were important to them to excel in ranking list. Hence product tinkering, packaging and marketing are more thought upon. Subsequent to this, the popularity of MBAs rose.

These Institutes are also affected by Global competition, as the time is passing on world is becoming smaller and students are moving to bigger cities and universities abroad for better prospects. Internet mode of communication and transportation has made life very easy and comfortable. Information sharing is quick and clear. Therefore to attract students has become very tough and complicated. Now the millennials understands the fake and genuine of information. They have their own area of interest and dreams to which they seek to fulfill by any means. Earlier this was the advantage to the higher income sector to receive education but now by the help of banks and other financial institutions providing loans to other sector and hence dreams of low and medium sector people are also promised to fulfil as they too can afford the management degree.

The number of B Schools has increased manifold. Now the challenges faced by the institute are to spread their existence and awareness into the market in front of the target customers. Every day customers are getting a bombarded of innumerable advertisements online and offline. Few of which he remembers and many gets slipped from his mind. Students are clever and they understand that all the glitters is not gold. They do complete analysis and research and make their mindsets before taking any admission. E-learning and computer based learning packages are making inroads slowly.

In year 2016 many of the management institutes and engineering colleges were shut down throughout the country by the AICTE and UGC as they were not able to comply with basic requirements. Hence it has become a red signal to the existing institutions on to their survival. All Management Institutes are up on their knees to get all factors fulfilled, comply all the rules and regulations and get their maximum seats full. To get more and more admissions and enrollment of the students, they leave no stone unturned. Strategies like product strategy, price, place, promotion, distribution, process, physical evidence and placement are the different strategy prepared by the Management Institute to attract more and more students for admission.

A business school not only imparts knowledge but also create knowledge. Here they study many new problems faced by the real world and come to solution by suggesting their recommendations which are further forwarded to the corporate houses after a lot of research and brainstorming hence B schools also act as a consultant to many of the SME's and big Corporate houses. Not only this even the government of India also seek advice and consultancy in relation to the policy formation in commerce industry

MANAGEMENT EDUCATION IN INDIA

Managers are required in every sector. India is a vast country and it has huge demand of managers which will remain evergreen. To fulfil the demand of future managers the management Institute has to be on the toes selecting and preparing the future managers. Quality is the need of an hour Hence government of India has made IIM's which cater the need of the world. In Mumbai there are many management institutes which are autonomous, private, state government approved and foreign collaborated. Few Institutes are world recognized like SP Jain Institute of management, Jamnalal Bajaj Institute, Xaviers Institute of management etc.

Moreover autonomous institutes approved by AICTE, universities running distance education program and open mode like IGNOU, NM College, Mumbai University- Alkesh Dinesh Mody , Bharti Vidhyapith University, ICFAI and several others are also offering courses in management. Some recognized institutes and universities are also offering 3 years part time program in evening faculty for working

REVIEW OF LITERATURE

Vipin Gupta, Kamala Gollakota and Ancheri Sreekumar presented paper on “*Quality in Business Education: A Study of the Indian Context*” reveals that recently, with the bursting of clicks as well as ethics bubbles, the credibility the business education has taken a beating. The rapid growth and proliferation of business schools, has led to the emergence of some schools having dubious quality – and business education has come under scrutiny The research article entitled “*Management Education - Present Scenario in Indian Context*” by Dr. T.Ramesh and Mr. P. Sreenafh reveals that management is of the most integrated, dynamic and civilized education system. The concerning aspect of management education are of high standard and yield oriented approach. AICTE which is known as highest apex body, is controlling the institution for achieving high quality with genius professionalism. The article written by Rajesh.S.Modi and Raju Rathod entitled “*New Version of Education: Seed of Development*” is mainly focused to address the key issues of current education system and how a new version of education can address the problems and bring a quality improvement in education , which is considered, to be a seed of development.

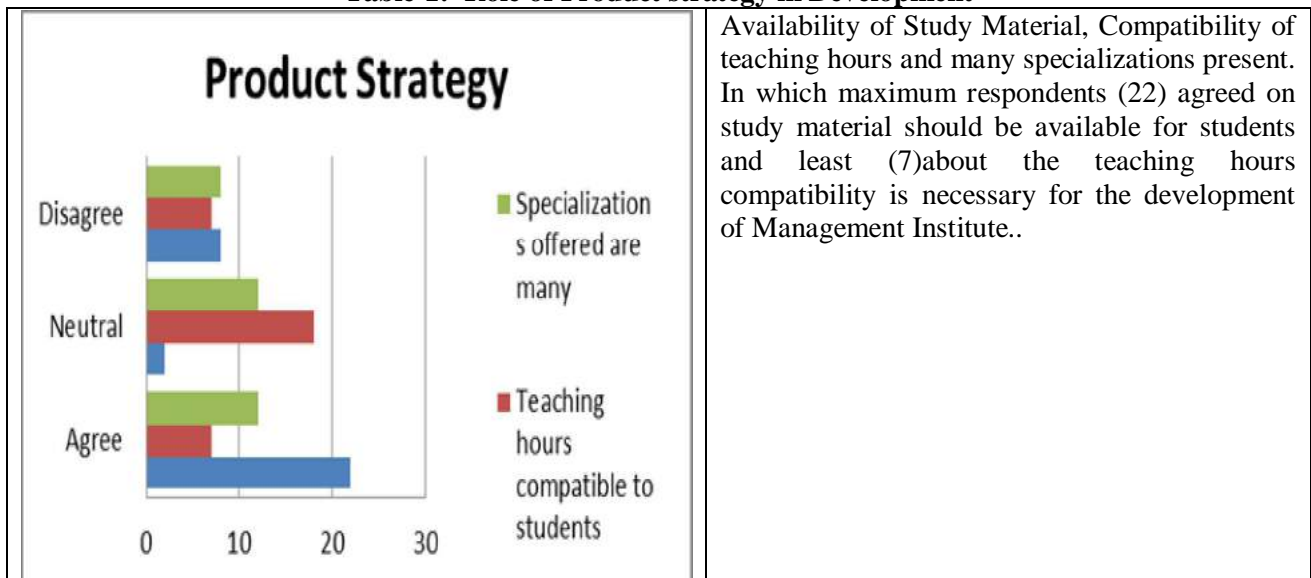
RESEARCH METHODOLOGY

The present study incorporates the collection of both primary and secondary data for an in depth investigation. Out of the questionnaires mailed to 35 institutes of selected B- schools in Mumbai region, 32 responded back, therefore the sample size for the Management Institute stands at 32. Secondary data has been selected through books, magazines, newspapers, thesis etc.

DATA FINDING, ANALYSIS AND INTERPRETATION

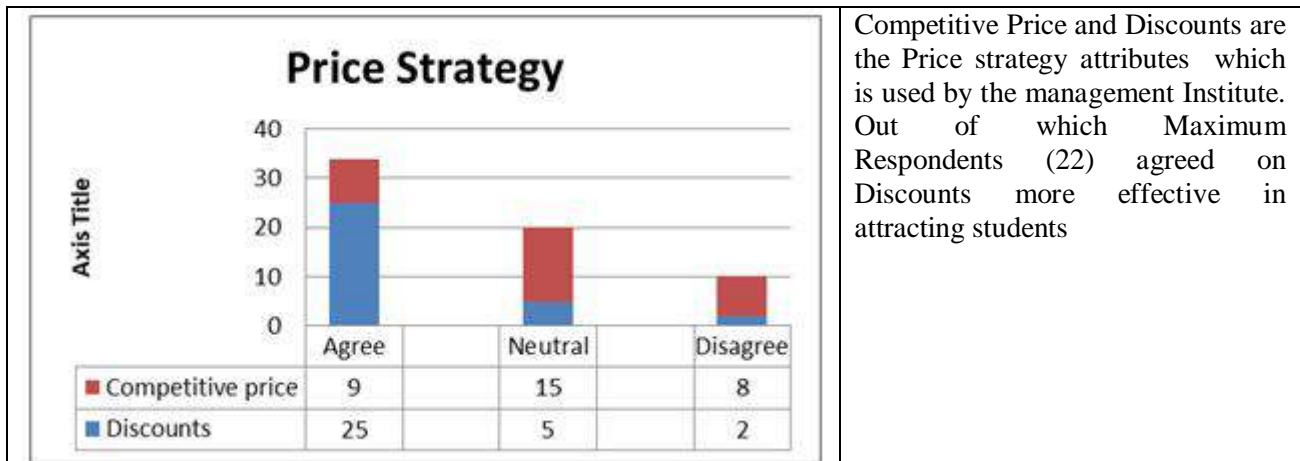
The data received from the survey done has been analyzed and interpreted as below

Table-1: Role of Product strategy in Development



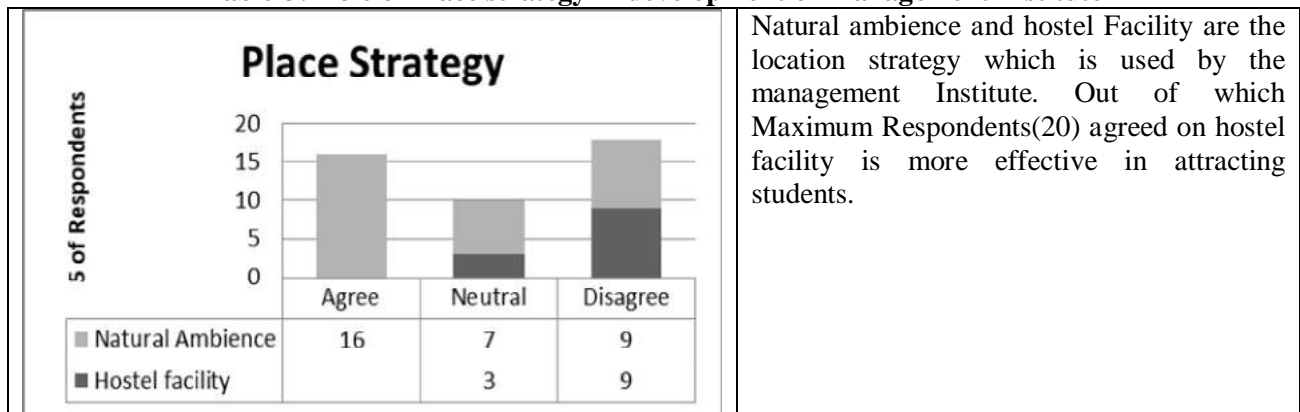
Availability of Study Material, Compatibility of teaching hours and many specializations present. In which maximum respondents (22) agreed on study material should be available for students and least (7) about the teaching hours compatibility is necessary for the development of Management Institute..

Table-2: Role of Price strategy in development of Management Institute



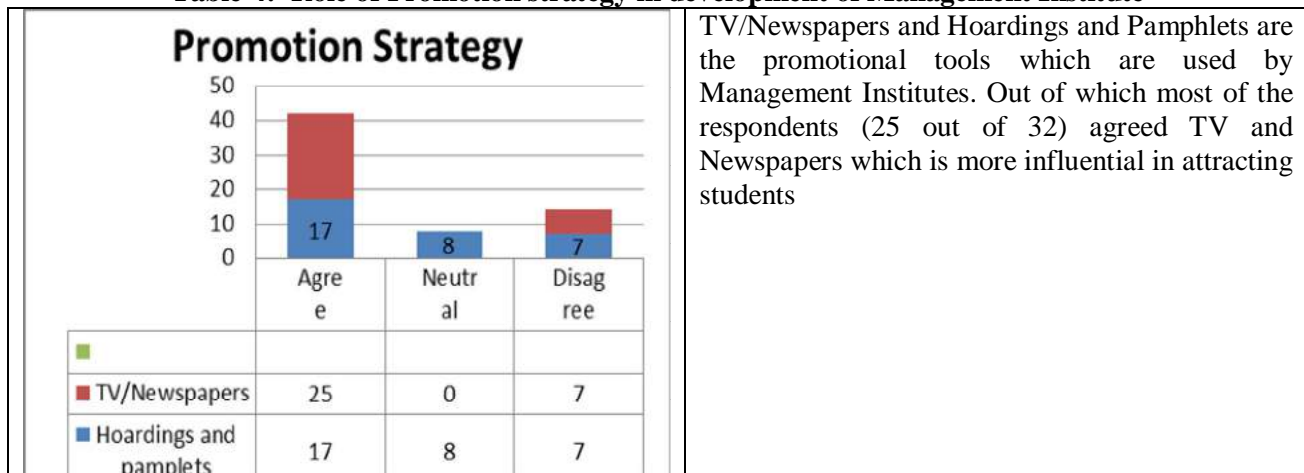
Competitive Price and Discounts are the Price strategy attributes which is used by the management Institute. Out of which Maximum Respondents (22) agreed on Discounts more effective in attracting students

Table-3: Role of Place strategy in development of Management Institute



Natural ambience and hostel Facility are the location strategy which is used by the management Institute. Out of which Maximum Respondents(20) agreed on hostel facility is more effective in attracting students.

Table-4: Role of Promotion strategy in development of Management Institute



TV/Newspapers and Hoardings and Pamphlets are the promotional tools which are used by Management Institutes. Out of which most of the respondents (25 out of 32) agreed TV and Newspapers which is more influential in attracting students

According to the survey conducted of 32 management Institutes the response has been categorized on the basis of 4 P's they are Product, Price, Place and Promotion Strategy.. The findings and Recommendations are as follows:-

FINDINGS AND RECOMMENDATIONS

There are various Recommendations to Management Institute which are as follows

- To attract Quality Students, it is suggested that Institutes should focus more on intangible factors like study material.
- The management Institute should emphasize more on Newspapers to update and for advertising purpose.
- Apart from good ambience the management Institute should focus more on Hostel Facility.
- Discounts also attract the students hence institute should focus on them. .

CONCLUSION

The future of the management Institute is really frightening as more and more challenges are predicted in the course of time. The global Schools are real threat as they pull most of the bright students. Apart from this there are many short courses which are offered by many private agencies which pull major chunk of the target customers. Hence to get admissions and enrollment of the students that too with good quality of the students is not an easy task. Institutes are doing marketing and Branding but most important is that they move in the right direction. Just Placement and Infrastructure is not the only tool which will make them to fill the students. Institutes should not go behind 100 Percent Placement. They are the Institutes not the consultancies whose main aim is to get ready the students for future managerial role.

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SOCIAL INSURANCE: SECURITY OR INSECURITY TO INDIAN LABOUR

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ABSTRACT

Social security is the protection given by the society to its members against contingencies of modern life such as sickness, unemployment, old age, invalidity, industrial accidents etc. In the present scenario social security is fast changing and social insurance and social assistance are moving closer to each other towards the common goal of a national system. Social insecurity means inability or lack of capacity of a person or individual to protect himself from the risks of unemployment, sickness, industrial accidents or disability, old age and other contingencies. Industrial workers are under full of risks. In the early decades of 20th century, social security has become a fact of life for millions of people throughout the world. Social security is present understood as one of the dynamic concept of modern age which is influencing social as well as economic policy. The effective weapon of war is nuclear missile, social security is the most effective weapon of peace.

Keywords: Social, Security, Economic, Policy, Insurance.

INTRODUCTION

In the early times man lived with his family on fruits and honey in the heavenly gardens without doing any work. But now labour are striving to earn their bread, raiment and shelter. Because industrial workers are under full of risks. The basic purpose of social security is to protect people against contingencies of modern life. Each individual is unique and desires to live more independently with dignity. Being a part of society one cannot live in isolation. At every stage of development there have been people requiring medical aid and care, handicapped and old people unable for a living.

CONCEPT

In the early decades of 20th century, social security has become a fact of life for millions of people throughout the world. Social security measures have introduced an element of stability and protection in the midst of stress and strains of life. Social security is “an attack of five giants that effect workers wants, disease, ignorance, squalor, and idleness. it is not a burden but a kind of wise investment that offers good social dividends in long run.” The underlying idea behind social security measures is that a citizen who has contributed to his country’s welfare should be given protection against certain hazards.

Beveridge defined social security means “security of income to take the place of earnings when they are interrupted by unemployment, sickness to provide for retirement through age to provide against loss of support by the death of another person and to meet exceptional expenditure such as those concerned with birth, death and marriage”.

The term social security is a combination of three separate trends:

- 1) An economic policy aimed at full employment.
- 2) Medical policy one of the equipment and organizations for the struggle against diseases, including preventive actions and best possible treatment.
- 3) A Policy of income distribution aimed at modifying the results of the blind interplay of economic forces and adapting the income of each individual and each family to those individuals having regard to all circumstances which may affect such income in the future

OBJECTIVES OF THE STUDY

To know whether social security is necessary for Indian labour

To understand the concept of social security

RESEARCH METHODOLOGY

Data has been gathered through secondary source, through journals, books, websites.etc

SOCIAL INSURANCE AS A CONSTITUENT OF SOCIAL SECURITY

Social insurance and social assistance are the two pillars of social security. Social insurance involves collective efforts of beneficiaries. Because the beneficiary has to pay contribution before he is entitled to secure benefits

.Thus the benefits are not gratuitous acts of the employer. They are systematically financed since it is subsidized by the state. Social insurance schemes specify certain contingencies in which benefits are provided to the persons specified. It provides security against risks. The main objective of social insurance is to serve society and its constituent individuals.

Besides social insurance schemes there are private insurance schemes which are in paid in such schemes and no medical benefits are provided. But in social insurance schemes a variety of benefits are provided to the beneficiary. An individual decides whether he wishes to have one or more number of risks covered.

SOCIAL INSURANCE

The ILO actively promotes policies and provides assistance to countries to help extend adequate levels of social protection to all members of the society these includes projects to help countries extend coverage at the national level and to strengthen community - community based social security organizations the preamble to the constitution of ILO contains the basic purposes for the attainment of which ILO has been established the ILO set forth a new fundamental principles at its 26th conference held in Philadelphia in 1994, known as Philadelphia declaration. It recognizes the obligation of the ILO to further among the nations of the world Programmes which would achieve

1. Full employment and the raising of standards of living
2. The extension of social security measures to provide a basic income to all in need of such protection and comprehensive medical care.
3. Adequate protection for life and health of workers in all occupations.
4. The effective recognition of the right of collective bargaining
5. Provision for child welfare and maternity protection
6. The provision of adequate nutrition, housing and facilitates for recreation and culture.

SOCIAL INSURANCE: INDIAN LABOUR LEGISLATION

A) E.S.I. ACT 1948: The Employee State Insurance Act, 1948 is the most important comprehensive scheme for providing social security benefits. The scheme which was originally framed to cover perennial i.e. non seasonal factories using power and employing employees. It brings all the benefits medical benefits, sickness benefit, maternity benefit, dependents benefit, disablement benefit, and funeral benefit under one integrated scheme. All employees in factories and establishments covered under this act are to be insured. To claim the benefits under this act, in respect of both the employers and employees are to pay to the E.S.I Fund which is administered by the E.S.I Corporation. The rates of the contribution were 1.75% employees' wages payable by the employees and 4.75% employees' wages payable by the employers. Employees who are getting wages Rs 40/per day do not have to pay contributions, but they receive benefits as a matter of right. The state govt bear 1/8 of the expenditure on medical benefit.

B) PROVIDENT FUND LEGISLATION: In 1951 the labour ministers conference emphasized the urgency of enacting the employees provident funds and Miscellaneous provisions act in 1952. the objectives of the act are

Make provisions for the future of the industrial worker after retirement or for his dependents in case of his early deaths.

To inculcate among the workers the habit of regular savings

To encourage the stabilization of a steady labour force in the industrial centers.

A new scheme called employees deposit linked scheme came into force with effect from August 1st 1976. the employee members are required to contribute to this scheme but they are required to pay contribution at the rate of 0.5% employee wages. An amendment to employees provident fund act 1953 provided the employees family pension scheme in 1971 which was amended in 1995 with the retrospective effect from 1st April 1993. Under the pension scheme neither the employer nor the employee is required to contribute any additional amount.

Social insurance: recommendations of the second national commission on labour

The second national commission on labour was appointed by the govt of India on October 15th 1999 under the chairmanship of Ravindra Varma former minister of labour, government of India. The commission submitted its report on June 2002. The terms of reference of the commission were

To suggest rationalization of the existing laws relating to labour .

To suggest an umbrella legislation for ensuring a minimum level of protection to the workers.

Provident funds, gratuity and unemployment insurance

A law to place all the provident funds under a common regime seemed to be desirable and EPF act be made applicable to classes of establishment.

Appropriate provisions has to be made in the EPF act to enable the organization to frame different schemes with different contributory and benefit packages .

The payment of gratuity act may be integrated with EPF act to convert in to a comprehensive social insurance scheme.

An Unemployment insurance scheme should be introduced to code with unacceptable levels of unemployment resulting from the implementation of the structural adjustment programmes and other economic reforms.

CONCLUSION

In the present scenario social security is fast changing and social insurance are moving closer to each other towards the common goal of a national system of social security. Many believe that the social insurance schemes are preferable to other forms of protection like social assistance, employer liability and social allowance schemes .Today many countries have comprehensive social insurance schemes which cover a large majority of population and provide protection against a wide range of contingencies and India is not an exception.

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MANUSCRIPT SUBMISSION

GUIDELINES FOR CONTRIBUTORS

1. Manuscripts should be submitted preferably through email and the research article / paper should preferably not exceed 8 – 10 pages in all.
2. Book review must contain the name of the author and the book reviewed, the place of publication and publisher, date of publication, number of pages and price.
3. Manuscripts should be typed in 12 font-size, Times New Roman, single spaced with 1” margin on a standard A4 size paper. Manuscripts should be organized in the following order: title, name(s) of author(s) and his/her (their) complete affiliation(s) including zip code(s), Abstract (not exceeding 350 words), Introduction, Main body of paper, Conclusion and References.
4. The title of the paper should be in capital letters, bold, size 16” and centered at the top of the first page. The author(s) and affiliations(s) should be centered, bold, size 14” and single-spaced, beginning from the second line below the title.

First Author Name₁, Second Author Name₂, Third Author Name₃

1 Author Designation, Department, Organization, City, email id

2 Author Designation, Department, Organization, City, email id

3 Author Designation, Department, Organization, City, email id

5. The abstract should summarize the context, content and conclusions of the paper in less than 350 words in 12 points italic Times New Roman. The abstract should have about five key words in alphabetical order separated by comma of 12 points italic Times New Roman.
6. Figures and tables should be centered, separately numbered, self explained. Please note that table titles must be above the table and sources of data should be mentioned below the table. The authors should ensure that tables and figures are referred to from the main text.

EXAMPLES OF REFERENCES

All references must be arranged first alphabetically and then it may be further sorted chronologically also.

• **Single author journal article:**

Fox, S. (1984). Empowerment as a catalyst for change: an example for the food industry. *Supply Chain Management*, 2(3), 29–33.

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Role of Gender and Motivation across Banking Sector in India

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ABSTRACT

Motivation is the basic drive for all of our actions. Motivation refers to the dynamics of our behavior, which involves our needs, desires, and ambitions in life. The role of gender in shaping motivation has a long history in psychological and educational research. This paper investigates the relationship between role of gender and motivational aspects of employees behaviour. The study comprised of analysing six motives (Achievement, Influence, Extension, Control, Affiliation and Dependency) by administering MAO-B questionnaire to respondents. Sample comprised of 102 respondents from Banking sector. The study shows that most significant motive influencing the managerial behaviour for both the gender is Extension followed by Achievement motive.

Keywords: Extension, Affiliation, Achievement, Managerial behaviour

Introduction:

Motivation refers to “the reasons underlying behaviour” (Guay et al., 2010). Motivation can also be defined as “the attribute that moves us to do or not to do something” (Gredler et al., 2004). A motivated employee is a loyal employee and to be loyal implies that the employee supports the actions and objectives of the firm. The appearance of the job as a whole has, in fact a bearing on the willingness and quality of an employee’s performance (Bruce, 1962). A person’s behaviour is the result of several factors or motives. Knowledge of the typical, primary motivators of behaviour in a work setting can help managers and consultants to deal more effectively with people. Murray (1938) developed a long list of human motives or needs and his work inspired further studies, which have produced different lists of significant behavioural motives. McClelland identified three important motives: achievement, affiliation and power (McClelland et al., 1953). Although McClelland’s study of achievement and affiliation motives showed them to be rather simple variables, he found the power motive to be a complex one. The desire for power contains three different elements: the need to control others, the need to make an impact on others and the need to use power to do something for other people and groups (McClelland, 1975). Maslow (1943) advanced the following important propositions about human behaviour: humans want beings (they always want and they want more), a satisfied need is not a motivator of behaviour and human needs are arranged in a series of levels-a hierarchy of importance. Maslow classified people needs in 5 categories: physiological, safety, social (sense of belonging), esteem and self-realization needs. Maslow said that, when an inferior rank need is satisfied (for example, assuring food, clothing, the need of breathing, etc), the next level need becomes dominant, and the attention of the person is dedicated to the accomplishment of this higher rank need. He mentioned that only an unsatisfied need can motivate the behaviour, the dominant need being the primary factor for behaviour motivation.

Managerial behaviour of an employee is defined as the in-role and extra-role behaviour of employee in an organisation. Motivation is important because it affects our lives everyday. Achievement motivation is based on reaching success and achieving all of our aspirations in life. Achievement goals can affect the way a person performs a task and represent a desire to show competence (Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997). These basic physiological motivational drives affect our natural behavior in different environments. Most of our goals are incentive-based and can vary from basic hunger to the need for love. Our motives for achievement can range from biological needs to satisfying creative desires or realizing success in competitive ventures. All of our behaviors, actions, thoughts, and beliefs are influenced by our inner drive to succeed. As motivation is the basic drive for all of our actions it is essential to analyse important motives that drives managerial behaviour.

Literature Review:

Murray (1938) developed a long list of human motives or needs. Murray's work inspired further studies, which have produced different lists of significant behavioral motives. McClelland, Atkinson, Clark, and Lowell (1953) suggested three important motives (achievement, affiliation, and power) and also suggested elaborate methods for measuring them. McClelland subsequently demonstrated the importance of the achievement motive for entrepreneurship and marketing (McClelland, 1961;

McClelland & Winter, 1971) and of power as a motivator in management (McClelland, 1975; McClelland & Burnham, 1976).

Although McClelland's study of achievement and affiliation motives showed them to be rather simple variables, study found the motive of power to be a complex one. As he suggested during his study of power (McClelland, 1975), the desire for power contains both an urge to control others and an urge to make an impact. McClelland called these variables personalized power and socialized power. Thus, McClelland seems to suggest three different elements in the power motive: the need to control others (personalized power), the need to make an impact on others, and the need to use power in doing something for other persons and groups—such as in organizations (socialized power). It is helpful to make clear distinctions among these three. Control seems to be focused around keeping track of developments according to an agreed-on plan to be informed about "how things are going." This seems to be an important need or motive in managerial behaviour. The so-called socialized dimension of power (reflected in the use of power for the benefit of others) seems to be a separate need or motive. Pareek (1968a, 1968b) suggests that this need is important for social development and calls it the extension motive. The need for achievement was defined by McClelland (1985) as a concern with "doing things better, with surpassing standards of excellence". Decades of research have shown n Achievement to be related to moderate risk taking, responsiveness to feedback, future-time-orientation, personal responsibility for performance outcomes, and participation in entrepreneurial activity. It is not surprising that research on gender and achievement motivation has been influenced by prevailing views about gender differences. Stewart and Chester (1982) focused their review of these differences on two areas—differential responses to achievement arousal and behavioural correlates of achievement.

Many researchers believed that it was difficult to arouse achievement motivation in women, most likely because achievement was seen as an exclusively masculine concern. It was also quite likely that because the original arousal studies had only male participants, key imagery to distinguish between high and low achievement-motivated women was left out of the coding categories. Stewart and Chester (1982) reviewed the early research on the arousal of n Achievement, and, after pointing out flaws in research design and missed opportunities to interpret main effects, they concluded that there is no consistent evidence that the motive was difficult or impossible to arouse in women.

Objectives:

In today's challenging work environment, engaging and motivating the tweeting generation is emerging as the biggest challenge. It is widely recognized in the human resource literature that promotion of the motivation of workers in both private and public organisations leads to a higher quality of human resources and optimum performance. Consensus is also growing among managers about the significance of combining good human resource performance approaches on motivation incentives to encourage good performance. Hence, it becomes important for the management to understand what drives the managerial behaviour.

Hypothesis:

Although Miner's research (1993) demonstrates no difference in managerial motivation between women and men in managerial positions in recent years in the USA, the question remains if these findings are generalizable to other countries. Based on the results of recent studies of managerial motivation of females and males in the USA (Miner, 1993; Miner and Smith, 1982; Miner et al., 1985), Hong Kong (Ebrahimi, 1997a), and the PRC (Chen et al., 1997) we postulate the following:

H₁: Managerial motivation for males and females employees are different .

Research Methodology:

Tool Used:

MAO-B INSTRUMENT

The Motivational Analysis of Organizations-Behavior (MAO-B) instrument contains sixty items, five for each dimension (approach and avoidance) of the six motives is used to study motivational aspects of managerial behaviour. The test-retest reliability coefficients for the six dimensions are between .61.

Sample and Sampling technique:

To study motivational aspects of managerial behaviour MAO-B was administered to 102 BPO professional (46% Male and 54% Female) . In the absence of any Sampling Frame and due to paucity of time, the sampling technique used was convenience.

Data Analysis and Result:

Table 1 shows mean and Standard deviation of both male and female gender for all the six motives (Achievement, Influence, Extension, Control, Affiliation and Dependency). The above table shows mean value of achievement motive for male (2.6) is higher than female (2.5). As standard deviation for female is higher than males shows females have comparatively less homogeneity in perception towards motivation. For Extension motive and dependency motive mean value is higher than male counterparts.

Table 1 Descriptive Statistics

Gender		Ach_Mot	Influence	Exten	Control	Affiliation	Dependency
MALE	Mean	2.60	2.66	2.46	2.46	2.46	1.80
	N	45	45	45	45	45	45
	Std. Deviation	.80	.79	.81	1.03	.72	.54
FEMALE	Mean	2.52	2.26	3.84	1.68	2.05	2.63
	N	57	57	57	57	57	57
	Std. Deviation	1.40	1.02	6.75	1.03	.69	1.14
Total	Mean	2.55	2.44	3.23	2.02	2.23	2.26
	N	102	102	102	102	102	102
	Std. Deviation	1.17	.949	5.10	1.10	.733	1.01

Table 2 shows significant difference in the mean value of male and female gender for all the six motives (Achievement, Influence, Extension, Control, Affiliation and Dependency).

ANOVA Table

The table show relationship is significant for influence motive (p =.032) ,control (p =.000), affiliation (p =.004) and dependency (p=.000) motive.

Table 2 : Anova Table

			Sum of Squares	df	Mean Square	F	Sig.
Ach_Mot * Gender	Between Groups	(Combined)	.137	1	.137	.098	.755
	Within Groups		139.011	100	1.390		
	Total		139.147	101			
Influence * Gender	Between Groups	(Combined)	4.094	1	4.094	4.703	.032
	Within Groups		87.053	100	.871		
	Total		91.147	101			
Extension * Gender	Between Groups	(Combined)	47.574	1	47.574	1.843	.178
	Within Groups		2580.779	100	25.808		
	Total		2628.353	101			
Control * Gender	Between Groups	(Combined)	15.396	1	15.396	14.320	.000
	Within Groups		107.516	100	1.075		

Affiliation * Gender	Total	122.912	101				
	Between Groups (Combined)	4.311	1	4.311	8.614	.004	
	Within Groups	50.042	100	.500			
Dependency * Gender	Total	54.353	101				
	Between Groups (Combined)	17.390	1	17.390	20.112	.000	
	Within Groups	86.463	100	.865			
	Total	103.853	101				

Table 3 below shows $p > \alpha$ for affiliation and control motive. Hence Equal variance for the control and affiliation motive is verified.

Table 3 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference		95% Confidence Interval of the Difference	
							Lower	Upper	Lower	Upper
Ach_Mot	Equal variances assumed	70.643	.000	.313	100	.755	.07	.23	-.39	.54
	Equal variances not assumed			.33	92.27	.740	.07368	.22152	-.36626	.51
Influence	Equal variances assumed	5.688	.019	2.16	100	.032	.40351	.18606	.03438	.77
	Equal variances not assumed			2.23	99.98	.028	.40351	.18067	.04506	.76
Extension	Equal variances assumed	6.472	.012	-1.35	100	.178	-1.37544	1.01305	-3.38531	.63
	Equal variances not assumed			-1.52	58.00	.133	-1.37544	.90228	-3.18151	.43
Control	Equal variances assumed	.162	.688	3.78	100	.000	.78246	.20677	.37223	1.19
	Equal variances not assumed			3.78	94.66	.000	.78246	.20672	.37204	1.19
Affiliation	Equal variances assumed	2.883	.093	2.93	100	.004	.41404	.14107	.13416	.69
	Equal variances not assumed			2.91	92.41	.004	.41404	.14187	.13229	.69
we accept null Dependency	Equal variances assumed	46.403	.000	-4.48	100	.000	-.831	.18543	-1.199	-.46
	Equal variances not assumed			-4.83	84.21	.000	-.83	.17	-1.17	-.48

As equality of variance is shown by only control and affiliation motive. Hypothesis are tested only for control and affiliation motive. Table 4 below shows p value for control motive (.000) is lower than α and also for affiliation motive p value =.004 is lower. Null hypothesis is rejected that is there is no difference in the mean of control and Affiliation motive for male and female gender. From Table 1 it can be inferred mean value of control motive(2.4) for male is higher than female (1.6) and also for affiliation motive mean value for male (2.4) compared to female (2.0) is higher.

Conclusion:

Study shows affiliation motive and control motive are influencing employees of Banking sector. Thus, no difference in the motives influencing both the genders in the Banking. From descriptive statistics it could be inferred mean value of control motive and affiliation motive for male is higher than female. Miner's research (1993) demonstrates no difference in managerial motivation between women and men in managerial positions in recent years in the USA. This study supports findings of Miners study which shows no difference in motivational aspects for both the gender at the workplace.

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Work Support and Family Support as Predictors of Work-to-family Enrichment and Family-to-work Enrichment

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Abstract

Of late, the relationship between work–family enrichment and support has started gaining some attention within the organizational behaviour literature. However, support emerging from the family front has often been neglected in previous studies. The purpose of our research is to empirically estimate the role of both work support (WS) and family support (FS) as predictors of work-to-family enrichment (WFE) and family-to-work enrichment (FWE) among sales employees in Indian organizations. Data were collected through structured questionnaires from 330 employees belonging to firms from some of the major sectors of Indian industry, namely manufacturing, IT, FMCG, pharmaceuticals and financial services. The study first validated the support scale in the Indian context using exploratory factor analyses (EFA) and confirmatory factor analyses (CFA). Further, structural equation modelling (SEM) using AMOS (version 20) was used to test the model. Results supported the 20-item work support and family support scale measuring work and family support in the Indian set-up. Further, results of SEM suggested that work as well as family support significantly predicts work-to-family enrichment as well as family-to-work enrichment. The study signals the importance of ensuring a supportive organizational environment for an effective workforce. This not only can help in enriching one’s work life, but also can impact one’s family life as well. The same phenomenon also applies to family front; a supportive family results in an improved enrichment in work domain. This study contributes to work–family literature by addressing role of support—both work and family—as predictors of WFE and FEW, which has rarely been studied in the Indian context.

Keywords

Work support, family support, work-to-family enrichment, family-to-work enrichment, sales employees, SEM, CFA, EFA, AMOS

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Introduction

Today, balancing work and family has become a critical issue in India against the backdrop of an era of globalization and rapid socio-economic change. Not just the demographic changes but also changes in the work context, like extended working hours, frequent interactions with customers and working across varied time zones, have become a norm of boundary spanning professions. Such changes, in turn, are leading to the dilution of boundary between work and family. For sales as a profession, this is all the more true.

Selling is largely seen as the backbone of any business. Sales employees are the ones who not only cover a territory but also sustain and enhance mutually beneficial partnerships with customers (Palmatier, Scheer & Steenkamp, 2007) and that is why they are the lifeblood of any organization (Milkovich, 1988). In real terms, they are the public face of an organization, with the principal task of generating sales. Since sales employees are immensely important for organizations, firms are making huge investments on their sales force (Zoltners, Sinha & Zoltners, 2001). There is very little research focusing on work–family balance of sales employees from the Indian perspective. Also, empirical studies focusing on sales personnel with respect to positive aspects, that is, enrichment, are rare to find although it is widely accepted that sales employees are the lifeblood of any organization (Milkovich, 1988).

Furthermore, organizational support has been shown to reduce role stress (Hamwi, Rutherford & Boles, 2011); so the support provided to sales people should also impact role stress. The more support sales people receive with respect to the roles that they perform, the more they are able to balance their time and job duty (Ahearne, Srinivasan & Weinstein, 2004), which in turn leads to enrichment. In other words, the better the organization treats its employees, better will be the responses from the employees, in terms of higher job satisfaction and lesser turnover intentions. Further, a large quantum of research focusing on work domain of sales employees and family is largely undermined. Hence, the present study incorporated both work and family domains with respect to enrichment. Studies exploring the positive work–family integrations are found to be rare in the Indian context (Baral & Bhargava, 2010; Bhargava & Baral, 2009). At a time when India has emerged as one of the major economic powers in the world, best of the global organizations have a significant presence in the subcontinent. It is therefore important at this juncture to make attempts to systematically study the positive effects of work on the family front and the family on the work domain as well as ascertain the generalizability of these concepts in Indian organizations. The study also aims to examine the role of both work support and family support as predictors of work–family enrichment among sales employees' in Indian organizations.

Review of Literature

To understand the issues concerning the balance between work and family, researchers have often focused on the negative perspective, that is, conflict perspective—primarily laid upon the scarcity hypothesis (Goode, 1960). From this viewpoint, people with a greater number of roles are more likely to deplete their resources, resulting in role overload or role conflict, which in turn lead to burnout (Kang & Sandhu, 2012), reduced job satisfaction and higher turnover (Burke, 1988; Galinsky & Stein, 1990).

On the contrary, for almost a decade, in line with the positive psychology movement, the positive side of work–family relationships (which heavily relies upon the expansion–enhancement perspective) has started getting research attention. This view has been discussed in several ways, like work–family enhancement, positive spillover, facilitation and enrichment (Crouter, 1984; Greenhaus & Powell, 2006; Grzywacz, Almeida & McDonald, 2002; Sieber, 1974). Though slight peculiarity exists between the said terms, the fundamental postulation is that participation in one role is made easier, or benefits from

enhanced performance, by virtue of participation in the other role (Karatepe & Bekteshi, 2008). In this research, we used *enrichment* as a comprehensive term for positive work–family interactions. As compared to work–family conflict perspective, enrichment perspective is theoretically and practically underdeveloped (Frone, 2003).

The concept of enrichment was introduced by Greenhaus and Powell (2006), which they conceptualize as the degree to which positive experiences in one role (work) improve the quality of life in the other role (family) and vice versa. In particular, enrichment is said to occur when resources (skills and perspectives, physical social capital, and material resources) gained from one role either directly (instrumental path) or indirectly (affective path) improves the performance in the other role. Both the instrumental (Kirchmeyer, 1992; Ruderman, Ohlott, Panzer & King, 2002) as well as the affective pathway (Rothbard, 2001) have indicated that enrichment or positivity improves the work as well as the family domain.

The concept of work–family enrichment is explored from both work and family dimensions, that is, work-to-family enrichment and family-to-work enrichment. Further, (Greenhaus & Powell, 2006) found that of the two types of enrichment, family-to-work enrichment (FWE) is typically stronger than work-to-family enrichment (WFE). This specifies that family enriches work more as compared to work enriching family life.

Using the framework suggested by Frone (2003), it was suggested that WFE and FWE are empirically discrete and have ‘domain-specific’ patterns (Byron, 2005). To be precise, predictors emerge from the originating role domain (i.e., work domain has predictors in work-related aspects) only. This was further supported by Wayne, Grzywacz, Carlson and Kacmar (2007) who presented the Resource-Gain-Development (RGD) perspective.

The role of resources has often been investigated in the work–family literature (e.g., Hakanen, Peeters & Perhoniemi, 2011; Halbesleben, Wheeler & Rossi, 2012; Odle-Dusseau, Britt & Greene-Shorridge, 2012; Siu et al., 2010). Researches in the current context have proven that work and family resources were more strongly related to positive interaction as compared to negative ones (Geurt & Demerouti, 2007). The theoretical foundation for the current research is provided by conservation of resources (COR) theory (Hobfoll, 2001), which suggests that employees enthusiastically seek out to conserve and recreate resources (i.e., conditions or energies valued by the individual). Support is an important job resource. Gaining support either at work or in the family is a resource that has a positive effect in one domain and which finally enhances one’s quality of life in the other domain (Greenhaus & Powell, 2006; Grzywacz & Marks, 2000). Thus, domain support is likely to be considered as a core antecedent of affective and instrumental enrichment.

Kammerman and Kahn (1987) have found that work support not only assists employees in assimilating work and family roles, but also improves work attitudes as well as overall performance. Researchers later confirmed that work support could predict job satisfaction for both British and Taiwanese workers (Lu, Siu, Spector & Shi, 2009). Siu et al. (2010) found a positive effect of work support on WFE in a sample of mainland Chinese workers.

The study undertaken by ten Brummelhuis, Van der Lippe & Kluwer (2010) investigated the impact of various work-life support measures in improving helping behaviour and performance among single employees, employees with a partner, and employees with a partner and children. It was found that those employees who are single tend to benefit from different types of support. However, the obvious work–family culture hindered them, as indicated by poorer work performance. Such employees not only appreciate telecommuting but also take advantage of flexible schedules. Further, supervisor support emerged to be of great importance in improving work performance and helping behaviour among couples. Moreover, a positive organizational culture wherein the focus is more on family-friendly aspects emerged as most important perceived support among parents, as compared to additional support strategies such as flexible work arrangements, supervisor support, etc.

Lingard, Francis and Turner (2010) in their study focused on the positive impact of work–family interface in the Australian construction industry. The study measured the work-to-family enrichment among Australian construction workers and explored linkages between job-related resources provided in the workplace and workers’ perceptions that experiences in their work role improve the quality of life in their family role and vice versa. It also investigated the impact of work schedule fit as a linking mechanism between job-related resources and work-to-family enrichment. The findings are consistent with the premise that job-related resources show a positive impact on interaction between work and family and vice versa.

It has been observed that family support has emerged as an important form of social support in western countries (Cohen & Syme, 1985). Recently, this is found true for Taiwan as well (Lu, 2006). Taking precedence from COR theory, King, Mattimore, King and Adams (1995) recommended social support as a significant resource which generates emotional feelings like love, care, etc. Such positivity facilitates individuals to transfer resources gained in the family domain to the work domain more efficiently (Wayne, Randel & Stevens, 2006). It may act as an extrinsic motivator as it may present instrumental advice and affective resources that would help employees in achieving their job goals (Grzywacz & Marks, 2000). Similar findings were reported by Yeh, Arora and Wu (2006) who suggested that family support motivates employees, especially those belonging to collectivistic societies to work harder. Indeed, family support has been found as an antecedent of both WFE and FWE in the west (Grzywacz & Marks, 2000; Lu et al., 2009) as well as in mainland China (Lu & Chang, 2014; Siu et al., 2010).

The above literature revealed that there is dearth of studies exploring the positive side of work–family integration in the Indian context (Baral & Bhargava, 2010; Bhargava & Baral, 2009). In view of this, the present research aims to empirically examine the role of both work support and family support as predictors of work–family enrichment (in both directions) among sales employees in Indian organizations. Using COR theory and the literature reviewed, we hypothesized that when employees receive support from both work and family front, they tend to acquire resources that improve their enrichment in both work and family directions in the form of work-to-family enrichment and family-to-work enrichment. The research contributes to the current literature by elaborating upon the matching as well as cross domain influence from work to family and family to work (Ferguson, Carlson, Zivnuska & Whitten, 2012; Westman, Vinokur, Hamilton & Roziner, 2004) in the Indian context.

The proposed theoretical model of the study is presented as Figure 1.

Overall the model presents the relationship between both forms of support (i.e., work and family support) and work-to-family enrichment and family-to-work enrichment. Work support (WS) and family

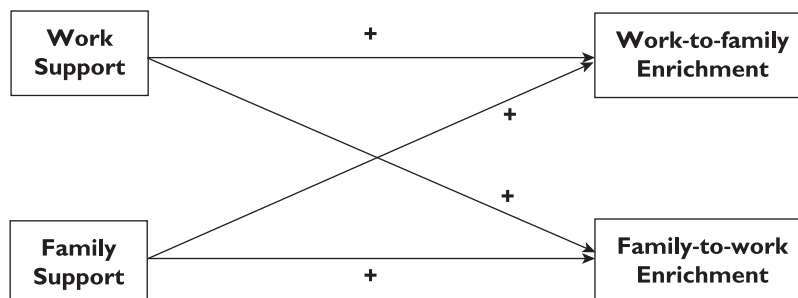


Figure 1. Proposed Research Framework

Source: Prepared by the authors.

support (FS) are independent variables; work-to-family enrichment (WFE) and family-to-work enrichment (FWE) are dependent variables in the empirical model.

Methodology

Sample and Procedure

Data were collected through a self-administered questionnaire in Mumbai from a sample of 330 sales employees belonging to both service and manufacturing sectors. Sample included both married and unmarried employees (a) over 21 years of age and (b) working with an organization for at least one year. Table 1 displays the demographic profiling of the sample under study.

Table 1. Demographic Characteristic of the Participants

Demographic Characteristics	Frequency	Percentage	
Gender	Male	292	88.5
	Female	38	11.5
Age	≤ 25 Years	60	18.2
	26–30 Years	153	46.4
	31–35 Years	59	17.9
	> 35 Years	58	17.6
Marital Status	Married	211	63.9
	Unmarried	119	36.1
Number of Children	N	173	52.4
	Y	156	47.6

Source: Authors' own calculations.

Measures

Work Support and Family Support Scale: Modified version of work support scale (Hennessy, 2007) originally developed by House and Wells (1978) was used in the study. The measure comprises of two subscales, comprising of five items each, gauging different types of support for work-related aspects from family/friends and coworkers.

Modified version of family support scale (Hennessy, 2007) originally developed by House and Wells (1978) was used in the study. The measure gauges the nonwork-related experiences, that is, family-related experiences from family/friends and coworkers. The measure comprises of two subscales, comprising of five items each, gauging different types of support for work-related aspects from family/friends and coworkers.

However, since the scales (work support scale and family support scale) have not been widely used in the Indian context, their validity will be tested in this study.

Work–Family Enrichment Scale: WFE and FWE were assessed using two scales developed by Carlson, Kacmar, Wayne and Grzywacz (2006). Extant literature with respect to enrichment has used this scale (Fung, Ahmad & Omar, 2014; Siu et al., 2010). Five-point Likert scale was used for the purpose of the study. High scores designate high levels of WFE/FWE, while low scores designate low levels of WFE/FWE.

Control Variables: We have used four control variables in the current study: gender, age, marital status and presence of children at home, as these variables have the tendency to affect both WFE and FWE (Jain & Nair, 2015).

Method

AMOS software (Arbuckle, 2011) version 20.0, which includes an SEM package with maximum likelihood estimation, was used to test both the measurement and the structural models related to the research hypotheses. Standard statistical procedures like descriptive and inferential statistics, such as frequency, means and factor analysis (to test the construct validity of work and family support scale) were conducted. The following statistical procedures were done to meet the objectives of the study:

1. Assessing construct validity of work support and family support scale.
2. Assessing reliability of various scales.
3. Exploring intercorrelations between variables (including control variables).
4. Assessing hypothesized relation between independent and dependent variables under study. The overall fit of the models was assessed using both absolute and relative fit indices as recommended by Hair, Black, Babin and Anderson (2010).

Results

Following section presents the results of the analysis undertaken for the study. First of all, the support scales were tested for their validity. Later, the intercorrelations were presented, followed by testing the hypotheses using SEM.

Validation of Work Support and Family Support Scale

The first step used for refining measures and for evaluating construct validity was EFA (Ford, MacCallum & Tait, 1986). Thus, EFA using principal component analysis (PCA) method and VARIMAX rotation was carried out to reveal the causal factors of the work and family support. Initially, KMO and Bartlett test was conducted. According to Tabachnick and Fidell (2001), KMO values of ≥ 0.60 are considered good for factor analysis. Further, a significant result (sig. < 0.05) using Bartlett test signified that matrix is not an identity matrix. Table 2 explores the result of KMO and Bartlett test. The results are found to be significant as per Tabachnick and Fidell (2001).

Further, multiple criteria (like Eigen values > 1.0 and variance explained of > 60 per cent; factor loadings > 0.5 ; Hair et al., 2010) were used for determining the number of factors to be retained (Hair, Anderson, Tatham & Black, 1998). All the 20 items were entered in a single analysis. A four-factor solution accounted for 70.65 of the total variance. All the 20 items corresponding to the dimensions of work support from family (ranging from 0.595 to 0.845), work support from colleagues (ranging from 0.711 to 0.824), family support from family (ranging from 0.726 to 0.820) and family support from colleagues (ranging from 0.756 to 0.818) were loaded appropriately in the pattern matrix. Table 3 highlights the factor loadings of the four factors.

Table 2. KMO and Bartlett Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.928
Bartlett's Test of Sphericity	Approx. chi-square	4126.438
	df	190
	Sig.	0.000

Source: Authors' own calculations.

Table 3. Rotated Component Matrix

	Component			
	1	2	3	4
WSF 1	0.080	0.174	0.136	0.845*
WSF 2	0.151	0.186	0.057	0.845*
WSF 3	0.076	0.186	0.048	0.779*
WSF 4	0.074	0.202	0.067	0.818*
WSF 5	0.103	0.293	0.193	0.595*
WSC 1	0.166	0.711*	0.186	0.243
WSC 2	0.167	0.817*	0.146	0.212
WSC 3	0.081	0.824*	0.156	0.223
WSC 4	0.119	0.804*	0.158	0.232
WSC 5	0.089	0.755*	0.222	0.174
FSF 1	0.235	0.184	0.789*	0.120
FSF 2	0.297	0.184	0.789*	0.051
FSF 3	0.234	0.229	0.820*	0.029
FSF 4	0.329	0.187	0.726*	0.120
FSF 5	0.257	0.142	0.735*	0.231
FSC 1	0.761*	0.089	0.302	0.135
FSC 2	0.818*	0.066	0.227	0.161
FSC 3	0.756*	0.192	0.280	0.053
FSC 4	0.790*	0.171	0.254	0.132
FSC 5	0.806*	0.100	0.187	0.039

Source: Authors' own calculations.

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in six iterations. *Significant Factor Loadings.

In order to ensure that the scale items converge on a single construct during measurement, the convergent validity was assessed (Steenkamp & Van Trijp, 1991). This was established from the assessment of the factor loadings (which must be between 0.30 and 0.35), composite reliability (CR) (at least 0.6) and average variance extracted (AVE) (at least 0.5) in the study (Hair et al., 2010). The results of convergent validity are found to be more than the prescribed values (CR \geq 0.6 and AVE \geq 0.5) (Hair et al., 2010). Table 4 presents the composite reliability and AVE values of the four factors. Both the scales are found to have appropriate convergent validity.

Subsequently, discriminant validity of various scales under study was worked out. It refers to the distinctiveness of different constructs (Campbell & Fiske, 1959). The rule is that variables should load significantly only on one factor. If 'cross-loadings' do exist (variable loads on multiple factors), then the

Table 4. Convergent Validity

Construct	CR (Composite Reliability)	AVE (Average Variance Extracted)
Work Support	0.95	0.62
Family Support	0.96	0.64

Source: Authors' own calculations.

Table 5. Discriminant Validity

	1	2
Work Support	0.79*	
Family Support	0.472	0.80*

Source: Authors' own calculations.

Note: *The square root of AVE is on the diagonal of the table, and remaining values represent the correlation between pairs of constructs.

cross-loadings should differ by more than 0.2 (refer Table 3). Also if the square root of AVE is higher than the correlation between the variables, discriminant validity is said to be achieved. Table 5 represents the discriminant validity of both support measures.

CFA was conducted on the 20-item work support and family support scale in order to acquire a robust evaluation of the quality of the measures (Jöreskog & Sörbom, 2001). Since results of EFA suggested a four-factor structure, two of which are related to work support and the other two explores the support from the family perspective. So we felt the need to confirm whether both work-related support (WSC and WSF) and family-related support (FSF and FSC) are related among each other or not. Therefore, a second-order factor analysis was conducted to understand the given aspect. The model fit statistic was found to be significant, that is, $\chi^2 = 254.787$, $df = 167$, $p = 0.000$, $CMIN/df = 1.526$, $SRMR = 0.05$, $RMSEA = 0.04$, $CFI = 0.978$ and $NNFI = 0.975$. The indices indicated a good fit; so the second-order factor structure was accepted and used for further analyses (see Figure 2).

Reliability of Scales

The Cronbach alpha value of all the scales exceeded the minimum standard of 0.7 (Nunnally & Bernstein, 1994), and hence, the scales under study can be considered to be reliable. Table 6 explores the Cronbach alpha values for various scales under study.

Intercorrelations

Table 7 presents the bivariate correlations among the variables (including control variables) as well as the mean and standard deviation for each variable. It is found that both work and family support were positively correlated with work-to-family enrichment ($r = 0.471$, $p < 0.001$; $r = 0.443$, $p < 0.001$) and family-to-work enrichment ($r = 0.441$, $p < 0.001$; $r = 0.524$, $p < 0.001$). Also it is observed that there is a positive correlation between WFE and FWE ($r = 0.516$, $p < 0.001$), as well as between WS and FS ($r = 0.472$, $p < 0.001$). In addition, it was found that control variables such as age, marital status and presence of children are found to be significantly correlated with both the exogenous variables.

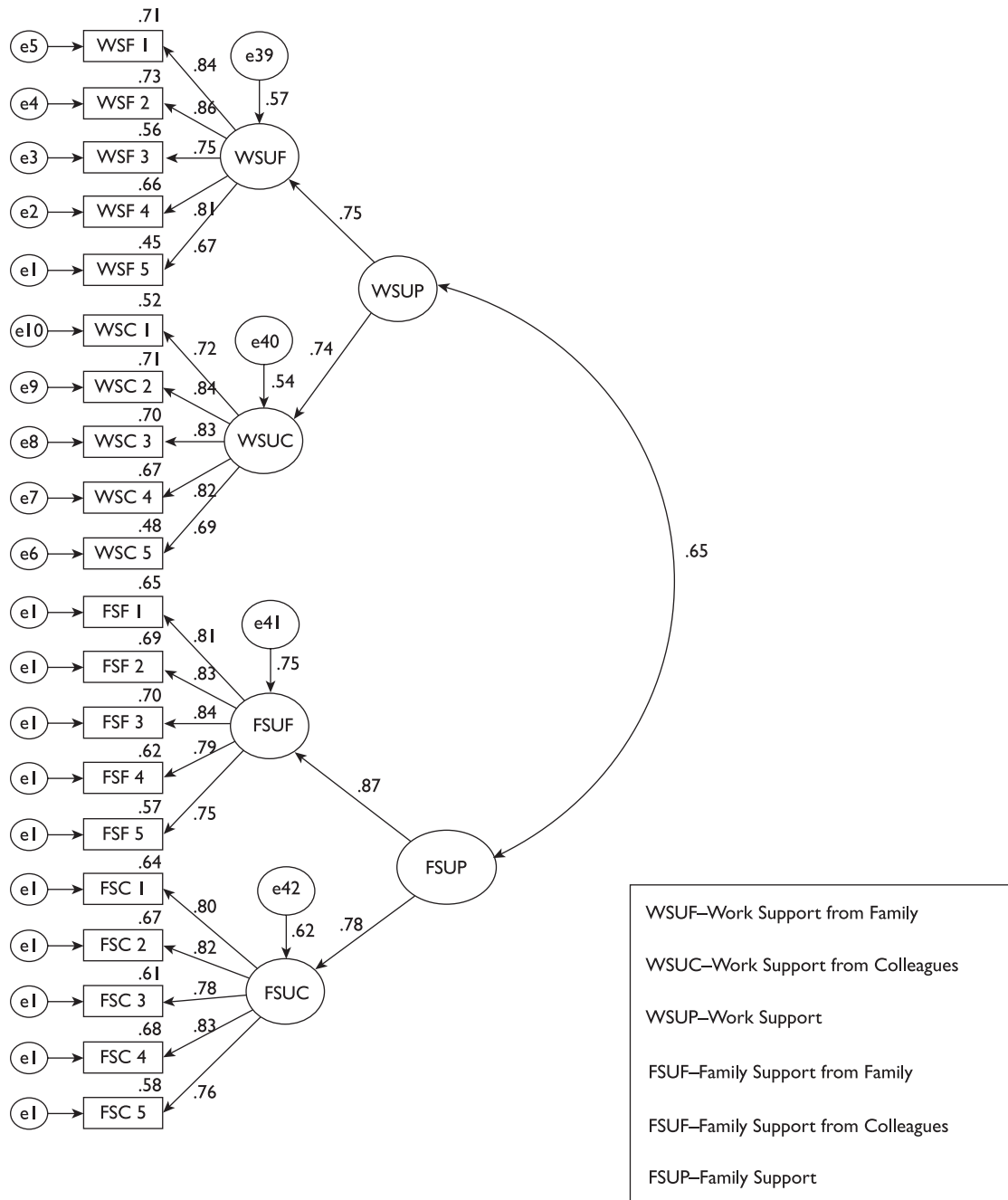


Figure 2. CFA Model for Work Support–Family Support

Source: Prepared by the authors.

Table 6. Reliability Analysis

Scale	No. of Items	Cronbach Alpha Value
Work Support	10	0.898
Family Support	10	0.918
Work-to-family Enrichment	9	0.936
Family-to-work Enrichment	9	0.936

Source: Authors' own calculations.

Table 7. Means, Standard Deviations and Correlations between Variables

	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	0.88	0.320	1	0.139*	0.065	0.097	-0.085	0.007	-0.073	-0.103
2. Age	2.35	0.972	0.139*	1	0.588**	0.664**	0.017	0.085	0.260**	0.229**
3. Marital Status	0.64	0.481	0.065	0.588**	1	0.715**	0.034	0.055	0.179**	0.154**
4. Presence of Children	0.48	0.500	0.097	0.664**	0.715**	1	0.029	0.083	0.189**	0.137*
5. WS	24.54	6.405	-0.085	0.017	0.034	0.029	1	0.472**	0.471**	0.441**
6. FS	30.55	6.691	0.007	0.085	0.055	0.083	0.472**	1	0.443**	0.524**
7. WFE	26.92	5.762	-0.073	0.260**	0.179**	0.189**	0.471**	0.443**	1	0.516**
8. FWE	27.39	5.817	-0.103	0.229**	0.154**	0.137*	0.441**	0.524**	0.516**	1

Source: Authors' own calculations.

Note: SD: Standard Deviation, * $p < 0.05$; ** $p < 0.01$.

Table 8. Results of Hypothesis Testing Using SEM

Hypotheses	Relationships	Hypothesized Direction	Values	Remark
H1	WS-WFE	Positive	$\beta = 0.50^{**}$	Accepted
H2	WS-FWE	Positive	$\beta = 0.33^{**}$	Accepted
H3	FS-WFE	Positive	$\beta = 0.19^*$	Accepted
H4	FS-FWE	Positive	$\beta = 0.39^{**}$	Accepted

Source: Authors' own calculations.

Note: * $p < 0.05$; ** $p < 0.01$. WS: Work support; WFE: Work-to-family enrichment; FS: Family support; FWE: Family-to-work enrichment.

The hypothesized relations between independent variables (work support and family support) and dependent variables (WFE and FWE) were tested using structural equation modelling (SEM). SEM comprises of models wherein regressions among the continuous latent variables is projected (Bollen, 1989; Jöreskog & Sörbom, 1979). Table 8 summarizes the various relationships between variables under study. Further Figure 3 presents the result of SEM analysis using AMOS.

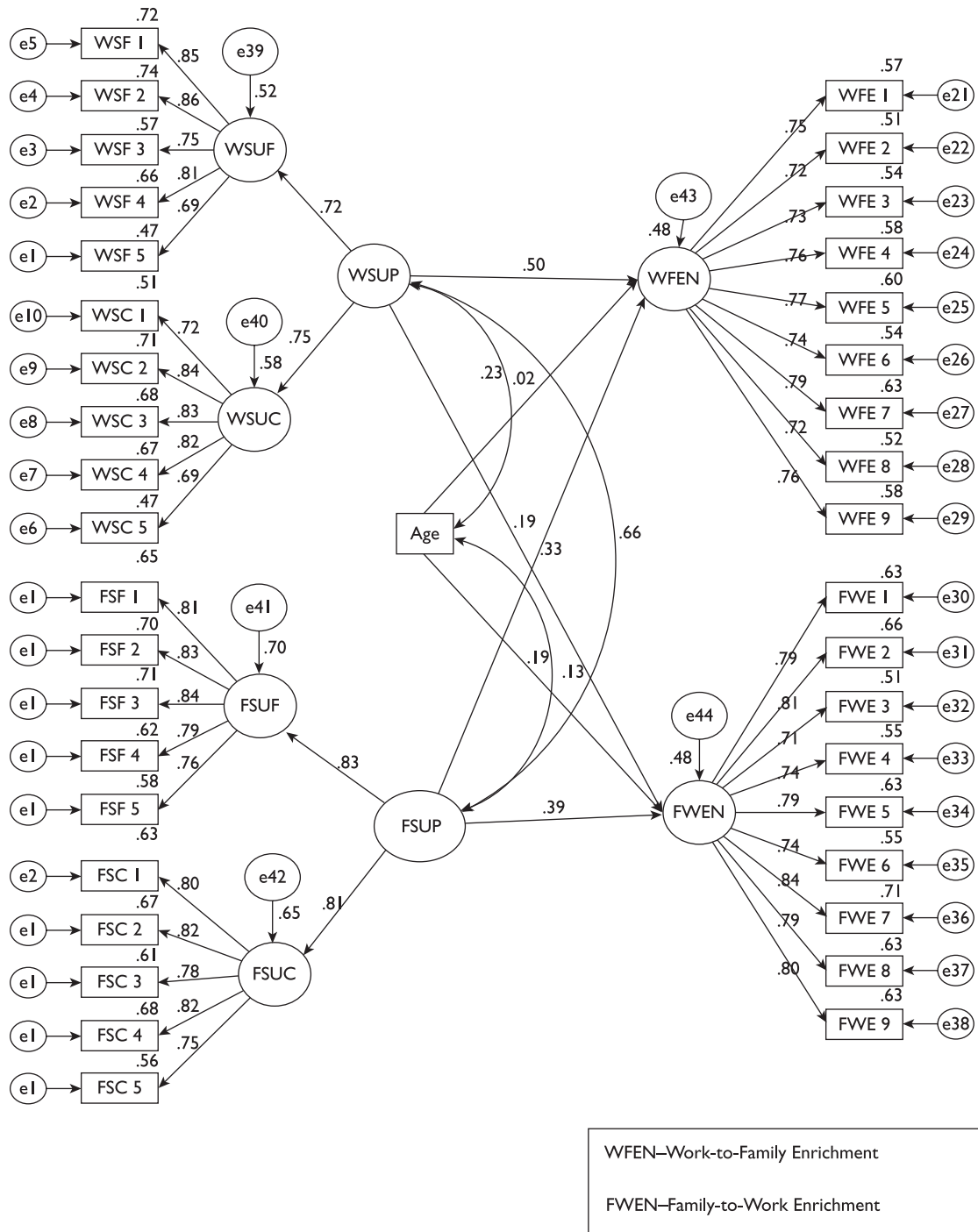


Figure 3. Result of SEM Using AMOS

Source: Prepared by the authors.

Model Testing

The fit measure of a structural equation model indicates to what degree the specific model matches the empirical data. In the present study, the researcher has used Hair et al. (2010) approach of reporting model fit indices values. Hence, apart from using CMIN/df and χ^2 values, absolute fit indices like standard root mean square residual (SRMR) and the root mean square error of approximation (RMSEA), relative fit indices like the non-Normed Fit Index (NNFI) or TLI, and the Comparative Fit Index (CFI) are also reported and used to assess for model fit. The entire SEM analyses were done using Amos 20.0. The model fit statistics are reflected in Table 9.

The model fit indices like $\chi^2(692) = 1028.473, p < 0.000$; CFI (0.96); TLI (0.96); RMSEA (0.04) and SRMR (0.05) are indicative of decent fit (Hair et al., 2010). The model did account for 49 per cent of the variance in WFE and 48 per cent of the variance in FWE. In addition, only age is found to be significantly associated with the exogenous variables (see Figure 4).

Table 9. Model Fit Indices

Model Fit Indices	Values
χ^2/df	1.486
CFI	0.96
TLI	0.96
SRMR	0.05
RMSEA	0.04

Source: Authors' own calculations.

Note: χ^2 : chi-square; df: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis index; SRMR: standardized root mean square residual; RMSEA: root mean square error of approximation.

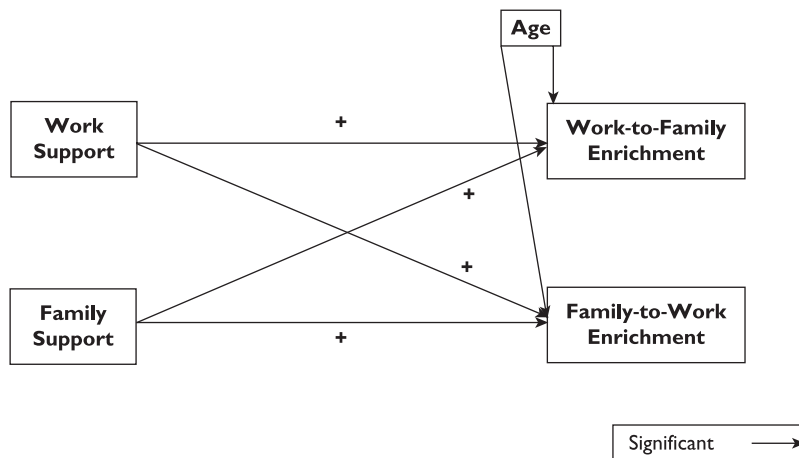


Figure 4. Path Diagram and Standardized Estimate of Final Model

Source: Prepared by the authors.

Discussion

The analysis primarily started with the validation of the work and family support scale. It was found that there are four factors that represent support, of which two are related to work support and the other two explore the family support. A second-order factor analysis was conducted which indicated that two factors, work support from colleagues (WSC) and work support from family (WSF) leads to overall work support factors, whereas family support from family (FSF) and family support from colleagues (FSC) lead to overall family support. This also points out that factors in both work and family contribute positively to each other (Zhang et al., 2012). It was further found that age is significantly affecting both WFE and FWE (Jain & Nair, 2015) which seems to indicate that with increasing age, both WFE and FWE improve.

Later, the study investigated the role of support as predictors of WFE as well as FWE. Results supported that work support is an important antecedent of WFE ($\beta = 0.50$; $p < 0.01$) consistent with the (COR) theory (Hobfoll, 2001). Results further confirmed that work support is also an important antecedent of FWE ($\beta = 0.33$; $p < 0.01$). This confirms the notion that sales employees who get higher level of support from their work tend to have higher levels of enrichment (both WFE and FWE). Further having higher annual salary (as is the case with sales people who get incentives for their efforts) or having higher flexibility/responsibility (especially sales function where responsibility and accountability are quite high) ones, WFE as well as FWE enhances. The findings are consistent with the premise that job-related resources show a positive impact on interaction between work and family and vice versa (ten Brummelhuis et al., 2010).

The hypothesized relationship between family support and work-to-family enrichment (WFE) also holds true ($\beta = 0.19$; $p < 0.05$). Furthermore, results confirm that family support is an important antecedent of FWE ($\beta = 0.39$; $p < 0.01$). This also suggests that positive experiences like having an understanding environment at home, which gets reflected from the higher level of FWE (refer Table 5) which further improves overall WFE. Again taking precedence from COR theory, King et al. (1995) recommended social support as a significant resource which generates emotional feelings like love, care, etc. Such a positive home environment facilitates individuals to transfer resources gained in the family domain to the work domain more efficiently (Wayne et al., 2006). Indeed, family support has been found as an antecedent of both WFE and FWE in the west (Grzywacz & Marks, 2000; Lu et al., 2009) as well as in Mainland China (Lu & Chang, 2014; Siu et al., 2010). Furthermore, this also reinforces the strength and power of family towards influencing positive outcomes among sales employees in Indian organizations.

Conclusions

This study tested the role of support as predictor of work–family enrichment for sales employees in Indian organizations. The relationships between both forms of support, that is, work support and family support, was studied with regard to both forms of enrichment, that is, WFE and FWE. All the four relationships emerged as positive and significant, indicating the effectiveness of the model. It was found that both forms of support, that is, work and family support, affect one's work-to-family enrichment as well as family-to-work enrichment. This points out the fact that organizational support to employees on work-related aspects alone is not sufficient to get enriched employees who are fully dedicated to their work. In fact, ensuring family-related support systems to employees should also be taken seriously by organizations. This in turn would have a significant effect on the employees' level of enrichment.

The study signals the importance of ensuring a supportive organizational environment for an effective workforce. Evidence from this study suggests that organizations should develop an environment or

‘culture’ of support, which intends to improve one’s WFE which has an enduring impact on one’s job, and family satisfaction as well as turnover intentions. If employees do not feel there is sufficient support from the organization and from colleagues with whom they work, then firms may not be able to achieve desired outcomes in the form of higher job satisfaction and lower turnover intentions. Hence, it can be concluded that a deeper insight into the positive side of work–family interaction may help to portray sales as a favourable profession.

Another important implication emerges in form of family support, which emerges as important for sales employees in the Indian context. So firms that intend to improve enrichment levels of their employees should build stronger ties with their families first. In recent times, it is observed that firms are inviting employees’ family members like children, spouse and parents to participate in family celebration events. Also, awards like ‘the best back-up’ (normally the spouse) and sending part of employees’ annual bonus to their parents (Zhang, Griffeth & Fried, 2012) are used in other parts of the globe. The same can be used by Indian companies to develop positive image about organizations intent towards family support and help balance employees’ work and family lives.

The present study has some limitations that need to be taken into account. First, the study is cross-sectional nature and thus causal conclusion cannot be drawn. Also, only Mumbai city has been chosen for data collection. However, choice of Mumbai was made as this city is considered to be the financial hub and hence having presence of maximum business houses.

Sample Questionnaire

Section-I

This section is concerned with the **support** that you get from your **family/friends/coworkers**. Kindly indicate the extent of your agreement/disagreement with each item by putting a tick mark (√)

Rarely = 1 Occasionally = 2 Often = 3 Usually = 4 Always = 5

Statement	1	2	3	4	5
My family/friends listen to my work-related problems.					
My family/friends give me useful suggestions in order to get through difficult times at work.					
My family/friends recognize and celebrate my work-related successes.					
My family/friends show concern about my job-related problems.					
My family/friends give me assistance in dealing with my work-related stress.					
My coworkers listen to my work-related problems.					
My coworkers give me aid in making work-related decisions.					
My coworkers give me tangible assistance in implementing my work-related ideas.					
My coworkers give me sound advice about problems encountered on the job.					
My coworkers recognize and celebrate my work-related successes.					
My family/friends listen to my family-related problems.					
My family/friends give me useful suggestions in order to get through difficult times at home.					
My family/friends recognize and celebrate my family-related successes.					
My family/friends show concern about my family-related problems.					
My family/friends give me assistance in dealing with my family-related stress.					
My coworkers listen to my family-related problems.					
My coworkers give me aid in making family-related decisions.					
My coworkers give me tangible assistance in implementing my family-related ideas.					
My coworkers give me sound advice about problems encountered at home.					
My coworkers recognize and celebrate my family-related successes.					

Section-2

This section is concerned with the **benefits** that you get from **work–family nexus**. Kindly indicate the extent of your agreement/disagreement with each item by putting a tick mark (√)

Strongly Disagree = 1 Disagree = 2 Neutral = 3 Agree = 4 Strongly Agree = 5

Statement

1 2 3 4 5

My involvement in my work helps me understand different viewpoints and this helps me be a better family member.

My involvement in my work puts me in a good mood and this helps me be a better family member.

My involvement in my work helps me to gain knowledge and this helps me be a better family member.

My involvement in my work helps me feel personally fulfilled and this helps me be a better family member.

My involvement in my work helps me acquire skills and this helps me be a better family member.

My involvement in my work makes me feel happy and this helps me be a better family member.

My involvement in my work provides me with a sense of success and this helps me be a better family member.

My involvement in my work makes me cheerful and this helps me be a better family member.

My involvement in my work provides me with a sense of accomplishment and this helps me be a better family member.

My involvement in my family helps me gain knowledge and this helps me be a better worker.

My involvement in my family puts me in a good mood and this helps me be a better worker.

My involvement in my family helps me acquire skills and this helps me be a better worker

My involvement in my family requires me to avoid wasting time at work and this helps me be a better worker.

My involvement in my family makes me feel happy and this helps me be a better worker.

My involvement in my family encourages me to use my work time in a focused manner and this helps me be a better worker.

My involvement in my family makes me cheerful and this helps me be a better worker.

My involvement in my family helps me expand my knowledge of new things and this helps me be a better worker.

My involvement in my family causes me to be more focused at work and this helps me be a better worker.

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THE VOLATILITY EFFECT: EVIDENCE FROM INDIA

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Abstract: We offer empirical evidence that stocks with low volatility earn higher risk-adjusted returns compared to high volatility stocks in the Indian stock market. The annualised excess returns for the low and high volatility decile portfolios amount to 11.40% and 1.30%, respectively, over the period January 2001 to June 2015. The difference of returns is statistically and economically significant for both low and high-risk stocks. Using risk measures of standard deviation and beta, the volatility effect remains after controlling for size, value and momentum. We uncover that the volatility effect is not statistically significant after controlling for beta effect. Our evidence for volatility effect is not dominated by small and illiquid stocks. Our results show that the low volatility portfolio outperforms benchmark portfolio not only in down market but also in up market conditions.

Keywords: Volatility effect; Betting against beta; Market efficiency; Low risk anomaly; Lottery effect; Limits of arbitrage.

1. Introduction

Finance theory suggests a positive relationship between risk and return. But, researchers like Haugen and Heins (1975), Blitz and Vliet (2005), Blitz, et al. (2013) show that a portfolio consisting of low volatility stocks outperforms matching portfolio as well as the equally weighted benchmark portfolio over the full market cycle during different time periods and in different markets leading to low-risk anomaly. Shifting attention to explanations for the existence of low-risk anomaly, possible explanations are ranging from economic and market frictions to behavioural biases.

We find empirical evidence for the volatility effect in the Indian stock market. The annualised excess returns for the low and high volatility decile portfolios amount to 11.40% and 1.30%, respectively, over the period 2001 to June 2015, which is statistically and economically significant. We uncover that the volatility effect is not statistically significant after controlling for the beta effect. We find the volatility effect after controlling for size, value and momentum also, suggesting that the volatility effect is not dominated by small and illiquid stocks. Our results show that low volatility portfolio outperforms benchmark portfolio not only in down market but also in up market conditions.

Our study attempts to contribute to the body of knowledge in several ways. First, we attempt to contribute to the existing literature by providing evidence of the low volatility and low beta anomaly in-universe carefully chosen to eliminate small and illiquid stocks focusing on the Indian stock market. This helps to understand the validity of Bali and Cakici (2008) argument about negative expected returns are due to small

and highly illiquid stocks. Second, we attempt to find the volatility as well as the beta effect in line with Blitz and Vliet (2005) focusing on the Indian stock market. Our results do not show a statistically significant volatility effect after controlling for beta. In our sample, the volatility effect is present but not significant once controlled for beta effect, which indicates that there is a little evidence for idiosyncratic risk-based volatility effect as shown by Ang et al. (2009). Third, analysis of regression coefficients for Fama-French-Carhart factors (Fama and French (1992), Carhart (1997)) shows the characteristics of the low and high volatility portfolios. In our sample, large, growth and winner stocks dominate the low volatility portfolio, while the high volatility portfolio has small and risky stocks. This provides clear evidence against Scherer (2011) who argues that large part of excess return of minimum variance portfolio over benchmark portfolio can be explained using Fama-French factors. Also, Scherer claims that the volatility effect is mainly a proxy for value effect. So this study further tries to offer evidence against that. We use the terms volatility effect and low-risk anomaly interchangeably following the industry practice. Fourth, our study attempts to address a concern that large part of outperformance of low volatility strategy is attributable to the period of 2000 to 2003 and is directly linked to the aftermath of dotcom bubble. Our study starts from January 2004 and still finds clear evidence for the low-risk anomaly. Last, but not the least, our study shows that volatility effect is highly significant not only on risk-adjusted basis but delivers superior absolute returns over equally weighted universe portfolio as well as a popular value-weighted benchmark Nifty 200 index.

The paper is organized as follows. Section 2 covers a detailed review of literature leading to the establishment of the evidence for the low-risk anomaly and possible explanations. Section 3 discusses data and methodology. Section 4 reports the results and discusses them, Section 5 offers a conclusion.

2. Review of Literature and Potential Explanations

Evidence on a flatter systematic risk and return relation than expected as per the CAPM comes from Black(1972), Black et al. (1972) and Fama and French (1992). Further, Haugen and Heins (1975), Haugen and Baker (1991), Haugen and Baker (1996), Clarke et al. (2006), Blitz and Vliet (2005) and Frazzini and Pedersen (2014) offer evidence on the negative relation between risk and return. Among others, Choueifaty and Coignard (2008), Baker et al. (2011), Baker et al. (2013), Soe (2012), Carvalho et al. (2012) also find evidence for low-risk anomaly. Blitz et al. (2013) find similar evidence for emerging markets as well.

We categorize the possible explanations for the volatility effect into economic and market friction based explanations as well as behavioural explanations. For the sake of brevity, here we cover only a few select explanations that are as much relevant in the Indian markets as in the global markets. However, we introduce performance chasing behaviour of mutual fund investors as one of the possible explanations due to which portfolio managers follow high beta stocks and are concerned only about outperformance during rising markets rather than falling markets. Some studies explain the volatility effect by giving economic reasons or behavioural explanations. While there are studies explaining away the low-risk anomaly attributing it to methodological choices.

Black (1972), Baker, et al. (2011), Blitz and Vliet (2005), Blitz, et al. (2013) and Baker, et al. (2013) provide explanations for the presence and sustainability of low-risk anomaly. They attribute the volatility effect to the benchmarking mandate given to institutional investors, limits to arbitrage, restricted borrowing as reported by, and decentralized investment approach to high beta-low alpha and low beta high alpha combinations.

They attribute such sustainable outperformance to behavioural biases such as a preference for lotteries, over confidence and representativeness.

Bali and Cakici (2008) argue that the significant negative relationship reported by Ang, et al. (2006) is due to the presence of small and illiquid stocks with lottery-like payoffs. Removing these stocks from the sample makes the anomaly insignificant. Martellini (2008) finds that positive relationship between risk and return is in tack. However, one must note that the study uses only surviving stocks and therefore systematically ignores stocks delivering significant negative returns before disappearing. Fu (2009) claims that one should focus on expected rather than historical volatility. And he reports a positive relationship between risk and return by using EGARCH models to estimate idiosyncratic volatility. Scherer (2011) argues that large part of the excess return of minimum variance portfolio over benchmark portfolio is attributable to systematic exposure to size and value factors and volatility effect is a mere proxy for value effect. Bali et al. (2011) further contest results of Ang et al. (2009) by arguing that inverted risk-return relationship is attributable to lottery-like payoffs associated with high idiosyncratic volatility stocks and they substantiate their results by developing lottery-like stocks payoff variable MAX.

3. Data and Methodology

The data set for the study includes all past and present constituent firms of Nifty 200 (earlier known as CNX 200) index of National Stock Exchange (NSE) from the Capitaline database for the period from January 2001 to June 2015. The study uses monthly log returns, volume, earnings to price and market cap data. We have taken Fama-French-Momentum factors for Indian Stock markets from Data Library for Indian Market by IIM Ahmedabad website (Agarwalla et al. (2013)).

This study follows Blitz and Vliet (2005) and Blitz et al. (2013) methodology with slight changes. Following Blitz and Vliet (2005), at the end of every month, we construct equally weighted portfolios by dividing the stocks into 10 groups after sorting stocks on the past three-year volatility of monthly returns. Portfolios are constructed such that top-decile portfolio (LV) consists of lowest historical volatility stocks, whereas bottom-decile portfolio (HV) consists of stocks with highest historical volatility. For each decile portfolio, we calculate excess monthly return (over risk-free rate) over the month (holding period) following portfolio formation. We use only log returns to make them additive. For the resulting time-series of returns for all the iterations, we calculate average return, the standard deviation of returns, Sharpe ratios, and CAPM style alpha as well as ex-post beta considering equally weighted index portfolio (EWI) as a proxy for market portfolio. We use the equally weighted portfolio as a proxy for market portfolio throughout the study.

We additionally calculate CAPM alphas and betas using Nifty 200 as a proxy for the market to make it more relevant and comparable with the publicly available benchmark. To compare the strength of volatility effect and separate it from other well-known classic effects such as size, value, and momentum, we use following three approaches. First, we sort portfolio returns based on their end-of-the-month market-cap (size) and then divide the sorted returns based on volatility. A similar approach is followed for earnings-to-price (value) sort and past 12-month minus 1-month total return (momentum) sort followed by volatility sort. For the size and value measures, stocks with the lowest value are assigned to top decile, whereas for momentum, stocks with the highest value are assigned to top-decile. We calculate excess returns to risk-free return, standard deviation, Sharpe ratio, CAPM alpha and beta for resultant time series of decile portfolio returns for each factor in a similar manner as the one

proposed for volatility decile portfolios. We compare characteristics of volatility decile portfolios with all other factor decile portfolios. Second, we use both three-factor (FF) and four-factor Fama-French-Carhart regressions to disentangle volatility from other effects. For Fama-French-Carhart regression, we use market capitalization as a measure of size for calculating small-minus-big (SMB) and earnings-to-price as a measure of value for calculating value-minus-growth (VMG) factors for Fama-French regression. In addition, we use total returns for past 12-months minus 1-month returns as a measure of momentum for calculating winner-minus-loser (WML). For calculating SMB, VMG and WML factors, we use the difference of return between top 30% and bottom 30% of the stocks sorted on size, value and momentum measures respectively. By regressing returns of volatility sorted portfolios on these factors, we control for any systematic exposure to SMB and VMG in the case of Fama-French and SMB, VMG and WML factors in the case of Fama-French-Carhart regression. The resultant alpha in volatility decile portfolio is now not overlapping with other well-known effects.

Now we describe the tests to calculate significance in the difference of Sharpe ratios, one factor CAPM alphas, three-factor Fama-French alphas and four factor Fama-French-Carhart alphas.

To test the statistical significant of a difference between Sharpe ratios over equally weighted universe (EWI) portfolio for each volatility decile portfolio, we use Jobson and Korkie (1981) test with Memmel (2003) correction.

$$Z = \frac{SR_1 - SR_2}{\sqrt{\frac{1}{T} \left[2(1 - \rho_{1,2}) + \frac{1}{2}(SR_1^2 + SR_2^2 - SR_1 SR_2 (1 + \rho_{1,2}^2)) \right]}} \quad (1)$$

Here SR_i is the Sharpe ratio of portfolio i , $\rho_{i,j}$ is the correlation between portfolios i and j , and T is the number of observations.

We calculate CAPM alpha using EWI return as a proxy for market by using following classic one factor regression.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m}(R_{m,t} - R_{f,t}) + \varepsilon_{p,t} \quad (2)$$

Where $R_{p,t}$ is the return on portfolio p in period t . $R_{f,t}$ is risk free return in period t . α_p is the alpha of portfolio p , $R_{m,t}$ is market portfolio return in period t , $\beta_{p,m}$ is the beta of portfolio p with respect to market portfolio and $\varepsilon_{p,t}$ is the idiosyncratic return of portfolio p in period t . We use equally weighted the universe as proxy for market portfolio in this study unless otherwise specified.

We calculate three-factor alpha by adding SMB (size) and VMG (value) proxies to the regression. We add a WML (momentum) proxy in addition to size and value to the regression to calculate four-factor alpha.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m}(R_{m,t} - R_{f,t}) + \beta_{p,SMB} * R_{SMB} + \beta_{p,VMG} * R_{VMG} + \varepsilon_{p,t} \quad (3)$$

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,m}(R_{m,t} - R_{f,t}) + \beta_{p,SMB} * R_{SMB} + \beta_{p,VMG} * R_{VMG} + \beta_{p,WML} * R_{WML} + \varepsilon_{p,t} \quad (4)$$

Where R_{SMB} , R_{VMG} and R_{WML} represent the return on size, value and momentum factors in our universe and $\beta_{p,SMB}$, $\beta_{p,VMG}$ and $\beta_{p,WML}$ represent betas of portfolio p with respect to size, value and momentum factors in our universe.

Third, we use bivariate analysis, which is a strong non-parametric technique to disentangle volatility effect from other effects. It is robust to situations involving time-varying coefficients in three and four-factor models that are assumed to be constant in the regressions as mentioned above. In double sorting, we first rank stocks on one of the control factors (size, value, momentum) and then by volatility within control factor (size, value, momentum) sorted stocks decile portfolio and then construct volatility decile portfolios to represent every decile of control factor. For example, to control for size effect, we first sort stocks based on size and divide them into size decile portfolios. Within each size decile portfolio, we sort stocks on volatility; next we construct top-decile volatility-sorted portfolio such that it has 10% least volatile stocks from every size decile. Similarly, we control for the size effect. We construct other volatility decile portfolios also to represent stocks of all size.

We perform three additional robustness tests to further substantiate our results. First, we compare CAPM alphas for portfolios sorted on both volatility and beta, sorting stocks based on beta using past three years monthly returns rather than volatility. We calculate beta using equally weighted universe (EWI) as a proxy for the market. Second, we use double sorting the stocks using volatility by controlling for the beta to evaluate whether volatility effect and beta effect represent the same effect comparing magnitude and strength. Finally, we check for sub-period January 2004 to December 2007, which is secular bull run.

4. Results and Discussion

4.1 Main Results – Univariate Analysis

Table 1 reports main results of univariate analysis for the volatility sorted decile portfolios. Top two decile portfolios (P1 and P2), consisting of lower volatility stocks, report significant above average returns. Such outperformance over universe portfolio loses steam and turns into significant underperformance as we move towards bottom decile portfolios (P9 and P10) – the decile portfolios consisting of high volatility stocks. These portfolios report significantly below average returns. Returns decline monotonically when we move from low decile portfolio to high decile portfolio with an exception of sixth decile portfolio. The difference between average returns between top and bottom decile portfolios is whopping 10.10% on annualized basis. The annualised excess return for the LV, HV and universe portfolio is 11.40%, 1.30% and 6.89%. Also, the difference of returns over the universe is statistically and economically significant for both LV and HV.

The results become noteworthy when we focus on a risk-adjusted performance rather than absolute returns. Ex-post standard deviations increase monotonically for successive decile portfolios. The volatility of top decile portfolio is about sixty per cent of that of universe portfolio and almost half of that of bottom decile portfolio.

Table 1: Main results (Annualized)

Table 1 reports main results of univariate analysis for the resultant time series of volatility decile portfolios constructed by sorting stocks based on their previous thirty-six months returns volatility and held for one-month investment period immediately following their construction. The analysis is based on 138 monthly rebalancing iterations starting from January 2004 and ending in June 2015. Panel A reports the annualized excess returns, standard deviations, Shape ratios, Memmel's statistics showing statistical significance of volatility decile portfolios over universe portfolio, ex-post betas and CAPM-style alphas with corresponding t-values. Panel B reports the performance of volatility decile portfolios during up and down markets compared to universe portfolio and maximum drawdown as defined to be the return difference from peak to trough.

Panel A: Decile portfolios based on historical volatility												
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)	EWI (Universe)
Excess return %	11.40	11.46	8.68	6.46	5.89	10.96	5.70	5.53	1.52	1.30	10.10	6.89
Standard Deviation %	17.84	21.24	24.66	28.52	29.37	32.32	32.62	34.64	40.47	45.14	35.16	29.14
Sharpe ratio	0.64	0.54	0.35	0.23	0.20	0.34	0.17	0.16	0.04	0.03		0.24
t-value for difference over Universe	7.05	7.94	4.06	-0.40	-1.60	4.88	-3.04	-3.12	-7.66	-6.44		
Beta	0.51	0.68	0.80	0.94	0.97	1.08	1.09	1.14	1.34	1.45	-0.94	
Alpha %	7.91	6.8	3.15	-0.01	-8.2	3.53	-1.8	-2.33	-7.7	-8.72	16.63	
t-value	2.66	2.88	1.37	0.00	-0.37	1.60	-1.09	-0.82	-2.40	-1.91	2.58	
Panel B: Risk Analysis of portfolios based on historical volatility												
Up Return % (Return difference over Universe)	-2.16	-1.36	-0.96	-0.60	-0.34	0.73	0.33	0.68	1.39	2.29	-4.46	0.00
Down Return % (Return difference over Universe)	4.09	2.93	1.78	0.79	0.30	-0.23	-0.73	-1.28	-3.14	-4.51	8.60	0.00
Max drawdown %	-43.2	-45.2	-60.5	-64.2	-70.1	-65.3	-69.7	-68.4	-74.2	-78.5		-64.7

Risk-adjusted performance of the decile portfolios makes these results even more interesting. On one hand, returns decline as we move from top-decile to bottom-decile portfolio (with an exception of portfolio P6). On the other hand, volatility increases as reported earlier. This results in a significant decline in Sharpe ratio as we move from top to bottom decile portfolio. The Sharpe ratio declines from 0.64 for top-decile to a mere 0.03 for the bottom-decile portfolio. The decline in Sharpe ratio is evident even in some of the middle decile portfolios where return differences are not significant. As in these cases, Sharpe ratio is dominated by standard deviation, which increases as we move from top to bottom-decile portfolio without any exception. Sharpe ratio of 0.64 for top-

decile, low volatility stock portfolio is much higher compared to Sharpe ratio of 0.24 for the universe portfolio. This difference is highly significant, both economically and statistically. The converse is true for the bottom-decile high volatility stock portfolio. Here, Sharpe ratio is significantly lower compared to universe portfolio both in economic and statistical terms. It is worth mentioning that, going by these results, there is a definite inverse relationship between pre-formation volatility and ex-post risk-adjusted returns and to a large extent absolute returns as well.

The bottom half of Panel A in Table 1 reports an alternative approach to test relation between pre-formation volatility and ex post returns for decile portfolios. We run CAPM regression using time-series of monthly returns of volatility sorted decile portfolios with universe portfolio as a proxy for market portfolio. The low volatility portfolio has a low ex-post beta of 0.51 and positive alpha of 7.91% which is economically and statistically significant. The high volatility portfolio has a high ex-post beta of 1.45 and a negative alpha of -8.72%, which again is economically and statistically significant, however, with a negative sign. The alpha spread between low and high volatility portfolios (P1-P10) is massive 16.63%. This result provides clear evidence for low beta-high alpha and high beta-low alpha anomaly. Putting it differently, it provides evidence not only for flatter than expected SML but a reversal in relationship between beta and return from positive to negative!

Panel B of Table 1 reports further details on the performance of decile portfolios, especially during up market and down market periods. Out of total 138 months in our study, 82 are upmarket months, whereas 58 are down market months. The first row of Panel B reports returns of decile portfolios over universe return during upmarket months, the second row reports the same for the down market months. During up market months, low volatility portfolio underperforms universe portfolio by 2.16%, during the same period high volatility portfolio outperforms universe by 2.29%. The difference between the performance of low volatility and high volatility portfolio is 4.46% and in favour of the high volatility portfolio. The relation reverses during down market months where the low volatility portfolio outperforms by 4.09% and high volatility portfolio underperforms by 4.51%. The difference between the performance of low volatility and high volatility portfolio is 8.6% and in favour of the low volatility portfolio.

This indicates that the high volatility portfolio tends to perform better during up market periods, whereas the low volatility portfolio tends to perform better during down market periods. However, it is important to notice that the outperformance of the low volatility portfolio during down market is sizably higher than the underperformance during down market. This, in turn, leads to net outperformance of low volatility portfolio over a period of full market cycle. The fact that we have considerably more upmarket months in our study period compared to down market months, it adds to the strength of our result. Finally, we report drawdown in the final row of Panel B as a proxy for worst entry-worst exit points. As expected, maximum drawdown for all portfolios is centred during the period around 2008 global financial crisis. The low volatility portfolio suffers maximum drawdown of -43.21% compared to -64.71% for universe portfolio and -78.51% for high volatility portfolio. Drawdown faced by low volatility portfolio is little over two third of the market and below sixty percent of its high volatility counterpart.

4.2 Volatility Effect and Other Investment Strategies

We shift our focus on how strong the low volatility effect is compared to other known effects such as size, value and momentum. We check the strength of volatility effect with respect to other effects and find if it is a proxy of some other effect or is

independent, i.e. if low volatility portfolio consists of a high proportion of value, momentum or small stocks.

Table 2 reports results similar to the one reported in Table 1 but for other important factors such as size, value and momentum. Our results are consistent with earlier evidence for momentum and size effects; top-decile of size and momentum portfolios outperform and the bottom deciles of size and momentum portfolios underperform the universe.

However, evidence for value effect in our sample is rather weak or only partially consistent with the global evidence. Top-decile of value portfolio reports higher Sharpe ratio and positive alpha, which is statistically not significant. However, bottom decile of growth portfolio underperforms universe portfolio both using Sharpe ratio as well as CAPM alpha measures and such underperformance is statistically significant. Here too the underperformance is restricted to bottom-decile of the value portfolio only and is not evident for higher decile portfolios.

It is interesting to compare characteristics of top-decile of volatility portfolio with top-decile portfolios of size, value and momentum portfolios. Sharpe ratio of the top decile of volatility portfolio is considerably higher compared to size, value and momentum top-decile portfolios. The results are the same when we use alpha as a measure of outperformance. Alpha of top decile volatility portfolio is third after alphas of top decile portfolios of momentum and size portfolio respectively.

Top decile momentum portfolio reports the highest alpha of 11.7%, followed by 8.79% for size portfolio and 7.91% for the low volatility portfolio. Alpha spreads for top and bottom decile portfolios of volatility-sorted portfolios are only next to momentum-sorted portfolios. We attribute this difference in ranking of top decile portfolios using Sharpe ratio and alpha to the presence of greater idiosyncratic risk in the top decile of momentum and size portfolio compared to top decile volatility portfolio.

Looking at the performance of various strategies during up and down market periods, it becomes further clear that volatility effect is very distinct from the size and value effects. While, the outperformance of top-decile size and value portfolios come during upmarket periods, top-decile of volatility portfolio delivers significant outperformance during down market periods and underperforms during up market periods.

For now, only momentum effect appears stronger to volatility effect. However, comparison of characteristics of top decile volatility portfolios with top decile portfolios of size, value and momentum portfolios really helps in understanding how volatility effect is very different than other well-known effects. This means ex-post volatility of bottom-decile portfolios is higher than universe portfolio, whereas the ex-post volatility of top-decile of volatility portfolio is only about sixty percent of universe portfolio. The picture does not change using beta instead of volatility. While top-decile portfolios of size and value have beta considerable higher than universe portfolio, top-decile momentum portfolio has beta slightly lower than universe portfolio. The beta of the top decile of low volatility portfolio is only half of the universe. Clearly, low volatility effect is very different than other classic effects and not proxy for that.

Table 2: Comparison with Other Investment Strategies

Table 2 reports the results of univariate analysis similar to panel A of table-1 for decile portfolios constructed by sorting stocks based on three well known factors Size, Value and Momentum to facilitate comparison of strength of volatility effect with other well-known stylized effects. Panel A, B and C show results of SIZE, VALUE and MOMENTUM sorted decile portfolios. SMB, VMG and WML are long-short portfolio constructed based on going long on top decile portfolios and going short on bottom decile portfolios based on size, value and momentum factors. Universe statistics is different for Value sorted portfolios as stocks with negative E/P and stocks with P/E > 150 are eliminated in this case.

Panel A: Decile portfolios based on SIZE (Market Capitalization)												
	P1 (SMALL)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (BIG)	P1-P10 (SMB)	EWI (Universe)
Excess return (% p.a.)	17.07	1.42	10.34	8.60	4.18	2.09	7.19	2.30	-1.42	2.63	14.44	6.89
Standard Deviation %	38.03	15.14	32.51	30.00	30.85	28.38	28.80	28.54	28.95	24.35	23.89	29.14
Sharpe ratio (t-value for difference over Universe)	0.45	4.09	-0.37	-1.55	-7.69	0.07	0.25	0.08	-0.05	0.11		0.24
Beta	1.22	1.12	1.09	0.99	1.03	0.94	0.96	0.94	0.94	0.77	0.44	
Alpha % (t-value)	8.79	7.5	2.95	1.87	-2.82	-4.32	0.66	-4.14	-7.85	-2.64	11.43	
	2.10	2.39	1.26	0.73	-1.22	-1.89	0.3	-1.78	-2.86	-0.95	1.91	
Panel B: Decile portfolios based on VALUE (earnings-to-price)												
	P1 (Value)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Growth)	P1-10 (VMG)	EWI (Universe)*
Excess return (% p.a.)	11.45	5.02	8.42	10.00	10.15	8.90	10.93	8.19	5.35	0.70	10.75	7.91
Standard Deviation %	0.39	34.50	32.26	31.84	28.65	28.96	24.44	25.01	24.11	28.60	20.32	28.60
Sharpe ratio (t-value for difference over Universe)	29.13	0.15	0.26	0.31	0.35	0.31	0.45	0.33	0.22	0.02		0.28
Beta	1.29	1.15	1.09	1.08	0.97	0.97	0.80	0.82	0.78	1.05	0.24	
Alpha % (t-value)	12.41	-4.08	-1.72	14.75	2.48	1.20	4.59	1.69	-0.83	-7.60	8.84	
	0.31	-1.32	-0.07	0.62	1.14	0.51	1.83	0.67	-0.31	-2.58	1.56	
Panel C: Decile portfolios based on MOMENTUM (12-month minus 1-month)												
	P1 (Winner)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Loser)	P1-P10 (WML)	EWI (Universe)
Excess return (% p.a.)	17.86	11.96	13.00	5.06	7.29	5.48	6.09	1.61	7.93	-6.87	24.73	6.89
Standard Deviation %	30.70	26.53	26.53	27.07	27.56	29.70	30.63	33.65	36.35	41.15	30.84	29.14
Sharpe ratio (t-value for difference over Universe)	0.58	0.45	0.49	0.19	0.26	0.18	0.20	0.05	0.22	-0.17		0.24
Beta	0.89	0.90	0.85	0.88	0.91	0.98	1.02	1.10	1.18	1.31	-0.42	
Alpha % (t-value)	11.70	5.74	7.13	-1.02	1.01	-1.35	-0.96	-6.05	-0.26	15.95	27.64	
	2.38	1.73	2.43	-0.39	0.42	0.58	-0.40	-2.03	-0.07	-3.44	3.29	

Table 3 reports another way of differentiating volatility effect from other effects using three-factor Fama-French (FF) and four-factor Fama-French-Carhart (FFC) regressions. The first row of Table 3 reports three-factor alpha with the corresponding t-values. Surprisingly, three-factor alpha for top-decile volatility portfolio is 13.12%, which is considerable higher than CAPM alpha of 7.91%. Similarly, three-factor alpha of bottom-decile volatility portfolio is -15.57%, which is considerable lower than CAPM alpha of -8.72%.

Table 3: Three Factor (Fama-French) and Four Factor (Fama-French-Carhart) Style Regression Analysis for Volatility Decile Portfolios

Table 3 reports results of three factor (Fama-French) and four factor (Fama-French-Carhart) alpha and regression analysis for volatility decile portfolios. It shows the strength of volatility effect after accounting for the well-known other factors- size, value and momentum.

Panel A: Three and four factor alphas for volatility decile portfolios												
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)	
3 factor alpha (annualized)	13.12%	10.25%	5.84%	2.14%	0.56%	3.10%	-2.49%	-4.89%	-12.05%	-15.57%	28.69%	
t-value	5.25	4.44	2.59	0.91	0.25	1.34	-1.17	-1.82	-3.76	-3.46	4.92	
4 factor alpha (annualized)	9.78%	9.52%	4.63%	2.42%	-0.51%	3.69%	-2.28%	-4.11%	-10.08%	-13.06%	22.84%	
t-value	3.90	3.89	1.95	0.97	-0.21	1.51	-1.01	-1.44	-2.99	-2.76	3.80	
Panel B: Three and four factor regression coefficient analysis												
Fama-French style regression coefficient for top and bottom decile volatility portfolios						Fama-French-Carhart style regression coefficient for top and bottom decile volatility portfolios						
LV portfolio	Co-efficient	t-value	HV portfolio	Co-efficient	t-value	LV portfolio	Co-efficient	t-value	HV Portfolio	Co-efficient	t-value	
FF alpha (monthly)	1.09%	5.25	FF alpha (monthly)	-1.30%	-3.46	FFC alpha (monthly)	0.81%	3.90	FFC alpha (monthly)	-1.09%	-2.76	
EVI	0.66	21.98	EVI	1.333	24.70	EVI	0.67	23.45	EVI	1.32	24.60	
SMB	-0.20	-3.32	SMB	0.383	3.59	SMB	-0.14	-2.38	SMB	0.34	3.09	
VMG	-0.35	-5.93	VMG	0.084	0.79	VMG	-0.26	-4.40	VMG	0.02	0.17	
						WML	0.16	4.02	WML	-0.12	-1.60	

Results are similar for four-factor alpha with momentum as an additional factor, besides size and value. Four-factor Alphas for top-decile and bottom decile volatility portfolios are 9.78% and -13.06% respectively. These alphas are sizably more than CAPM alphas in magnitude with the same sign.

Panel 2 of Table 3 reports coefficients of three-factor Fama-French and four-factor Fama-French-Carhart factors for top and bottom decile volatility portfolios. Coefficients of both SMB and VMG factors in three-factor model are statistically significant but with a negative sign. And that explains why three-factor alpha is much higher than CAPM alpha. Converse is true for High volatility portfolio where SMB and VMG factor both have positive coefficients, however, only SMB factor is statistically significant and not VMG.

It is evident that Low volatility portfolio consists of big and growth stocks rather than small and value stocks and high volatility portfolio consists of small stocks. Four-factor

regression coefficients with momentum (WML) as added factor, helps to explain some part of positive alpha associated with low volatility portfolio. Four factor (FFC) alpha for top-decile volatility portfolio is 9.78% compared to three factor (FF) alpha. The coefficient of WML factor is positive and statistically significant in FFC regression for top-decile volatility portfolio and that explains some part of three-factor alpha. Four-factor (FFC) alpha for bottom-decile volatility portfolio is -13.06%, while three-factor alpha is -15.57%. The coefficient of WML factor is negative but not significant. The fact that both three-factor and four-factor alphas are higher than CAPM alphas shows that volatility effect cannot be explained by size, value or momentum effect. Looking at the regression coefficients it is clear that large stocks dominate low volatility portfolio, whereas, small stocks dominate high volatility portfolio.

Table 4 reports results of double sorting approach of a robust non-parametric method that enables us to control for other effects. It also captures any time-varying factor loadings for size, value and momentum factors that are assumed to be constant in Fama-French or Fama-French-Carhart multi-factor models.

Panel A of Table 4 reports the results showing double sorted alphas of decile portfolios with their statistical significance. The difference here compared to alphas reported in Table 1 is that these alphas are based on portfolios constructed using double sort on size followed by volatility and therefore controlling for size effect. Every month, stocks are sorted based on size (market cap) and divided into decile portfolios. Each size decile portfolio is then sorted within itself based on volatility. Finally, volatility decile portfolios are constructed using top decile stocks of each size decile portfolios. This robust arrangement helps us control for size effect. Putting it differently, each volatility decile portfolio now represents stocks with all different size. The similar process is followed for controlling value and momentum effects. Panel B and Panel C of Table 4 report these results.

Alpha for top-decile volatility portfolio after controlling for size effect is 11.01%, which is considerably higher and statistically more significant than top-decile volatility portfolio alpha of 7.91% without controlling for other effects. Looking at this outcome and keeping in mind that in our sample we have evidence for size effect, ideally, double sorted alpha must be lower if low volatility portfolio is dominated by a large number of small stocks. Instead, we see the exactly opposite, where low volatility portfolio alpha controlled for size effect is economically and statistically more significant than alpha without controlling for size effect. It implies that low volatility portfolio has a greater proportion of large stocks rather than small within each size-sorted decile portfolio; if at all such minute observation is worth anything. Bottom-decile of volatility portfolio has an alpha of -7.99% after controlling for size. This is slightly smaller than -8.72% without controlling for size effect. It shows that controlling for size does not lead to any improvement in performance of high volatility portfolio. Going by the results, we confirm that volatility effect is independent of size effect.

Table 4: Double-sorted results controlling for other effects

Table 4 reports the annualized alpha and corresponding t-value for volatility decile portfolios after controlling for other effects like size, value and momentum. Panel A, panel B and panel C reports results for size, value and momentum effects respectively. This analysis enables us to detangle the alpha of volatility sorted portfolios from alphas of size, value and momentum factors.

Panel A: Annualized alpha from double sort on size (market capitalization) and volatility of past 3 years											
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)
Alpha	11.01%	9.49%	4.47%	3.62%	-0.81%	-0.37%	-2.64%	-1.83%	-12.57%	-7.99%	19.00%
t-stat	4.12	3.77	1.89	1.72	-0.34	-0.18	-0.78	-0.60	-3.91	-1.97	3.34
Panel B: Annualized alpha from double sort on value (earnings/price) and volatility of past 3 years											
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)
Alpha	4.99%	4.63%	4.51%	2.70%	2.30%	-2.43%	2.49%	-2.24%	-5.06%	-8.77%	13.76%
t-stat	2.06	2.01	2.15	1.15	1.10	-1.20	0.98	-0.79	-1.49	-2.13	2.58
Panel C: Annualized alpha from double sort on momentum (12-month minus 1-month returns) and volatility of past 3 years											
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)
Alpha	9.71%	6.94%	3.06%	1.20%	2.71%	-0.54%	-7.37%	-4.87%	-1.02%	-9.83%	19.54%
t-stat	3.75	3.05	1.38	0.58	1.20	-0.25	-2.74	-1.66	-0.24	-2.59	3.58

Alpha of top-decile volatility portfolio after controlling for value effect is 4.99% compared to 7.91% without controlling for value effect. It is still economically and statistically significant. Corresponding alphas for bottom-decile volatility portfolios are -8.77% and -8.72%. A positive alpha of top-decile volatility portfolio and negative alpha of bottom-decile volatility portfolio are sizeable and significant both in economic and statistical terms. This proves that volatility effect is not value effect but clearly an independent distinct effect than classic value effect.

Alpha of top-decile volatility portfolio after controlling for momentum effect is 9.71% compared to 7.91% without controlling for momentum effect. Corresponding alphas for bottom-decile volatility portfolios are -9.83% and -8.72%. A positive alpha of top-decile volatility portfolio and negative alpha of bottom-decile volatility portfolio are greater than volatility decile alphas and more significant both in economic and statistical terms. In a nutshell, volatility effect is not even momentum effect but an independent effect.

The volatility effect remains economically and statistically significant even after controlling for all well-known effects including size, value and momentum.

4.3 Robustness Tests

Table 1 reports main results of univariate analysis for the volatility sorted decile portfolios. Top two decile portfolios (P1 and P2), consisting of lower volatility stocks, report significant above average returns. Such outperformance over universe portfolio loses steam and turns into significant underperformance as we move towards bottom decile portfolios (P9)

We report the results of the robustness tests to further substantiate our results. First robustness test involves using beta as a measure of risk. We calculate beta for each stock using equally weighted index (EWI) as a proxy to the market portfolio. We then report here the results of comparison between CAPM alphas for portfolios sorted on standard deviation and beta. Second robustness test involves sorting stocks on volatility after controlling for beta using double-sorting to evaluate whether volatility effect and beta effect represent the same effect comparing magnitude and strength of both.

4.3.1 Beta as a Measure of Risk

Panel A of Table 5 shows alpha comparison based on portfolios sorted on volatility vs. beta. There is a clear beta effect similar to volatility effect discussed earlier but lesser magnitude.

Panel B of Table 5 shows results of double-sorted decile portfolios, first on beta and then on volatility such as to control beta effect in decile portfolios. The results show that large chunk of alphas disappears and alphas don't remain statistically significant. However, going by numbers, there is still a clear trend. In closing, we summarise that market misprices systematic risk decile and to some extent idiosyncratic risk too but a large chunk of volatility effect is a beta effect. This is explicable, since, by design, our universe eliminates small stocks, which have greater idiosyncratic volatility and lottery-like payoffs. Besides, our choice of the equally weighted universe as a proxy of the market portfolio makes our beta more representative of total volatility itself. These combined effects dwarf the idiosyncratic volatility effect as reported by other studies.

4.3.2 Sub-period Analysis

We perform sub-period analysis to see if low volatility strategy outperforms only during turbulent times and underperforms during an upward trending market. The period of January 2001 to December 2007 saw a secular bull run in global markets including India before the start of a reversal from January 2008. We check results of volatility decile portfolios with respect to benchmark Nifty 200 in a period from January 2004 to December 2007. We find absolute returns of low-volatility portfolio similar to that of Nifty 200 but at much lower risk measured by annualised standard deviation. Consequently, Sharpe ratio is considerably higher. In fact, LV portfolio delivers marginal outperformance even in the period of secular bull-run in the study.

Table 5: Robustness Test using Beta as Risk Measure

Table 5 reports the results of robustness test using beta as a measure of risk. For the readability, we have reported the alpha for the volatility sorted decile portfolios from Table 1 again here in Panel A for comparison with the beta analysis. Panel B reports alpha for the volatility sorted decile portfolios after controlling for beta see the relative strength of volatility effect as well as beta effect.

Panel A: CAPM style annualized alpha for decile portfolios sorted on volatility verses beta											
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)
Alpha (Volatility sorted)	7.91%	6.80%	3.15%	-0.01%	-0.82%	3.53%	-1.80%	-2.33%	-7.70%	-8.72%	16.63%
Alpha (Beta sorted)	4.86%	5.53%	3.34%	0.93%	4.01%	2.89%	1.93%	-7.07%	-7.78%	-8.64%	13.50%
Panel B: CAPM style annualized alpha from double sort on beta and volatility											
	P1 (LV)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (HV)	P1-P10 (LV-HV)
Alpha	1.06%	3.16%	3.16%	0.66%	1.75%	0.95%	0.01%	-4.16%	0.18%	-2.17%	3.23%
t-value	0.52	1.55	1.50	0.32	0.79	0.43	0.01	-1.57	0.05	-0.56	0.68

5. Conclusion

In closing, we find clear evidence for volatility effect. A portfolio consisting of low volatility or low beta stocks systematically outperforms benchmark portfolio as well as high volatility or high beta stocks portfolio. This outperformance is not only on risk-adjusted basis but also an absolute basis over a period of our study. We also conclude that volatility effect is separate and significant effect and it is neither timid enough to be ignored nor it is a proxy for other well-known effects such as size, value and momentum. In fact, our low volatility portfolio consists of relatively large and growth stocks rather than small and value stocks. Besides, we conclude that a large part of our volatility effect is the same as beta effect and after controlling for beta we don't find volatility effect significant. However, even after controlling for the beta, low volatility portfolio retains positive alpha whereas high volatility portfolio retains negative alpha. None of them are significant and therefore we conclude that volatility effect is not due to idiosyncratic risk only as claimed by Ang, et al. (2006). and if at all idiosyncratic volatility effects, it may be adding to volatility effect. Evidence of volatility effect in our sample also rebuts the claim of Bali, et al. (2011) that low-risk anomaly disappears once we eliminate small and illiquid stocks from the sample. Our universe consists of relatively large and liquid stocks only and we still find strong evidence for volatility effect. We also find evidence to conclude that outperformance of low volatility portfolio over benchmark is not concentrated during negative markets only. We find all the possible economic, as well as behavioural explanations offered in existing literature for the persistence of low-risk anomaly, are also valid in the Indian context. In addition, we add performance chasing behaviour of mutual fund investors as one of the possible explanation for the low-risk anomaly. We conclude with the claim that low-risk anomaly is very strong and significant anomaly in the history of capital markets and it will stay for a long time unless economic and behavioural reasons as well as the market friction that causes it or it becomes overcrowded investment place and loose its sheen. All these are unlikely to happen at least in the near future.

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PLACE IMPACT ON PRICE SENSITIVITY

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Abstract: Consumers' price sensitivity to price changes is an important input for tactical and strategic decisions. Consumer reaction to price has been largely confined to examining consumers' price information search, evaluation of price alternatives, and individual purchase behaviors without regard to location influencers. It has been also argued that price sensitivities depend on factors such as advertising, brand image, availability of the brand and valuation of a product's overall attractiveness or utility. Although, Price sensitivity is often attributed to an individual, but aspects related to the location of the consumer set and its impact on price sensitivity is not explored fully. This research addresses the issue; whether individuals residing in diverse locations such as urban & rural exhibit different level of price sensitivity. We have examined this area across a study that individual's price sensitivity is in fact modified by their consumption location. The generalizations based on the study have important implications for the practitioners and researchers. For managers, the need to coordinate between pricing and competitive edge is the driver of success. Researchers can get the direction of future research from our summary and conclusive discussion.

Key Words: Price sensitivity, FMCG, Urban-Rural

INTRODUCTION

There is substantial evidence for variation in price sensitivities of a product across various stores and chains. In the prevailing environment, consumer's reaction to economic function of price is not irrational, as it is well established that consumer consider price as an attribute while forming buying decision. How consumer perceives; price gains and price losses in the reference price models, to insulate themselves from monetary losses i.e. the impact of prices on consumption. It empirically attempts to verify this strong actual correlation and dependence upon place i.e. Urban and Rural.

Price is what the consumer pays to get the right to use the product. It is the give-up by the consumer in an exchange. The pricing of a consumer product is a

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two-step process: producers charge retailers and retailers subsequently charge consumers, ignoring any distribution intermediaries. Dynamics of the pricing problem differ for a retailer and a producer. The retailer determines the final price on the shelf, whereas the producer can only affect the final price by changing the cost to retailer. The retailer has the control of prices for all products in a category, but producer can control the prices of its products only. Moreover, the retailers' inherent power in pricing is substantially strengthened with the recent developments in retailing. These developments include the consolidation into large retail institutions, fragmentation of consumer markets, and availability of store scanner data. As the retailers vests power in determining the consumer prices, assuming retailers as the "final intermediaries in the distribution channel" becomes inappropriate. Consequently, retailer orientation dominates producer orientation in recent marketing literature.

Today, most marketing executives cite pricing as the most important element of the marketing mix. This is an easily justifiable claim, as price is a key variable in all business equations like unit sales, sales revenue, and profit, it is the most flexible among the 4 P's. The impact of price on business results is usually immediate and quantifiable. Moreover, price significantly interacts with all the other marketing mix elements and creates perception based on price – like higher price for better quality – are easily communicable to the consumers.

Pricing problems are now being addressed with more sophisticated approaches, as their importance is appreciated by marketing executives. Before the 1980s, pricing was perceived as procedural work of adding a target return on costs: cost oriented era. Today, pricing is rather perceived as a key subject and its relation with demand is carefully engineered: demand-oriented era. Recent developments in academic literature appear to be parallel with the renewed interest in pricing.

Understanding the distinctive characteristics of the rural consumer is essential for any mass consumer product marketer that aims to reach this market. Earlier work (Prahlad, 2005) identified the three A's – Accessibility, Affordability and Availability – as essential components for reaching rural markets. Awareness – that is the knowledge of consumers about the existence of the product (Anderson & Markeides, 2007). The notion that low-income also form an important market is not new. Several authors have attended that poor people pay more for the same than the rich people (Caplovitz, 1963). The reason behind poor paying more is that they usually shop at small, independent stores, which charges higher prices, owing to their inefficiencies and higher operational costs (Berry, 1972).

Poor people tend to be more loyal to brands because they cannot make mistakes. The financial risk is too high, because if the product does not deliver the expected value, consumer will not be able to buy an alternative or branded product till the

product is consumed. Therefore, buying branded product is a rational behaviour (Prahlad, 2005).

One cannot doubt the importance of price for the consumer with limited budget. However, due to social cost, transport limitations and distribution inefficiencies, the poor usually pay more for the same products. It has also been argued that small-scale decentralized initiatives may make more sense in low-income markets (Christensen *et al.*, 2001). Based on the findings (Barki & Parente, 2006) suggest that choice of the preferred shopping destination is not based on pricing rather on satisfying economic, social and psychological need. Which suggest that hard discount stores, when competing with more service-oriented & efficient, satisfying the aspirations of the rural population, may not be the best store format? There is an understanding that consumer's buying behavior in all socio-economic segments are based on selecting the best alternative that maximizes the value; trading-off between benefits and costs. What differs among low income and high income consumer is the way they perceive the value proposition of products or brands. Owing to the limited budget, there is still a misconception that rural consumers just buy cheaper and quality compromised products. According to data lead brands of mass consumer goods satisfy the aspirations of those on low incomes. Apparently owing to economic deprivation, low income consumers have a positive perception of abundance and a high level of aspiration to feel socially included. The importance of relationship has been highlighted as one of the major marketing ingredient of success for any business enterprise (Morgan & Hunt 1994).

Rural people tend to create a stronger sense of community and social network, based on mutual help, from bargain trips to mutual cooperation. As competition increases in all market segments, successful companies must go for fulfilling consumer's objective needs. In order to foster the stronger relationship, companies will need to understand the social and psychological need and try to satisfy their symbolic needs. For large companies, it will be important to go beyond just researching the rural markets, could gain more relevance by identifying new alternatives of values to help improve communities and help them in day-to-day life.

The Objective

Based on the historical researches, researchers ambition is to explore the deviation in the level of price sensitivity among rural and urban consumers.

The Hypothesis

H_0 = The price sensitivity of buyer does not depend upon the location.

H_1 = The price sensitivity of buyer does depend upon the location.

RESEARCH METHODOLOGY

Dewey (1933) outlines a general archetype of enquiry that underpins the scientific approach, consisting of inductive discovery (induction) and deductive proof (deduction). Deduction begins with a universal view of a situation and works back to the particulars; in contrast, induction moves from scattered details to a connected view of a situation.

The deductive approach moves towards hypothesis testing, after which the principle is confirmed, refuted or modified. These hypotheses present an assertion about two or more concepts that attempts to explain the relationship between them. Concepts themselves are abstract ideas that form the building blocks of hypotheses and theories. The first stage, therefore, is the elaboration of a set of principles or allied ideas that are then tested through empirical observation or experimentation.

SAMPLE DESIGN

(Rubon & Babbie, 2002) suggest in their study that study population is the representative of aggregating elements; which the sample is actually selected for the study. (De Vos *et al.*, 2002) defines the population to be studied, as individuals who possess certain characteristics. Thus, the individual units selected, represent the population that generates the research problem and the final results will be generalized.

The following criteria were used to identify the population:

- The respondent must be of age 15 years or above,
- Who has been involved in either the purchasing process or consumption situation or both?
- Respondent is resident of the chosen geographical location
- Respondent is able to understand the questionnaire

A sample size of 400 was taken for the study, after the scrutiny 369 samples found to be adequate and complete to the extent of being included in the study. Out of the sample collected from both the diverse geographical locations, half of the sample belongs to rural area.

To begin with, often information gathered in the social sciences, marketing and business, relative to attitudes, emotions, opinions, personalities, and description's of people's environment involves the use of Likert-type scales. As individuals attempt to quantify constructs which are not directly measurable they often use multiple-item scales and summated ratings to quantify the construct of interest (Gliem & Gliem, 2003). (Nunnally & Bernstein, 1994), (McIver & Carmines, 1981) and (Spector, 1992) discuss the reasons for using multi-item measures instead of a

single item for measuring psychological attributes. An individual item cannot discriminate among fine degrees of an attribute.

Cronbach's alpha is a test reliability technique that requires only a single test administration to provide a unique estimate of the reliability for a given test. Cronbach's alpha is the average value of the reliability coefficients one would obtain for all possible combinations of items when split into two half-tests. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale.

The construct is tested for reliability statistics using Cronbach's Alpha, the value reported is 0.86, which indicates that multi-item scale is not only reliable, but also internally consistent. It is important to know that while a high value for Cronbach's alpha indicates good internal consistency of the items in the scale, it does not mean that the scale is one-dimensional. Factor analysis is a method to determine the dimensionality of a scale.

The construct

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	369	100.0
	Excluded ^a	0	.0
	Total	369	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.860	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1. I can wait for a week or more to get better price/discount	10.1870	24.343	.676	.831

contd. table

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted
2. Promotion offer is an excellent option to save money	9.8401	24.955	.612	.843
3. Price is more important than brand	9.7696	21.939	.720	.824
4. I can switch brand to get discount on price	9.9539	23.718	.659	.835
5. I prefer to buy on particular day / time to get the price discount	10.1978	26.175	.673	.835
6. I may pre-pone / post-pone purchase to receive the price discount	10.0244	27.095	.605	.846

Factor Analysis

Factor analysis is a method of data reduction. It does this by seeking underlying unobservable (latent) variables that are reflected in the observed variables (manifest variables) (Bruin, 2006).

In the descriptive statistics table in factor analysis, it shows the means of various items, standard deviation of the item responses and the number of responses considered for the computation. Since the determinant value in this table is .067, it depicts that items are not highly correlated to support multicollinearity, in factor analysis.

KMO and Bartlett's Test

(a) **Kaiser-Meyer-Olkin Measure of Sampling Adequacy** - This measure varies between 0 and 1, and values closer to 1 are better. A value of .6 is a suggested minimum. Whereas, the data set value is .834, which is absolutely adequate.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.834
Bartlett's Test of Sphericity	Approx. Chi-Square	985.848
	df	15
	Sig.	.000

(b) **Bartlett's Test of Sphericity** - This tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is matrix in which all of the diagonal elements are 1 and all off diagonal elements are 0. You want to reject this null hypothesis. However, as we can see that the Bartlett's test of sphericity

is significant. That is, its associated probability is less than 0.05. In fact, it is actually 0.000, i.e. the significance level is small enough to reject the null hypothesis. This means that correlation matrix is not an identity matrix.

Communalities

The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors. For instance over 60% of the variance in “Purchase Timing” is accounted for while 63% of the variance in “Price Preference” is accounted for.

Communalities

	<i>Initial</i>	<i>Extraction</i>
I can wait for a week or more to get better price/ discount	1.000	.622
Promotion offer is an excellent option to save money	1.000	.529
Price is more important than brand	1.000	.660
I can switch brand to get discount on price	1.000	.585
I prefer to buy on particular day / time to get the price discount	1.000	.632
I may pre-poner / post-poner purchase to receive the price discount	1.000	.547

Extraction Method: Principal Component Analysis.

Total Variance Explained

The next item shows all the factors extractable from the analysis along with their eigen values, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. Notice that the first factor accounts for 46.367% of the variance, all the remaining factors are not significant.

Total Variance Explained

<i>Component</i>	<i>Initial Eigenvalues</i>			<i>Extraction Sums of Squared Loadings</i>		
	<i>Total</i>	<i>% of Variance</i>	<i>Cumulative %</i>	<i>Total</i>	<i>% of Variance</i>	<i>Cumulative %</i>
1	3.574	59.571	59.571	3.574	59.571	59.571
2	.769	12.814	72.385			
3	.635	10.583	82.968			
4	.396	6.600	89.568			
5	.339	5.644	95.212			
6	.287	4.788	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

The table below shows the loadings of the six variables on the one factor extracted. The higher the absolute value of the loading, the more the factor contributes to the

variable. The gap on the table represent loadings that are less than 0.5, this makes reading the table easier. We suppressed all loadings less than 0.5.

Component Matrix^a

	<i>Component</i>
	1
1. I can wait for a week or more to get better price/ discount	.788
2. Promotion offer is an excellent option to save money	.727
3. Price is more important than brand	.812
4. I can switch brand to get discount on price	.765
5. I prefer to buy on particular day / time to get the price discount	.795
6. I may pre-pone / post-pone purchase to receive the price discount	.739

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

The factor analysis is uni-component factor analysis with six variables. Since, just one component is extracted, therefore, this solution cannot be rotated.

The t-Test Analysis

The independent-samples t-test (or independent t-test, for short) compares the means between two unrelated groups on the same continuous, dependent variable. This t-test is designed to compare means of same variable between two groups. The Independent Samples *t* Test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different. The Independent Samples *t* Test is a parametric test. The variables used in this test are known as Independent variable, or grouping variable. The Independent Samples *t* Test can only compare the means for two (and only two) groups. It cannot make comparisons among more than two groups.

Homogeneity of variances (i.e., variances approximately equal across groups)

When this assumption is violated and the sample sizes for each group differ, the *p* value is not trustworthy. However, the Independent Samples *t* Test output also includes an approximate *t* statistic that is not based on assuming equal population variances

Group Statistics

	<i>Location of Respondent</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>
PS	Rural	184	2.7083	.94011	.06931
	Urban	185	1.2937	.20022	.01472

In group statistics, the first column gives categories of independent variable Location of Resident i.e. the rural and urban resident. N is the number of valid observations in each group, in the above table 184 observations are collected from rural India and remaining 185 are from urban India.

Third column, represent mean of the dependent variable for each of the level of independent variable. In this study mean value for rural population is 2.7083 and urban India is 1.2937.

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means				95% Confidence Interval of the Difference		
	F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Differ- ence	Lower	Upper
PS Equal variances assumed	202.025	.000	20.016	367	.000	1.41464	.07068	1.27566	1.55362
Equal variances not assumed			19.966	199.480	.000	1.41464	.07085	1.27493	1.55435

The second section **Independent Samples Test**, displays the results most relevant to the Independent Samples *t* Test. There are two parts that provide different pieces of information: (A) Levene's Test for Equality of Variances and (B) *t*-test for Equality of Means.

Levene's Test for Equality of of Variances: This section has the test results for Levene's Test. From left to right:

- *F* is the test statistic of Levene's test
- *Sig.* is the p-value corresponding to this test statistic.

The *p*-value of Levene's test in this study is ".000" (but should be read as $p < 0.001$ – i.e., *p* very small), so researcher can reject the null of Levene's test and conclude that the variance in price sensitivity of rural and urban consumer is significantly different.

The above result suggest us to *t*-Test for equality of means, in this test,

- *df* is the degrees of freedom

- *Sig (2-tailed)* is the p-value corresponding to the given test statistic and degrees of freedom
- *Mean Difference* is the difference between the sample means; it also corresponds to the numerator of the test statistic

The mean difference is calculated by subtracting the mean of the second group from the mean of the first group. The sign of the mean difference corresponds to the sign of the *t* value. The positive *t* value in this study indicates that the mean price sensitivity for the first group i.e. rural is significantly greater than the mean price sensitivity of the second group i.e. urban India.

The associated *p*-Value is 0.000, since, *p*-Value are never actually zero, SPSS prints .000, because the *p*-value is so small that it is hidden by rounding error.

CONCLUSION

Among the consumers belong to rural and urban centers (N = 369), there is a significant difference in the price sensitivity of the population ($PS_R = 2.7083$ & $PS_U = 1.2937$) and Standard Deviation ($SD_R = .94011$ & $SD_U = .20022$) and *p* - value $\geq .05$, therefore, we reject the null hypothesis that there is no difference in price sensitivity of the consumers representing rural and urban centers. Therefore, price sensitivity of urban consumer is different than the price sensitivity of the consumers from rural areas.

Marketing Implication of the study

We argued in this paper that price sensitivity of the consumer may be moderated by their location; we used an information framework to guide the design of price sensitivity experiment to test our hypothesis about the impact of location on consumer price sensitivity. Our empirical strongly suggest that location of the consumer moderates consumer price sensitivity.

From the perspective of pricing policy, marketers may wish to consider the likely implications of our findings for the intimate relationship between location of the consumer and their price sensitivity. Based on our results, the greater proportion of population in rural India has exhibited price sensitivity towards personal care category low involvement products. Clearly, the type of information produced by our research approach would make it possible to quantify gains and losses and permit managers to make pricing decisions that take into account the value of price to consumers.

Our study suggest that marketing manager should be zealous about maintaining pricing strategy that should strive to reflect consumers' higher utility, as well as lower price sensitivity. It will enable them to include all the aspects of

value proposition credibility and careful consideration of extension. We see many future price sensitivity research issues worthy of attention. For example, in this paper, we focused on low involvement product category and location factors that could affect the impact of price sensitivity. However, consumer characteristics also may determine the extent of this impact.

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CONFIRMING THE FACTORS FOR PRODUCT QUALITY: A STUDY ON TWO WHEELER USERS IN INDIA

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ABSTRACT

Purpose: The Study purposes to confirm the factors for Product Quality for Two wheeler buyers in Indian context. With the arrival of latest technologies, it the need of the hour to identify the various factors that are considered by buyer.

Method: The study was exploratory in nature, using survey for data Collection. Sample size for the study was of 150 respondents including both male and female exclusively in Gwalior region. Non-probability purposive sampling technique was used. Standardised questionnaire with five point likert scale was used. Test like Reliability, Confirmatory Factor Analysis and Correlation were applied to achieve the purpose of the study

Results: Performance, Reliability, Durability, Conformance, Perceived quality, Special features were the factors that are confirmed using CFA, further Performance, Reliability, Durability were found to be strongly correlated and Conformance, Perceived quality, Special features were found to be strongly correlated with each other. Serviceability and aesthetics were factors that were dropped in the CFA. The Fitness statistics reflected that the Value of χ^2 was 173.407 along with $DF = 155$ & $\chi^2/df = 1.119$ that shows high fitness of the data RMSEA was found to be .028, GFI was .898 & AGFI was .862. The incremental fit measures i.e. NFI = .791, RFI = .744, IFI = .913, TLI = .965, CFI = .971 were found to be as per threshold limit. The value of PRATIO, PVFI & PCFI was .816, .645 and .816 respectively. These GOF statistics reflects that the model fitted the data. The Construct reliability for Performance, Reliability, Durability, Conformance, Perceived quality, Special features was .707, .750, .636, .373, .590 and .536 respectively.

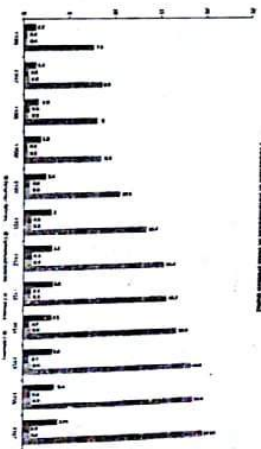
Originality Value: the study is an unique attempt to identify the leading factors that are perceived and considered for a product to be of high quality. Along with this the factors are correlated in a unique combination also which implies that the manufacturers must not consider these factors in isolation but always in presence of the combination i.e. Performance, Reliability, Durability should be considered together and Conformance, Perceived quality, Special features should be considered together to achieve high benefits.

Keywords: Product Quality, Two wheeler, Performance, Reliability, Durability.

INTRODUCTION

Indian two wheeler markets is one of the largest two wheeler market in the world, contributing 7.1% to GDP and providing jobs to millions. This industry also generates excise revenue of 13%. 25.12 million Units were produced during financial year 2017 of total automobile out of which 79% is the share of two wheelers. Indian automobile sector is able to grab 15.79 billion dollar FDIs from April 2000 to September 2016. Out of the above figure, replacing China, India sold 19.91 million units in year 2017 of two wheelers. Two wheeler sale included Mopeds, Scooter, Motorcycles, Electric two wheelers mainly. The major players in India Scooter segment are Hero Motocorp, Honda Motorcycle and Scooter India (HMSI), TVS motors. HMSI is the leader in the segment holding 60% of the market share.

In case of Motorcycle Royal Enfield and Bajaj is added wherein Hero motocorp is the leader with 50% of the market share.



RESEARCH PURPOSE

The Study has been conducted to confirm the underlying factors for Product Quality in case of two wheeler buyers in Indian context. With the arrival of latest technologies, it the need of the hour to identify the various factors that are considered by any buyer before buying the same at the same time it is utmost important even for the manufactures for to consider the findings of the study. This research contributed to the product quality study on two wheelers. Quality of a product is very important for the customer satisfaction and loyalty for purchasing two wheelers. At examining personal satisfaction one must think as of design, production, and administration. Most of the people concern the price, mileage, brand of the two wheelers, design and style, after sales service when purchasing a vehicle. Therefore, the current study is focused in confirming the factors of product quality in two wheeler segment.

REVIEW OF LITERATURE

Product quality is not a new concept in marketing although it has been revised with some new proposition by various authors. It is a concept which prevails in all sort of products be it perishable, durable etc. The current study reviews the work done on the concept irrespective of product /industry. Atiyah (2016) reviewed the definition given by Parasurman (1990) and Tenen

(1995). Parasurman (1990) defined quality as "the interaction between the customer and the service provider, since the customer sees the service quality through comparing his expectations of this service with the actual performance" and Terner (1995) defined it as "an essential working strategy largely understood in the consumers expectations in and outside whether these expectations are explicit or implied".

Atiyah (2016) mentioned quality "as the source basic and important as it leads to pleasing the customer and increase loyalty and increase the degree of profitability in the medium and long term in the organization". He found in dairy products that complacency comes from quality and that generates loyalty to earn more profits. The study also mentioned that the customer confidence comes from services provided to them and they are more loyal in case of favorable services.

Although there are studies which do not mention any contribution of variables like Technological updated, Antique, Joint venture on customer satisfaction however it is safety and CSR which affects customer satisfaction (Khan and Rao, 2018). Perceived product quality is another strong variable that affects customer satisfaction as well as purchase intention for any product/Saleem, Ghafar, Ibrahim, Yousuf, & Ahmed, 2015).Jalanshahi, Gashti, Mirzadadi, Nawaser, & Khakkar (2011) studied automotive industry wherein Customer service quality and product quality influences customer satisfaction and Customer satisfaction influences customer loyalty. In FMCG industry it is the functional value and price of the product that leads to customer satisfaction. However customer value also equally affects customer satisfaction as a mediating variable (Razak, Nirwanto, & Triatnanto, 2016) leading to customer commitment specially in Auto industry (Ehsani & Ehsani, 2015). Similar kind of study in Retail marts wherein the impact of Service as well as product quality on customer satisfaction (Sutanto, Hongdyanio, & Minantyo, 2014), customer retention in Grocery Store (Hussain and Kanabhat, 2013), along with product quality and service quality, contextual experience have a major influence on customer perceived value in case of retail(Sam & Dhanya, 2012).

Alfin, Alhabssii, & Nimran (2013), discussed the significant impact of service quality on corporate image and customer satisfaction, however product quality affected only customer value as well as corporate image and not customer satisfaction. At times corporate image and customer satisfaction plays a mediating role in maintaining significant effect of service quality on customer trust and in reverse corporate image plays a mediating role in maintaining significant effect of service quality on customer satisfaction.

Industry like airlines where Hasniaty (2015), confirmed that product affects trust, customer satisfaction and loyalty, but no effect is seen on commitment. Similarly price affects trust, commitment, satisfaction, but not loyalty. In the same study Service quality affects trust, commitment, satisfaction but not loyalty and trust affects satisfaction and loyalty. Commitment affect loyalty and Satisfaction has significant positive effect on satisfaction and loyalty too. Quality is also one of the major variable to be studied in other service industry like hotels and restaurants, where quality of service positive and significant influences purchasing decisions, brand image positive and significant impact on purchasing decisions, product quality positive and

significant impact on purchasing decisions, and service quality, brand image and product quality jointly influence positively and significantly the purchasing decision (Priyono, 2017) and customer satisfaction(Abdullah & Rozario, 2009). Moreover Mohayudin, Chand, Aziz, Bashir, & Irfan (2017) mentioned that food safety has mediating effect on food quality and customers satisfaction. Even packaging quality has a critical role to play in building profitable consumer-brand relationships and consumer loyalty like the quality of bottle in water bottles (Jeffrey, Singh, Metcalif & Danes, 2014).

There is a high acceptance of Indian two wheeler in other Asian countries too. For Instance in Sri Lanka Market, Indian two wheelers are accepted because of their product related factors like Price, Technology and Design, Spare Parts Availability, After Sales Services and Product Awareness and Economic Conditions are found to be consumer related factors. Other consumer related factors were age, gender, income level, education level which undoubtedly affects purchasing decisions(Wecerasiri & Mendis, 2015)

In mobile phones, perceived product quality affects brand loyalty whereas customer satisfaction is found to partially mediates the relationship between perceived product quality and brand loyalty (Kasim, Igan, Swidi, Tahajuddin, Neezm, 2013). However there are certain studies which do not reveal any impact of Product Quality, Quality of Service and Trust on neither Customer Satisfaction nor Customer Loyalty(Rimawan, Mustafa, & Mulyanto, 2017)

Cruz(2015), mentioned a significant statistical relationship between product quality and customer satisfaction. He mentioned that nothing mediates this relationship be it product safety or its cost. Undoubtedly high quality vehicles leads to fewer injuries and deaths associated with vehicular accidents. Indian recorded at least 4,80,652 accidents in 2016, leading to 1,50,785 deaths; 413 people died everyday in 1,317 road accidents which reveals that 17 deaths occurred in road accidents in 55 accidents every hour in the given time period(The Indian express, 2016), however a this figure came down by 3% in 2017(Dash, 2018)

Ackratalguningsri (2015), conducted a demographic based study using gender, age, income and education as main variable for evaluating product quality. He found Men and women both consider function of the product, reliability, durability, and design for the purchase of automobile. In case of age, Various age groups consider dimensions of product quality differently. For instance, young generation considers function, design, and reliability, 21-25 years considers durability, 26-30 years of age considers reliability, durability, and design for automobiles; 31-35 years of age considers function, durability, and reliability. 36-40 years old considers function, reliability, and durability in their buying decision of automobile. 41-45 years old considers reliability, customer satisfaction, and function. Going to Upper age group eco-friendliness, customer satisfaction, and durability are considered as the most important attributes when deciding to buy a car/automobile. Those at 51 years of age and above ranked reliability, durability, and ease of use as their most influential attribute dimensions in buying automobiles. He also mentioned that people with high education considers eco friendliness whereas slightly less educated considers reliability, durability, and design as the most important attributes. At

times product's positive or negative externality and customers of different involvement types perceive quality differently in intrinsic and extrinsic products (Liaw, Zhu & Lee, 2004)

OBJECTIVES OF THE STUDY

The goal of this study is to explore the factors of product quality that encourages any buyer to make his/her final purchase. Other objectives were to restandardize the questionnaires to measure product quality, along with evaluation and confirming factors of product quality. The study was also undertaken to find out the correlation between various confirmed factors

METHOD

Study- The study was exploratory in nature with survey method used as a tool for data Collection.

Participants: Population- The Population for the study was included all the customers of all two wheeler users both male and female respondents included. **Sample Size-** Sampling size for the study was 150 respondents. **Sample techniques-** Non probability sampling technique was used to select sample. **Tools used for data collection -**For product quality standardised questionnaire (Shaharudin, Mansor, Hassan, Omar, & Harun, 2011) based on liker type scale from 1 to 5 where 1 shows the minimum agreement and 5 indicates maximum agreement **Tools use for data analysis-** Reliability test was used for checking the reliability of the questionnaire. Confirmatory Factor analysis was used for analyzing the confirmed factors of product quality. Correlation was applied between the confirmed factors.

FINDINGS AND DISCUSSION

For this research purpose in total 200 questionnaires were distributed out of which only 185 were received back. However 35 respondents did not completely filled the questionnaire. Therefore, these 35 incomplete questionnaires were removed from the analysis at all the levels. Response rate was 81% and finally 150 completely filled questionnaires were used for further data analysis. The Mean in case of 'age' was found to be 1.533 and in case of 'Gender' it was 1.526. Three age groups were used for the study i.e. 15-25, 25-35, 35-45. In '15-25' years of age group 86 respondents participated that makes it 57.3 %, in '25-35' years of age group 48 respondents filled the questionnaire that makes it 32% of the total respondents, in '35-45, years of age group only 16 respondents participated that makes it 10.7% of the total respondents.

Descriptive Statistics		age	Gen
N	Valid	150	150
	Missing	0	0
Mean		1.5333	1.5267
Std. Deviation		.68215	.50096
Skewness		.907	-.108
Std. Error of Skewness		.198	.198

Age analysis				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-25	8	57.	57.
	25-35	4	32.	89.
	35-45	1	10.	100.
Total	15	100.	100.	

Gender Analysis				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	71	47.3	47.3
	female	79	52.7	100.0
	Total	150	100.0	100.0

RESULTS OF RELIABILITY TEST

Reliability test was applied by using PASW software on questionnaire and reliability test values of all questionnaire is given in Table 1. Overall 41 items were used in the tool to measure Product Quality.

Table 1. Reliability Statistics

Cronbachs Alpha	No. of Items
.866	41

The reliability value from the above table indicated that the reliability coefficient cronbachs alpha value is more than 0.866 which is far above the threshold value of .7, indicating that the reliability of the questionnaire was high and it is suitable for further analysis.

CONFIRMATORY FACTOR ANALYSIS (CFA) (INITIAL)

Confirmatory Factor Analysis (CFA) was applied using AMOS (analysis of moments structures (18.0 Version). Standardised questionnaire from shaharudin(2011) was adopted wherein the tool has already been processed with EFA. Therefore in the current study first order CFA has been applied to Product Quality (Figure 1).

Model specification and CFA Results of Product Quality (PQ)

CFA was performed on PQ to evaluate unidimensionality, reliability, and Validity of measure. In this Goodness of Fit (GOF) and Validity & Reliability of PQ was evaluated (Table 2). **Goodness of fit Indices:** CFA was carried out on PQ model containing eight factors including performance (PR), reliability (RE), durability (DU), conformance (CO), perceived quality (PQ), serviceability (SE), aesthetics (AE), and special features (SF). Overall 41 statements resulting from EFA were used.

The model was evaluated by maximum likelihood (ML) estimation using AMOS 18. Table presents summarized findings of preliminary CFA where the results revealed that Chi square value ($\chi^2=1207.701$, $DF=751$) was significant at $p < 0.000$ indicating that data fit to the model was not good. Since CMIN/DF value should be < 3 for high fit. Therefore, further other techniques were used to assess the same.

RMSEA (Root Mean Square Residual) and GFI (Goodness of Fit Index): The First set of GOF Indices shows the value of GFI and AGFI (Adjusted Goodness of Fit Index) should range between 0 to 1, with a cut off value of .9 or in other words it should be $> .9$. Here GFI=.738 and AGFI=.700. The outcome specify for more improvement of model as value received are not suggested values.

Incremental / Comparative GOF: Here the Value of all five fit indices should be $> .9$. Results revealed that the value of NFI (Normated fit Index) =.565, RFI (Relative Fit Indices) = .525 the outcome specify for more improvement of model as value received are not suggested values but IFI (Incremental Fit Index) = .775 TLI (Tucker-Lewis coefficient) = .745, CFI (Comparative Fit Indices) = .767 the outcome specify for more improvement of model as value received are not suggested values.

Parsimony -Adjusted Measures: All values should be $> .5$ for high GOF. Here PRATIO=.916, PNFI=.517 and PCFI=.702. The outcome specify for more improvement of model as value received are not suggested values.

RMSEA (Root Mean Square Error of approximation): It reflects Comparative badness of fit Index it should be $< .5$, in other words when we are improving the RMSEA the track of RMR should be kept that it should also be low. "Through RMSEA sample size issue can be resolved as any differences present between the hypothesized models." In case of smaller values indicating better model fit and can range from zero to one. Here RMSEA was .064, which was still required to be improved.

RESULTS OF CONFIRMATORY FACTOR ANALYSIS TEST (INITIAL)

Table 2 Goodness of Fit statistics for the initial CFA of PQ

	Absolute Fit Measures					Parsimony Fit Indices			
	χ^2	DF	χ^2/DF	GFI	AGFI	RMSEA	PRATIO	PNFI	PCFI
Crt.			$1 < X 3$	≥ 0.90	≥ 0.90	< 0.05			
Obt.	1207.701	751	1.608	.738	.700	.064			
	Incremental Fit Measures					Parsimony Fit Indices			
	NFI	RFI	IFI	TLI	CFI	PRATIO	PNFI	PCFI	
Crt.	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.50	≥ 0.50	≥ 0.50	
Obt.	.565	.525	.775	.738	.700	.916	.517	.702	

Obt.	0.565	0.525	0.775	0.745	0.971	0.916	0.517	0.7
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χ^2 = Chi Square; df =degree of freedom; GFI= Goodness of fit Index; AGFI= Adjusted goodness of fit index; RMSEA= Root Mean square error of approximation; NFI= Normated Fit Index; RFI= Relative fit Indices; IFI= Incremental Fit Index, TLI= Tucker-Lewis coefficient, CFI= Comparative fit index PRATIO= Parsimony Ratio; PNFI= Parsimony Adjustment to NFI, PCFI= Parsimony Adjustment to CFI

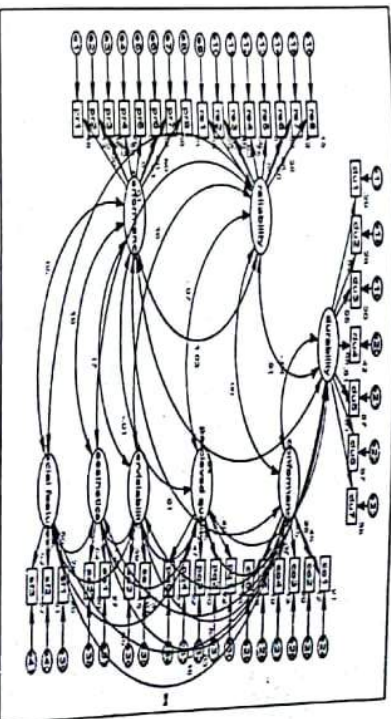


Table 3 Goodness of Fit statistics for the Initial CFA model of PQ

	Absolute Fit Measures					Parsimony Fit Indices			
	χ^2	DF	χ^2/DF	GFI	AGFI	RMSEA	PRATIO	PNFI	PCFI
Crt.			$1 < X 3$	≥ 0.90	≥ 0.90	< 0.05			
Obt.	173.407	155	1.119	.898	.862	.028			
	Incremental Fit Measures					Parsimony Fit Indices			
	NFI	RFI	IFI	TLI	CFI	PRATIO	PNFI	PCFI	
Crt.	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.50	≥ 0.50	≥ 0.50	
Obt.	0.791	0.744	0.973	0.965	0.971	0.816	0.645	0.792	

χ^2 = Chi Square; df =degree of freedom; GFI= Goodness of fit Index; AGFI= Adjusted goodness of fit index; RMSEA= Root Mean square error of approximation; NFI= Normated Fit Index; RFI= Relative fit Indices, IFI= Incremental Fit Index, TLI= Tucker-Lewis coefficient, CFI= Comparative fit index PRATIO= Parsimony Ratio; PNFI= Parsimony Adjustment to NFI, PCFI= Parsimony Adjustment to CFI.

Either covariance was attached or item was removed when it is related to more than one factor known as inter construct loadings where ever error variance are showing having high M (Modification Indices) has to correlate between two items. The Final model resulted in to High Goodness of Fit (Table 3). PR3, PR4, PR6, PR7, PR8, RE1, RE6, RE7, RE8, DU2, DU4, DU5, DU7, CO2, CO3, CO4, CO5, SE1, SE2, AE1, AE2, AE3 were removed from the model to improve the results. After reducing these problematic statements, the measurement model was re-run. The Value of χ^2 was 173.407 along with DF= 155 & $\chi^2/df=1.119$. RMSEA was 0.022 respectively; GFI was .898 & AGFI was .862. The incremental fit measures i.e. NFI= .791, RFI= .744, IFI= .973, TLI= .965, CFI= .971. The value of PRATIO, PNFI & PCFI was .816, .685 and .816 respectively. These GOF statistics reflects that the model fitted the data. (Figure 2)

Other evaluation criterion also shows that model sufficiently fit the data. In case of standard regression weights, all were greater than .5. The final outcome confirmed that model was fit to the data and hence no further improvement and modification was essential.

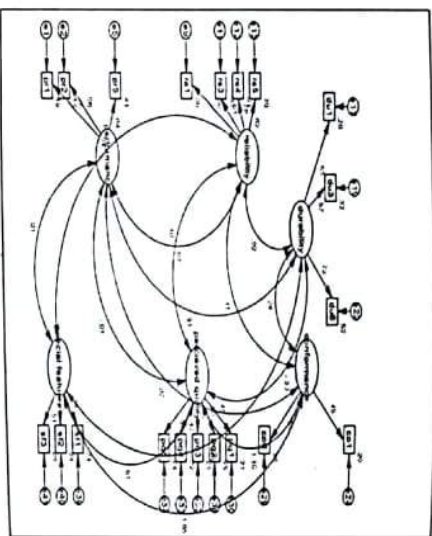


Figure 1 Final CFA

Description of factors: Shahrudin et al (2011) and Yogi (2016) have mentioned the contribution of the following factors in product quality enhancement. Performance had overly three manifest variables pr1(.698), pr2(.663), pr5(.643) and reliability is (.707). Reliability had overly four manifest variables rel(.599), re3(.613), re4(.779), re5(.624) and durability is (.750). Durability had overly three manifest variables du1(.530), du3(.567), du6(.719) and reliability is (.636). Conformance had overly two manifest variables co1(.448) and co6(.510) and reliability is (.373). Perceived quality had overly five manifest variables pq1(.455), pq2(.496), pq3(.463), pq4(.466), pq5(.485) and reliability is (.590). Special features had overly three manifest variables sf1(.494), sf2(.582), sf3 (.506) and reliability is (.536).

RESULT OF CORRELATION TEST

Table 4. CORRELATIONS

	PR	RE	DU	CO	PQ	SF
PR	1	.699**	.618**	-.034	-.002	.003
RE		.000	.000	.681	.977	.975
DU			1	-.049	-.055	.016
CO				.551	.501	.847
PQ					1	.354*
SF						1

** . Correlation is significant at the 0.01 level (2-tailed).

a. List wise N=150

In current study, Correlation was applied on confirmed factors of product quality (Table 4). Here, Performance, reliability and durability were found to be significantly correlated and on the other hand Conformance, Perceived Quality and Special Feature were found to be correlated significantly.

SUGGESTIONS

The current study has been done by taking sample of 150 respondents only, therefore it is suggested to take bigger sample size in order to obtain more accurate results. This study has been done in Gwalior region only so it is suggested to take larger area or other region so that more appropriate results can be done. The study resulted in the fact that we can change the product as well as its segment. Another important suggestion in line can be adding on some more related variable to Product Quality. As the current is a more focused and limited by confirming the factors of product quality and does not explore its relationship with other variables, therefore it is suggested to identify the relationship of product quality i.e the dependency product quality on other variables and vice versa.

MANAGERIAL AND RESEARCH IMPLICATIONS

This study is a useful contribution towards two wheeler users for increasing product quality. More emphasis should be paid towards. Performance related aspect, reliability, durability, conformance, Perceived Quality and Special Feature related aspects. It must be noted that Performance, reliability and durability were found to be significantly correlated and on the other hand Conformance, Perceived Quality and Special Feature were found to be correlated significantly. Therefore due care must be taken to utilize this set of findings at the time of

manufacturing and even after sales. From the buyer point, the buyers must pay adequate attention to the factors confirmed for the product quality wherein more weightage can be given to Performance, reliability and durability followed by Conformance, Perceived Quality and Special Features. Researcher can use this study as the base for further analysis in the field of two wheeler product quality. Same study can also act as guideline for the researchers in the similar industry may be with different demographic. As the current study is a work done in semi urban city i.e. Gwalior (M.P.) but the work can also be extended to some developed and urban city/ states. The scale that is confirmed here in this study for Product Quality can be re-used. The review done can also be studied for the better understanding of the subject and references provided can be further explored.

CONCLUSION

The study examined confirmation of the factors of product quality for two wheelers automobiles in Gwalior region. After getting the questionnaires filled by users of two wheelers in Gwalior and by applying test like reliability, confirmatory factor analysis and correlation the analysis has been done. The results of the study reflected high degree of correlation between the confirmed factors of product quality. out of eight factors used in the study Performance, Reliability, Durability, Conformance, Perceived quality, Special features were confirmed using CFA, further Performance, Reliability, Durability were found to be strongly correlated and Conformance, Perceived quality, Special features were found to be strongly correlated with each other. Serviceability and aesthetics were dropped in the CFA. The Fitness statistics reflected that the Value of χ^2/d was 1.119. GOF statistics reflects that the model fitted the data. The Construct reliability for Performance, Reliability, Durability, Conformance, Perceived quality, Special features was found to be as per threshold limits. The Study presented a unique proposition and two different sets of Product quality that are correlated i.e. Performance, reliability and durability were found to be significantly correlated and on the other hand Conformance, Perceived Quality and Special Feature were found to be correlated significantly.

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Conservation and Sustainable use of Medicinal Plants

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Abstract

Medicinal plants are worldwide valuable sources of herbal products, and these medicinal plants are on the way of extinction at higher speed. This paper deals with the world wide trends for conservation of medicinal plants and their sustainable use for the strategies and methodology. We had practiced in different way or types for conservation of medicinal plants (conservation by aware in peoples, cultivation practice), and resource management i.e. agricultural practice and sustainable use solution. It should be essentially taken in to account for the sustainable use of medicinal plant resources. We also use or implement biotechnological approaches like tissue culture, micro propagation, seed technology etc. It should be applied to improve yield and modify the contents of medicinal plants.

Key Words: Medicinal plants, Herbal products, Conservation, Sustainable, Agricultural.

Introduction:

Medicinal plants are worldwide source of new drugs. There are over 1500 medicinal plants are used in India of which 90 % are harvested from natural or wild resources and no of medicinal plants prescription drugs are based on natural source. As per our survey 80% of peoples in majority of states are totally dependent on herbal drug for their primary health care, and in Ayurveda more no prescribed medicines are derived from wild plants species. With the increasing demand for herbal drugs, natural health products and secondary metabolites of medicinal plants, the use of medicinal plants is growing rapidly throughout the world. A highly conservative estimate states that the current loss of plant species is between 1000 and 1000 higher than the expected natural extinction rate and planet - earth losing drugs. According to the International Union for Conservation of Nature and World Wild life fund there are between 50,000 and 80,000 different plant species used for medicinal purposes. Among these about 15,000 species are threatened with extinction from overharvesting and habitat destruction. Some wild resources have been exhausted with increase in human population and plant consumption.

Exploring the moderating role of core self-evaluation in the relationship between demands and work-family enrichment

Role of core self-evaluation

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Abstract

Purpose – Extant literature reveals that the personality variable, core self-evaluation (CSE) which represents an employee's self-assessment of himself has rarely been researched with respect to sales employees. The purpose of this paper is to identify the role of personality variable, core self-evaluation (CSE), in the relationship between demands and work – family enrichment. In this study, CSE has been treated as a moderating variable in the relationship between demands and work-family enrichment. This paper also aims to validate the CSE scale developed by Jugde *et al.* (2003) in Indian context.

Design/methodology/approach – Data were collected through structured questionnaires from 330 sales employees belonging to firms from some of the major sectors of Indian industry namely, Manufacturing, IT, FMCG, Pharmaceuticals and Financial Services. The study first validated the CSE scale in the Indian context using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Further, moderated regression analysis (MRA) was used to test the model.

Findings – The present research supported the 12-item CSE scale in the Indian context. Also, results of MRA suggested that, irrespective of higher work demands, sales employees having higher CSE experience higher levels of work to family enrichment (WFE). In addition, higher CSE employees tend to experience higher levels of FWE at the family front.

Research limitations/implications – In an emerging economy such as India wherein sales professionals are facing a lot of work demands, organizations should invest in their frontline employees to be able to deliver value for money to the customers and thereby gain competitive advantage. With this realization, managers should acquire and retain frontline employees with positive core self-evaluation. Therefore, organizations should select and try to retain candidates with positive core self-evaluations.

Practical implications – Corporates should focus on nurturing sales employees' positive CSE to make sure that their employees can contentedly adjust to various challenging work situations. In addition practices like job transitions, empowerment, enrichment and rewarding employees for their desired performance might be some of the interventions which positively impact core self-evaluations.

Originality/value – This study contributes to work – family literature by addressing the role of CSE in achieving WFE and FWE among sales employees in Indian context.

Keywords SEM, CFA, MRA, Core self-evaluation, Work demands, Work to family enrichment, Family to work enrichment, Family demands, EFA, AMOS, Sales employees

Paper type Research paper



1. Introduction

Work and family are the most vital domains for most individuals (Westman *et al.*, 2009, Tang *et al.*, 2014). However, the demands emerging from both these domains are a matter of

real concern not just for individuals but for organizations as well (Valcour, 2007; Kossek *et al.*, 2014). Such concern was prominent among the developed societies since last three decades. The primary reasons for such concerns are changes in workforce demography, dual career couples, emergence of nuclear families and changing nature of work itself (Amstad *et al.*, 2011) which holds true for the Indian context as well (Bharat, 2003).

While majority of work–family studies have been researched from a conflict perspective (Greenhaus and Beutell, 1985; Goh *et al.*, 2015), the enrichment perspective has started catching the attention of researchers only recently (De Klerk *et al.*, 2014; Greenhaus and Powell, 2016). Greenhaus and Powell (2016) defined work–family enrichment as a bi-directional concept wherein work resources enhance the quality of one’s family life, i.e. work to family enrichment (WFE) and family resources can enhance the quality of one’s work life, i.e. family to work enrichment (FWE). According to Greenhaus and Powell (2016), resources can be understood as possessions that can be utilized when one handles a challenging situation. Such resources can be in form of proficiencies, physical and psychological abilities, and material resources (e.g. money), etc.

While support (resources) from work and family has emerged as a significant predictor of work to family enrichment and family to work enrichment (McNall *et al.*, 2010; Jain and Nair, 2015; Jain and Nair, 2016), the linkages between demands and work to family enrichment and family to work enrichment has hardly been explored. However, as per the JDR theory (Bakker *et al.*, 2014), demands may enhance work engagement when balanced properly with support mechanism (Meijman *et al.*, 1998).

Prior studies on positivity at the work place have asserted that employee satisfaction is not only dependent on the job characteristics (like job demands) but also on the predispositions that individuals bring to the job (Lemelle and Scielzo, 2012). The personality construct that closely resembles these fundamental assessments of one’s self-worth, is core self-evaluations. Prior research suggests that employees with high core self-evaluations (Judge *et al.*, 1997) are motivated to achieve higher performance. Hence, employees who have positive core self-evaluations may cope with stressors and strains better as compared to others. Further, very limited number of studies to date has assessed the influence of personality on enrichment which may be useful in proper understanding of the work–family interface (Boyar and Mosley, 2007; Aminah and Noryati, 2011; Baral and Bhargava, 2011). Evidence indicates that while the impact of situational or organizational variables on work–family enrichment has been studied, the analysis of the effects of personality variables has largely been neglected (Ma *et al.*, 2014; Qing and Zhou, 2017). Although some empirical studies have examined the effects of CSE on certain aspects of stress at work (Best *et al.*, 2005; Boyar and Mosley, 2007), yet, rarely any study (Biçaksiz, 2009) seems to have directly investigated the effect of CSE in the relationship between demands (emerging from both work and family domains) and work-family enrichment (both WFE and FWE).

Tying together these interwoven themes, the current study aims to understand the moderating role of CSE in the relationship between demands (work and family) on WFE and FEW respectively. The present study used a sample of sale employees to understand the impact of demand on work-family enrichment. This study aims to contribute to the work–family literature in the following ways. As indicated earlier, empirical evidence investigating the moderating roles of personality variables especially core self-evaluation on the relationships between demands and work-enrichment is scant and mixed (Best *et al.*, 2005; Boyar and Mosley, 2007). In addition, CSE is an emerging concept in work–family aspects (Karatepe, 2011) and empirical research on CSE and stress is scarce in the Indian context. Further, some of the Western studies have confirmed that the 12-item CSE loaded on a single dimensional construct and there is a strong support for the validity of the CSE

scale (Gardner and Pierce, 2009). However, the same is yet to be confirmed in Indian studies. Therefore, there is a need to explore this variable in greater detail. To test the aforesaid relationships and gain richer insights, this study uses cross-sectional data obtained from a sample of full-time frontline sales employees in India as the study setting.

2. Review of literature

2.1 Work demands and family demands

Employees in frontline service jobs – more specifically sales – are confronted with elevated levels of stressful and demanding situations both demographic and/or situational (Boyar *et al.*, 2008). Meta analytic review based on 1,080 correlations conducted by Michel *et al.* (2011) suggested that not just work-related demands (job stressors, role conflict, role ambiguity, role overload, time demands) are related to WFC but family related aspects like family stressors, family role conflict, family role overload too leads to WFC (Mihelič and Tekavčič, 2014). Similarly, FWC results because of both work and family related stressors. Not surprisingly, such situations, including unsocial work hours, heavy workloads, role stress, number of children and elder care have been well documented in varied management literatures as work and family demands (Mulki *et al.*, 2006; Karatepe and Baddar, 2006; Barnes *et al.*, 2012; Jain and Nair, 2016). Further, there are considerable tangible and intangible costs associated with such demands in a cut-throat marketplace (Gabriel and Liimatainen, 2000).

2.2 Core self-evaluation

Since the time the concept was introduced, CSE has become an important topic of investigation in the organizational sciences, because of its relationship with phenomena like satisfaction (Judge *et al.*, 1998), engagement (Rich *et al.*, 2010), decision making (Di Fabio and Palazzeschi, 2012), stress (Creed *et al.*, 2009) and job performance (Kacmar *et al.*, 2009; Chang *et al.*, 2012). Its popularity can be gauged by its presence in organizational behaviour literature (Nelson *et al.*, 2012) as an important higher order personality construct (Chang *et al.*, 2012).

The preliminary idea with regards to CSE can be traced back to the work of Packer (1985, 1985/1986). He was of the view that evaluations of definite situations are affected by more fundamental appraisals. He termed it as core evaluations. Later on, Judge *et al.* (1997) extended this idea and introduced the concept of CSE which they defined as “the fundamental assessment that people make about their worthiness, competence, and capabilities” (Judge *et al.*, 2003, p. 304). Hence, it can be suggested that CSE entails fundamental judgment that employees render about their own competencies and capabilities (Judge *et al.*, 2005). This is a higher order construct and includes: self-esteem, generalized self-efficacy, internal locus of control and emotional stability (Judge *et al.*, 2005). The definitions of these four dimensions of CSE are given in Table I.

Certain studies even suggest that CSE is argued to be more than just an aspect of an individual's self-worth (Judge *et al.*, 2002). Additionally, CSE theory proposes that the assessment of self-worth and capabilities is extremely important for understanding how employees identify with their work and even conduct themselves at the workplace (Akkermans and Tims, 2017). Individuals having higher core self-evaluation not only evaluate themselves positively across various situations but also consider themselves as capable, worthy as well as masters of their own fate.

2.3 Work-family enrichment

Work-family enrichment is an important positive work-family perspective which was introduced by [Greenhaus and Powell \(2006\)](#). It is defined as “the extent to which experiences in one role improve the quality of life in the other role” ([Greenhaus and Powell, 2006](#); p.73). In particular, enrichment is said to occur when resources (skills and perspectives, psychological and physical resources, social-capital, flexibility and, material resources like salary, bonus) gained from one role either directly (i.e. instrumental path) or indirectly (i.e. affective path) improve the performance in the other role. Both the instrumental ([Kirchmeyer, 1992a](#); [Ruderman et al., 2002](#)) as well as the affective pathway ([Rothbard's, 2001](#)) have indicated that enrichment or positivity improves work as well as the family domain. [Aryee et al. \(2005\)](#) and [Lallukka et al. \(2013\)](#) in their studies on positive work–family perspective suggested that involvement of an individual in multiple roles provides several benefits that may outweigh the costs, leading to net gratification rather than strain because personal resources are abundant and expandable. In fact, “the fundamental thinking behind enrichment is that both work and family provide individuals with resources such as enhanced esteem, income, and other benefits that may help the individual perform better across other life domains” ([Carlson et al., 2006](#)).

The concept of work-family enrichment is bi-directional with regards to work and family domains. Whereas work to family enrichment (WFE) refers to the transfer of positive experience from work to family, family to work enrichment (FWE) is the transfer of positive experiences from family to work (p. 73). It has been proven that family enriches work more rather than work enriching family life ([Greenhaus and Powell, 2006](#)).

Enrichment perspective also has its roots in [Sieber \(1974\)](#) and Marks' (1977) approach which is linked with fulfillment of multiple roles. The fundamental conjecture is that handling multiple roles are neither essentially difficult, nor is it always related with the depletion of resources which in turn leads to strain. On the contrary, participation in multiple roles might offer a gamut of opportunities and resources that can be used to advance growth and improve performance in various domains of life ([Barnett, 1998](#)). Therefore, skills, behaviours, and values learned in one role can offer positive benefits for other roles. The major predictors of WFE emerge from work domain like job resources ([Carlson et al., 2006](#); [Grzywacz and Marks, 2000](#)) while majority of antecedents for FWE emerge from family domain like family resources and even family characteristics ([van Steenbergen et al., 2007](#)). Prior studies on FWE mainly capture the transfer of personal resources like understanding, affirmative emotions and inspiration ([Carlson et al., 2006](#); [Hanson et al., 2006](#)). In fact, some studies confirmed that family experiences such as managing the household and having sound sleep improves one's problem-solving skills and dynamism ([Ruderman et al., 2002](#); [Sonnetag et al., 2008](#)). [Rothbard \(2001\)](#) even confirmed

Variable	Dimension	Definition	Author
Core self-evaluation	Self-esteem	Individual's evaluation of one's own self-worth	Semmer et al. (2007)
	Generalized Self-Efficacy	Individual's trust to have the ability to perform and cope successfully across life situations	Bandura (1994)
	Locus of control	Individual's belief to be able to impact the environment to reach desired outcomes	May et al. (1997)
	Emotional stability	Individual's disposition to feel calm and secure and a sensitivity to positive emotional states	Judge et al. (2003)

Table I.
Dimensions of core self evaluation

that positivity at home can even boost work absorption. Thus, both WFE as well as FWE have the potential to influence employee attitudes related to work and family.

Prior studies also suggest that demographic features like gender (Rothbard, 2001; Gutek *et al.*, 1991), age (Stoddard and Madsen, 2007), elder care (Pagani and Marenzi, 2008) and presence of children impacts WFE (Baral and Bhargava, 2010) as well as FEW (Jain and Nair, 2015). Further studies found that women independent of their work demands tend to give importance to their family responsibility (Aryee *et al.*, 2005), whereas men focus more on work responsibility as compared to family (Milkie and Pelotola, 1999; Andrews *et al.*, 1993). Additionally, presence of children is found to be positively associated with WFE (Baral and Bhargava, 2010) as well as FWE (Jain and Nair, 2015). Certain studies even point out the importance of elderly parents who may help to mitigate the stress within the family domain (e.g. Pagani and Marenzi, 2008) thereby leading to positive resources.

Further, the conservation of resources (COR) theory (Hobfoll, 1989) put forward a novel perspective for work-family studies. It proposes that people seek to acquire and maintain resources. The resources may take different forms like conditions (such as being married or having children) or any energies (such as time, money and knowledge that allow one acquire other resources) that may facilitate individuals. Unlike role stress theory, this theory emphasized that the fulfillment of multiple roles is not certainly related to strain; rather each role may also offer resources that help individuals to deal with other demands associated with the fulfilment of other roles.

2.4 Work and family demands, work-family enrichment and core self-evaluation

Researchers worldwide are trying to identify ways that prevent, curb or handle stress and its associated outcomes. In this context, organizational interventions could be drawn with respect to work or it could be worker-driven interventions. Those interventions which are more worker-related are expected to find the relevance of CSE.

CSE has contributed to stress related researches both in the form of predictor as well as moderator (Judge *et al.*, 1997; Lazarus and Folkman, 1984; Harris *et al.*, 2009; Judge *et al.*, 2012). Specifically, the role of CSE in stress related research indicated that individuals having higher CSE levels tend to observe lesser stress (Creed *et al.*, 2009). A few studies have supported the proposition that CSE moderates the effects of social stressors (Harris *et al.*, 2009) and organizational constraints (Best *et al.*, 2005: Study 2) on outcomes. However, Kacmar *et al.* (2009) found contradictory results with respect to the aforesaid phenomenon. They found that individuals having high CSE are largely affected by organizational politics. Certain other studies also failed to find empirical support (Judge *et al.*, 1998; Kammeyer-Mueller *et al.*, 2009) of CSE acting as a moderator. Among studies that supported CSE as a moderator, the outcomes of interest were limited to well-being such as health (Tsaousis *et al.*, 2007) and job satisfaction (Harris *et al.*, 2009). In one of the recent studies CSE is found to act as a moderator in the negative relationships between challenge stress and safety compliance and between hindrance stress and safety participation (Yuan *et al.*, 2014).

Not many studies have tried to identify the effects of CSE on stressors and conflict/enrichment (Boyar and Mosley, 2007; Michel and Clark, 2009; Biçaksiz, 2009; Aminah and Noryati, 2011; Baral and Bhargava, 2011). Boyar and Mosley (2007) in their study explored the impact of WFC and WFE on work and family related outcomes. It was found that CSE is negatively related with WFC and FWC but not with WFE and FWE. Williams and Harter (2010) in their study found that older people generally have higher levels of core self-evaluations as compared to younger people.

A strong sales team is, no doubt, essential to the survival of a business as can be seen from the fact even during recessionary periods companies continue to recruit sales

representatives. After all, they are responsible for bringing in revenue for the company. Many organizations seek to hire top salespeople who, from day one, can open doors and close sales with minimal guidance and training. Moreover, sales employees need to demonstrate inquisitiveness to determine prospects, underlying needs and motivations for buying, expertise on the company’s offerings and market trends, and command of the issues customers are facing. This in turn leads to a lot of work demands. Moreover, as many sales employees work remotely from their manager, there is a need for them to be self-driven (Manpower, “Hardest-to-fill” jobs survey, 2009).

At the family front, the presence of children and elders might pose demands on the sales employees as both children and elderly people expect quality time. Similarly, husbands of women working full time experienced higher role stress and manifested more neurotic symptoms compared to those whose wives were working part-time or were full-time housewives (Srivastava, 1995). However, as suggested by Ferris *et al.* (2011), high CSE individuals are sensitive to positive stimuli and insensitive to negative stimuli. That is, they are found to be attracted by positivity more as compared to negativity. Additionally, people with a positive attitude tend to view tasks/jobs as more enriching in contrast to negatively inclined ones (Necowitz and Roznowski, 1994). It is likely that sales professional with higher CSE will be able to cope with the pressures in a better way as compared to those whose CSE levels are lower both at work and family front. Therefore, it is hypothesized that:

- H1. Core self-evaluation moderates the relationship between work demands and work to family enrichment.
- H2. Core self-evaluation moderates the relationship between family demands and family to work enrichment.

From the above-mentioned studies, it can be clearly observed that CSE has largely been neglected across work-family studies though it can be an important variable, as it gauges an individual’s perception about oneself and the situation *per se*. Also, the results are mixed in nature and so firm conclusions cannot be drawn from the studies.

The proposed conceptual model of the study is depicted in Figures 1 and 2.

Overall, the proposed model presents the moderating role of CSE in the relationship between both forms of demand (i.e. work and family demand) and both forms of enrichment. Work demands (WD) and family demands (FD) are independent variables in Figures 1 and 2, respectively; CSE is a moderating variable in both the models (Figures 1 and 2) and WFE and FWE are dependent variables in Figures 1 and 2, respectively.

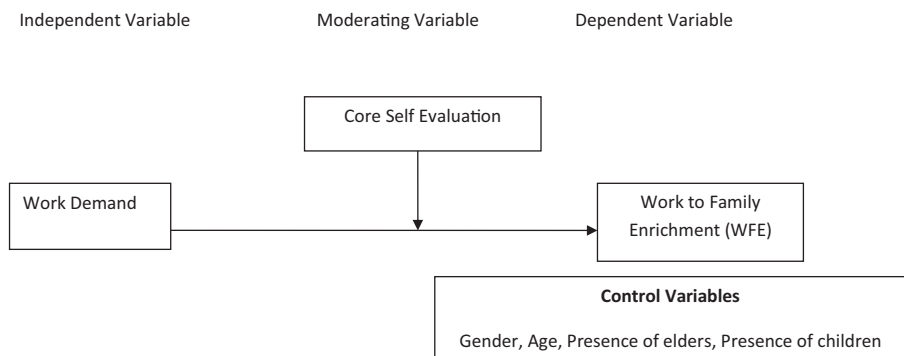


Figure 1. Moderating role of core self-evaluation on work demands and WFE

3. Methodology

3.1 Sample

The study adopted a non-probability purposive sampling approach (Leedy and Ormrod, 2005). Such type of sampling is suitable when:

It is more convenient and economical and allows the study of populations when they are not amenable to probability sampling or it is not possible to locate the entire population (Brink and Wood, 1994, p. 131).

The study is non-experimental and quantitative in nature. A total of 330 sales employees belonging to both service and manufacturing sectors from Mumbai participated in the study. Further, the sample includes both married and unmarried employees (a) over 21 years of age and (b) currently working with an organization for at least one year. The reason for such choice is because of the very fact that it takes at least a year (in most of the firms) to understand an organization and also availing the benefits meant for the employees (Table II).

3.2 Measures

3.2.1 Work demand and family demand scale. Revised Boyar *et al.* (2007) scale, recently validated by Jain and Nair (2016) was used to assess the work demand and family demand of the respondents under study. The measure consisted of two subscales, comprising four items each for assessing work and family demand respectively. A five-point Likert scale, wherein 1 indicates “rarely” to 5 indicating “always” was used for each subscale. The overall scale scores are obtained by adding the value of four items for “work demand” and by adding the scores of four items for “family demand” respectively.

3.2.2 Core self-evaluation scale. It represents the elementary beliefs that one holds about his or her own competence and self-worth. CSE encompasses four personality traits, namely, self-esteem, self-efficacy, locus of control and emotional stability. The 12-item CSE Scale developed by Judge *et al.* (2003) is used for the study. Of the 12 items, 6 items are reverse-scored. The overall scale scores are obtained by adding the scores on the 12 items (after adjusting for reverse-scored items). High scores indicate high levels of CSE while low scores indicate low levels of CSE. As the scale has not been validated in the Indian context, its validity is tested in this study.

3.2.3 Work-family enrichment scale. WFE and FWE were assessed using two scales developed by Carlson *et al.* (2006). Extant literature with respect to enrichment has used this

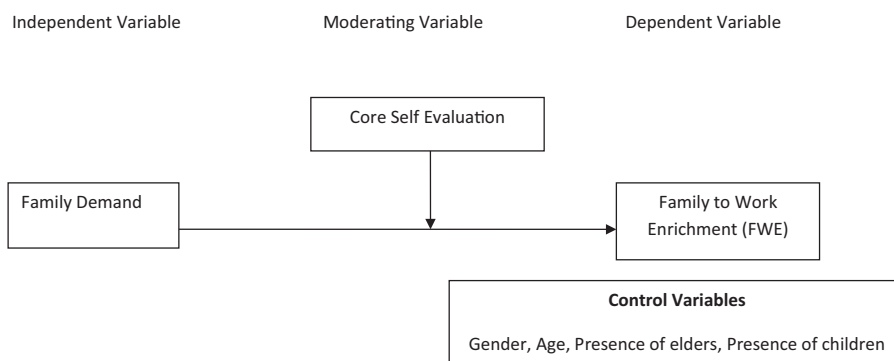


Figure 2. Moderating role of core self-evaluation on family demands and FWE

scale (Siu *et al.*, 2010; Fung, Ahmad and Omar, 2014). Five-point Likert scale was used for the purpose of the study. High scores denote high levels of WFE/FWE, while low scores designate low levels of WFE/FWE.

3.2.4 Demographic variables. We have used four control variables in the current study: gender (0 = female; 1 = male), age (1 = <25 years; 2 = 25-30 years; 3 = 31-35 years; 4 = >35 years), presence of elders (0 = not living; 1 = living) and presence of children (0 = No; 1 = 1; 2 = 2), as these variables have the tendency to affect both WFE as well as FWE (Jain and Nair, 2015).

3.3 Data analysis

AMOS software (Arbuckle, 2011) version 20.0, which consist of an SEM package with maximum likelihood (ML) estimation, was used to test the measurement model. Further, moderated regression analysis (MRA) was used to assess moderating effect of CSE between demands and work-family enrichment. Standard statistical procedures like descriptive and inferential statistics, such as frequency, means and factor analysis (to test the construct validity of core self-evaluation scale) were conducted. The following statistical procedures were done to meet the objectives of the study:

- assessing construct validity of core self-evaluation scale using EFA and CFA as well as by assessing convergent validity and discriminant validity;
- assessing reliability of the scales;
- examining the inter-correlations between variables; and
- testing the impact of the moderator in the relationship between independent and dependent variables under study.

4. Results

First of all, CSE scale was tested for its validity. Later, the intercorrelations were worked out, followed by testing of the hypotheses using MRA.

Demographic characteristics	Frequency	(%)
<i>Gender</i>		
Male	292	88.5
Female	38	11.5
<i>Age</i>		
≤ 25 Years	60	18.2
26-30 Years	153	46.4
31-35 Years	59	17.9
> 35 Years	58	17.6
<i>Number of children</i>		
N	173	52.4
Y	156	47.6
<i>Presence of elders (Living together)</i>		
N	96	29.1
Y	234	70.9

Table II.
Demographic characteristic of the participants

4.1 Validation of core self-evaluation scale

EFA was used as a first step for refining measures and for evaluating construct validity (Ford *et al.*, 1986). Thus, EFA using PCA (principal component analysis) method and VARIMAX rotation was carried out to explain the factors of CSE.

Before conducting EFA, it is imperative to assess the factorability of the variables using Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy as well as overall significance of correlation matrix using Bartlett’s Tests of Sphericity (Liu and Treagust, 2005). Malhotra and Dash (2011) suggested that a KMO score of 0.9 is considered outstanding, 0.8 as very good, 0.7 as average, 0.6 as tolerable, 0.5 as miserable and below 0.5 is considered as unacceptable. Tabachnick and Fidell (2001) suggested that KMO values of 0.60 and higher are required for good factor analysis. The results are found to be significant as per Tabachnick and Fidell (2001) (KMO values of ≥ 0.60) and Bartlett test (Sig. < 0.05) (Table III).

Multiple criteria like Eigen values > 1.0 ; variance explained > 60 per cent; factor loadings > 0.5 ; (Hair *et al.*, 2010) were used for determining the number of factors to be retained (Hair *et al.*, 1998). All the 12 items were entered in a single analysis. A single factor solution accounted for 65.05 per cent of the total variance. All the 12 items corresponding to the dimensions of CSE were loaded appropriately in the pattern matrix. Table IV shows the factor loadings of CSE.

To ascertain that the scale items converge on a single construct during measurement, the convergent validity was assessed (Steenkamp and Van Trijp, 1991). This was established from the assessment of the factor loadings (which must be between 0.30 and 0.35), composite reliability (CR) (at least 0.6) and average variance extracted (AVE) (at least 0.5) in the study (Hair *et al.*, 2010). The results of convergent validity are found to be more than the prescribed

Kaiser–Meyer–Olkin measure of sampling adequacy		0.955
Bartlett’s test of sphericity	Approx. Chi-Square	3,137.200
	Df	66
	Sig.	0.000

Table III.
KMO and Bartlett test

	Component 1
CSE 1	0.844
CSE 2	0.781
CSE 3	0.826
CSE 4	0.804
CSE 5	0.762
CSE 6	0.832
CSE 7	0.713
CSE 8	0.844
CSE 9	0.840
CSE 10	0.847
CSE 11	0.760
CSE 12	0.816

Table IV.
Component matrix

Notes: Extraction Method: Principal Component Analysis.a; 1 components extracted

values (CR ≥ 0.6 and AVE ≥ 0.5) (Hair *et al.*, 2010). Later on, the composite reliability (CR) and average variance extracted (AVE) values of the CSE was measured. The CR (0.96) AND AVE (0.61) were found be higher than the benchmarked values (CR ≥ 0.6 and AVE ≥ 0.5) (Hair *et al.*, 2010). Thus, the CSE scale is said to have adequate convergent validity.

Later, discriminant validity (distinctiveness of different constructs; Campbell and Fisk, 1959) of CSE scale was worked out. The rule is that variables should load significantly only on one factor. Since in the given case only one factor emerged with appropriate factor loadings, discriminant validity is said to be achieved (Table IV).

To acquire a robust evaluation of the quality of the measures, CFA was conducted on the 12 item CSE scale (Jöreskog and Sörbom, 2001). As results of EFA suggested a single-structure, the first-order factor analysis was conducted. The fit measure of a structural equation model indicates to what degree the specific model matches the empirical data. According to Hair *et al.* (2010), when three to four indices including one of the absolute indices value and one of the incremental indices meet the criteria, it provides adequate evidence of a model fit. Further, it has been found that values of 0.90 and over (for NNFI, and CFI) or 0.08 and under (for SRMR and RMSEA) signify an acceptable fit (Byrne, 2001). However, for SRMR, values < 0.10 are also found to be acceptable fit according to Kline (2005).

In the present study, the researchers have used the approach of Hair *et al.* (2010) for reporting model fit indices values. Hence, apart from using CMIN/df and χ^2 values, absolute indices like standard root mean square residual (SRMR) and the root mean square error of approximation (RMSEA), absolute indices like the non-normed fit index (NNFI) or TLI and the comparative fit index (CFI) are reported for assessing the model fit.

The model fit statistics were found to be significant, i.e. $\chi^2 = 224.980$, $df = 52$, $p = 0.000$, CMIN/df = 4.322, SRMR = 0.04, RMSEA = 0.100, CFI = 0.945, NNFI = 0.933. The indices indicated a good fit and hence the first-order factor structure was accepted and used for further analysis (Figure 3).

4.2 Reliability of scales

The Cronbach's alpha value of all the scales exceeded the minimum standard of 0.7 (Nunnally and Bernstein, 1994) and hence the scales under study can be considered to be reliable. Table V depicts the Cronbach's alpha values for various scales under study.

4.3 Intercorrelations

Table VI presents the bivariate correlations among the variables (including control variables) as well as the mean and standard deviation for each variable. It is found that neither work demand were correlated with work to family enrichment ($r = -0.085$, $p > 0.05$) nor family demand was correlated with family to work enrichment ($r = -0.021$, $p < 0.001$). Moreover it is observed that there is a positive correlation between WFE and FWE ($r = 0.606$, $p < 0.001$), as well as between WFE and CSE ($r = 0.472$, $p < 0.001$) and between FWE and CSE ($r = 0.472$, $p < 0.001$). In addition, it was found that control variables like age, marital status and presence of children are found to be significantly correlated with both the exogenous variables.

4.4 Moderated regression analysis

Arnold (1982) suggested that MRA provides the most straightforward method to test the hypothesis where interaction is involved. This interaction term (product of independent variable and the moderator in case) is included as an additional independent variable (Hartmann and Moers, 1999).

Role of core self-evaluation

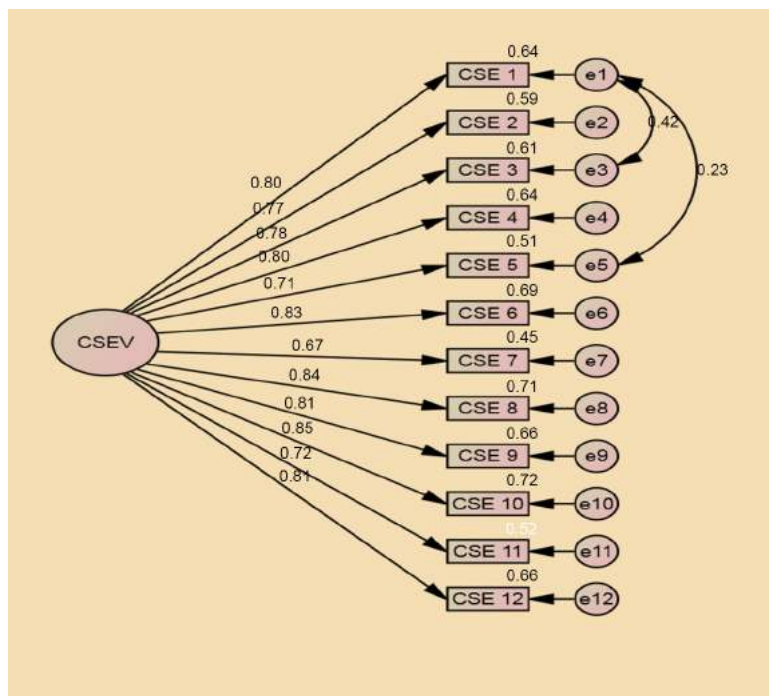


Figure 3.
CFA model for core self-evaluation

Scale	No. of items	Cronbach's alpha value
Work demand	4	0.799
Family demand	4	0.822
Work to family Enrichment	9	0.943
Family to work Enrichment	9	0.960
Core self-evaluation	12	0.951

Table V.
Reliability analysis
of scales

MRA involved two steps. First, two regression equations were formulated; the first equation included only the first order:

$$Y = a + b1X + b2Z + e$$

Y = is a dependent variable.

X = is a predictor.

Z = is the second binary predictor that is hypothesized to be a moderator.

The second model included the first-order effects as well as a product term including the moderating variable:

$$Y = a + b1X + b2Z + b3X*Z + e$$

where, b3 in the sample was based leased-squares estimations of the population regression for the product term.

Thus, MRA is used to test the hypothesized relations between work demands (independent variable) and WFE (dependent variable) moderated by CSE and between FD (independent variable) and FEW (dependent variable) moderated by CSE. As mentioned by [Aguinis \(2004\)](#), the change of R^2 seemed to be the most frequently used way to examine the magnitude of the moderating effects.

As suggested by [Aiken and West \(1991\)](#), following three steps were used to convert the data.

- (1) WD, FD, WFE, FWE and CSE were centered and z-scores were obtained;
- (2) These z-scores were multiplied (WD*CSE)/(FD*CSE), and two new variables as the interaction term emerged; and
- (3) Finally, the researchers controlled for the respondents “gender, age, marital status, presence of elders and presence of children”.

The variables were entered into the regression equation in a hierarchical order: the control variables in Step 1, WD and CSE or FD and CSE in Step 2, and the interaction term in Step 3 (WD*CSE in one case and FD*CSE in another case). The results of this moderated regression analysis are presented in [Tables VII and VIII](#). [Figure 4](#) is the pictorial representation of the moderated relationship.

It has been hypothesized that core self-evaluation moderates the relationship between work demands and work to family enrichment. [Table VII](#) shows that for Model 1, $R = 0.274$, $R^2 = 0.075$, adjusted $R^2 = 0.057$, and $\{F(4,206) = 4.192, P < 0.01\}$. R^2 means that 7.5 per cent of the variance in WFE is explained by demographic variables (gender, age, presence of children and presence of elders at home). Further, in Model 2, $R = 0.496$, $R^2 = 0.246$, adjusted $R^2 = 0.224$, and $\{F(2,204) = 23.083, P < 0.01\}$. This means that 24.6 per cent of the variance in WFE is explained by independent variables (Work demands and CSE). With regards to Model 3, $R = 0.519$, $R^2 = 0.270$, adjusted $R^2 = 0.244$, and $\{F(1,203) = 6.552, P < 0.01\}$. R^2 means that 27 per cent of the variance in WFE is explained by the moderator (interaction effect, WD * CSE). The results supported the presence of a moderating effect. Hence, $H1$ is accepted.

Table VI.
Means, standard deviations and correlations between study variables

	Mean	SD	1	2	3	4	5	6	7	8	9
Gender	0.88	0.320	1	0.139*	-0.016	-0.064	0.010	0.026	-0.030	-0.214**	-0.033
Age	2.35	0.972	0.139*	1	-0.351**	-0.079	0.195**	0.204**	0.245**	0.272**	0.197**
Presence of children	1.66	1.130	-0.016	-0.351**	1	0.115*	-0.156**	-0.271**	-0.075	-0.140*	-0.070
No of Elders	0.71	0.455	-0.064	-0.079	0.115*	1	0.029	-0.028	-0.099	-0.082	-0.129*
WD	17.26	1.830	0.010	0.195**	-0.156**	0.029	1	0.424**	-0.085	-0.060	-0.065
FD	15.51	2.321	0.026	0.204**	-0.271**	-0.028	0.424**	1	-0.030	-0.021	-0.076
WFE	26.61	7.180	-0.030	0.245**	-0.075	-0.099	-0.085	-0.030	1	0.606**	0.423**
FWE	27.03	7.712	-0.214**	0.272**	-0.140*	-0.082	-0.060	-0.021	0.606**	1	0.364**
CSE	36.85	8.954	-0.033	0.197**	-0.070	-0.129*	-0.065	-0.076	0.423**	0.364**	1

Notes: SD: Standard Deviation; * $p < 0.05$; ** $p < 0.01$

It has been hypothesized that core self-evaluation moderates the relationship between family demands and family to work enrichment. Table VIII shows that for Model 1, $R = 0.338$, $R^2 = 0.114$, adjusted $R^2 = 0.097$, and $\{F(4,206) = 6.622, P < 0.01\}$. R^2 means that 33.8 per cent of the variance in FWE is explained by demographic variables (gender, age, presence of children and presence of elders at home). Further in Model 2, $R = 0.421$, $R^2 = 0.177$, adjusted $R^2 = 0.153$, and $\{F(2,204) = 23.083, P < 0.01\}$. This means that 17.7 per cent of the variance in FWE is explained by independent variables (Family demands and CSE). However, with regards to Model 3, $R = 0.421$, $R^2 = 0.177$, adjusted $R^2 = 0.149$, and $\{F(1,203) = 6.552, P > 0.01\}$. It is observed that there is no change in R^2 ; i.e. there is no impact of the interaction effect (FD*CSE). The results do not support the presence of a moderating effect. Therefore, $H2$ is rejected.

5. Discussion

The analysis primarily started with the validation of the CSE scale. It was found through EFA that all the 12 items load on a single factor, though they are found to have an essence of

Step and variable	β	R^2	ΔR	F
<i>DV: Work to family enrichment</i>				
<i>Step 1</i>				
Gender	-0.227	0.075	0.075	4.192**
Age	0.212*			
Presence of children	-0.086			
No of elders	0.134			
<i>Step 2</i>				
Work demands(WD)	-0.234**	0.246	0.171	23.083**
Core self-evaluation(CSE)	0.304**			
<i>Step 3</i>				
WD*CSE	0.170**	0.270	0.024	0.024**

Notes: * $p < 0.05$; ** $p < 0.01$

Table VII.
Effect of work demand and core self-evaluation on work to family enrichment

Step and variable	β	R^2	ΔR	F
<i>DV: Family to work enrichment</i>				
<i>Step 1</i>				
Gender	-0.235**	0.114	0.114	6.622**
Age	0.172			
Presence of children	0.147*			
No of elders	-0.011			
<i>Step 2</i>				
Family demands(FD)	-0.086	0.177	0.064	7.874**
Core self-evaluation(CSE)	0.234**			
<i>Step 3</i>				
FD*CSE	0.000	0.177	0.000	0.000

Notes: * $p < 0.05$; ** $p < 0.01$

Table VIII.
Effect of family demand and core self-evaluation on family to work enrichment

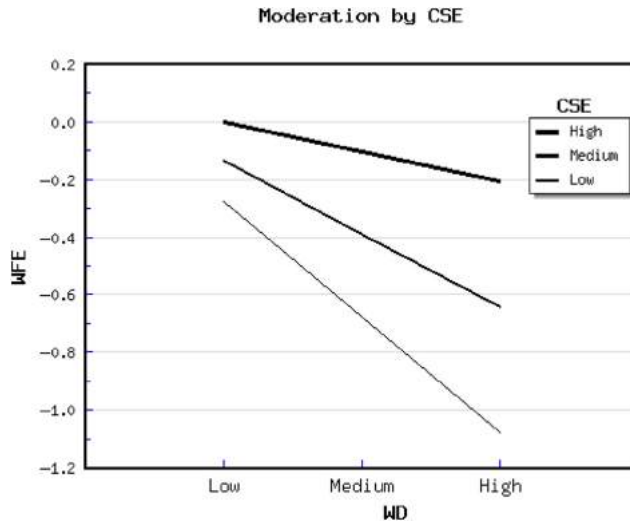


Figure 4.
Moderating impact of
core self-evaluation
on work demands
and WFE

four different personality factors. Further, results of CFA confirmed the fact that CSE is a higher-order variable and apt enough to capture the essence of self-esteem, generalized self-efficacy, emotional stability and internal *locus* of control.

CSE emerges as a moderator of the relationship between work demands and WFE. This indicated that individuals who have higher levels of CSE cope with work demands better, as compared to those having lower levels of CSE. This result can be interpreted using the work of Bolger and Zuckerman (1995) and Kammeyer-Mueller *et al.* (2009) who confirmed that CSE may affect employees' reactivity to stressors. Similarly, by providing employees with a sense of self-worth and control, CSE moderates the exhaustion of mental energy when job demands are higher (Chang *et al.*, 2012).

In a profession like sales, where demands are bound to be high, individuals with higher levels of CSE are best-suited as they are assertive enough to deal with challenging work situations successfully (Bolger and Zuckerman, 1995). Additionally, age is significantly seen to be impacting WFE in this relationship. Findings are in conformance with the works of Grzywacz and Marks who suggest that younger men experience less WFE as compared to older men.

Prior studies have also confirmed that individuals with high CSEs are generally more successful and have higher job satisfaction than those with low CSEs (Judge *et al.*, 2009). This in turn brings a lot of positive outcomes for organization. Firms not only will get benefitted in terms of lesser attrition of sales professionals, but also be able to have more committed and self-driven people. The results of the present study can also be explained using the findings of Boyar and Mosley (2007) as well as Bıçaksız (2009) who in their independent studies suggested that the feeling of mastering a challenging situation may be the reason for enhancement in the case of positive core self-evaluations.

Results suggest that family demands are not associated with FWE. India is considered to be a "family-centric society" wherein there is considerable emotional bonding among family members as compared to other countries (Sinha and Sinha, 1990). Thus, in the Indian context, family demands are equalised by resilient emotional warmth that one gets from his/her family. In addition, while the posited moderating effects of CSE on FWE could not be

found, the results still suggest the importance of core self-evaluations in experiencing enrichment. CSE has emerged as a predictor rather than a moderator in the tested relationship. It was found that people having higher levels of CSE have significant impact on FEW, suggesting that employees who have higher CSE are having higher FWE. This confirms that people with low CSE tend to experience higher stress as they transmit negative emotions and attitudes from work to family and vice versa, thus decreasing their levels of work to family enrichment and family to work enrichment (Judge *et al.*, 2016).

Both gender and presence of children are seen to have a significant impact on FWE. The results are in accordance with the findings of Aryee *et al.* (2005), who suggested that women independent of their work demands tend to give importance to their family responsibilities and hence the positive experiences tend to be observed more amongst women as compared to their male counterparts. Moreover, Parasuraman and Greenhaus (2002) in their study confirmed that parents learn problem-solving and coping skills in their parental role that support them in managing their work roles.

6. Conclusions

This study validated the CSE scale in the Indian context. It was found that all the 12 items correspond to core self-evaluation. Thereafter, the role of core self-evaluation as moderator in the relationship between demands (work and family) and work-family enrichment for sales employees in Indian organizations was tested. The relationship between work demands and work to family enrichment, moderated by core self-evaluation was supported whereas, the relationship between family demand and family to work enrichment, moderated by core self-evaluation was not supported. The significant role of CSE as a moderator between work demands and work to family enrichment confirmed the role of personality determinants in work-family studies. This finding is in line with the principles of COR theory (Hobfoll, 2001) which suggested that participation in multiple roles may offer resources that help individuals to deal with demands associated with the fulfillment of other roles. Most importantly, this aspect has not been captured by any other Indian study which is the notable contribution of the study.

7. Managerial implications

In an emerging economy like India wherein sales professionals are facing a lot of work demands (Jain and Nair, 2016), organizations should invest in their frontline employees to be able to deliver value for money to the customers and thereby gain competitive advantage. With this realization, managers should acquire and retain frontline employees with positive core self-evaluation. Therefore, organizations should use objective and standard tests to select candidates with positive core self-evaluations.

It is found that CSE acts as a moderator of the relationship between work demands and WFE which means that individuals possessing higher CSE have a fairly higher level of enrichment. That is, they are more inclined to perceive positivity as compared to those whose CSE is low. Sales is one such profession where the demands are from multiple stakeholders. Therefore, there is a need for individuals having the required optimism to craft positivity in present-day organizations. In fact, while hiring sales employees, organizations may identify and pick individuals who have higher levels of CSE. It is also necessary for organizations to retain such high-CSE employees for achieving better work outcomes from them in the long run.

In addition, corporates should focus on nurturing sales employees' positive CSE to make sure that their employees can contentedly adjust to various challenging work situations (Karatepe *et al.*, 2010a, 2010b), which otherwise may affect their work-life balance. Managers

should invest in high performance work practices to motivate such employees. Practices such as job transitions, training for practicing empowerment, adding responsibilities and rewarding employees for their desired performance might be some of the interventions which positively impact core self-evaluations (Kammeyer-Mueller *et al.*, 2009).

The current study has certain limitations that need to be taken into account while making inferences. The study is cross-sectional in nature and, therefore, causal conclusions cannot be drawn. Also, only Mumbai city has been chosen for data collection, though choice of Mumbai was made as this city is considered to be the financial hub of the country and thereby having the presence of maximum number of business houses. Further, as the sales employees were not allowed to share details with the researcher directly, we had to collect data from the frontline sales employees through snowball sampling. Although the researcher has little control over the sampling method, which becomes mainly dependent on the original respondents, the snowball sampling method has been widely used in prior empirical researches (Schwepker and Hartline, 2005). Lastly, the sample for this study comprises only private sector employees. Future research can consider diverse samples to confirm the results obtained from the current study and generalize the same for other sectors.

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Construct validation and exploration of turnover intentions of sales employees: evidences from India

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Abstract: Turnover and turnover intentions (TOI) appear to be important variables for study in sales management. By virtue of their job profile, sales employees are required to respond to multiple demands from co-workers, customers and their respective family members as well, which eventually lead to negative outcomes such as stress. This in turn results in withdrawal decision process that finally leads to quitting. Of importance to the study is turnover intentions measurement. The study first validated the modified version of Ku (2007) scale in Indian context using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The results of the data analysis are in line with the indications in the literature. Further, this study explored the impact of demographic variables on turnover intentions of sales employees in India. The study contributed to the sales management literature by identifying the key demographic variables that can have an effect on sales employee's turnover intentions. Results indicated that sales employee intent to leave an organisation is associated with both work (hierarchy and annual salary) as well as family related domains (marital status, presence of children). Implications of these findings are discussed.

Keywords: turnover intentions; turnover intention scale; exploratory factor analysis; EFA; confirmatory factor analysis; CFA; SEM; demographic variables; ANOVA; post hoc Scheffe's test; sales employees; India.

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1 Introduction

To remain competitive in the swiftly intensifying global economy and to keep pace with the latest advancements in businesses, organisations worldwide requires a workforce with robust institutional knowledge. As a result, employee retention or reducing turnover is of great importance to business communities (Becker, 2007; Mohsin et al., 2013). This is all the more important for sales professionals as they are the ones who directly generate revenue for the organisations.

Since the past three decades, turnover and turnover intention appear to be important variables in sales management (Batt and Valcour, 2003). Both theoretical as well as experiential models of turnover intentions very strongly supported that behavioural intentions comprise the most immediate determinant of actual behaviour (Triandis, 1980), more specifically turnover (Lee and Mowday, 1987). Prior literature has identified that work related factors and personal characteristics are core determinants of turnover intentions (Tyagi and Wotruba, 1993; Burakova et al., 2014). Certain studies even claim that there are significant correlations between turnover intention and certain demographic variables like gender, age, education, income and marital status (Randhawa, 2007; Hancock et al., 2013; Agyeman and Ponniah, 2014; Shukla and Srivastava, 2016). Despite its importance, there was a gap of limited empirical research regarding this subject in the literature (Rageb et al., 2013).

The measurement of turnover intention can determine the likelihood of the staff leaving the organisation. This assists the HR as well as the line manager to ascertain ways to reduce the overall turnover. Most of the earlier studies are found to have ignored sales employees across a wide spectrum of sectors as a sample for study, though sales is one of the most important functions of an organisation (Awang et al., 2013). Additionally, the researches which suggest the usage of modified version of Mitchel's (1981) scale developed by Ku (2007), which gauges turnover intentions, are rare to find in the Indian context.

Hence, the study aims to validate the scale developed by Ku (2007) for measuring turnover intentions. Furthermore, the current status of turnover intentions through assessment of demographic variables (viz., gender, age, marital status, level in the organisation, tenure with the respective organisation, hours spent in office, presence of

children and annual salary) was attempted. The study will contribute to the sales management literature by identifying the key demographic variables that had an effect on sales employees' turnover intentions.

2 Review of literature

2.1 Turnover intentions

Turnover intent is expressed as a conscious and deliberate wilfulness to depart from an organisation (Tett and Meyer, 1993; Panatik et al., 2012). Mobley et al. (1978) defined employee turnover intention as the withdrawal decision process that would lead to final quitting. Researches on turnover intention suggest that it is the single best indicator of an individual's actual turnover behaviour (Steel and Ovalle, 1984; Cotton and Tuttle, 1986; Hayes et al., 2006). This indicated that real turnover could be avoided through understanding predictors of turnover intention. Therefore, early exposure of employee job dissatisfaction through turnover intention measure would be more useful than taking remedial action after actual turnover had occurred. The outcome of turnover usually results in uncertainties in human capital investments and increased organisational spending (Batt and Colvint, 2011). For instance absenteeism, recruitment, new employee screening and hiring, orientation and training, and temporary hires are cited as major reasons of exhaustion of monetary and human resources in many previous researches (Hancock et al., 2013; Llorens and Stazyk, 2011). However, the factual but unmeasured costs that emerges from losses of customer relationships by sales employee is highly critical and is never deliberated. Thus, employee turnover intention is an important element of consideration for the individuals concerned with organisational profitability (Grissom et al., 2012; Kim, 2012; Lambert et al., 2012).

2.2 Turnover intentions and demographic variables

Lately, it is observed that there is a sizable rise in percentage of women in the work participation rate, i.e., 12.1% in 1979 to 25.5% in 2011 (Singh, 2014). Most turnover studies have given not enough contemplation to 'gender' which is a generic source of individual difference in turnover. In fact most of the literature on gender and turnover has been conducted in private sector. Turnover intentions are found to be affected by gender among IT professionals (Thatcher, 2002); that is, females have higher turnover intentions as compared to men (Marsh and Mannari, 1977). Similar results were found in the meta-analysis conducted by Cotton and Tuttle (1986) wherein it was implied that there is higher organisational turnover for women than for men and that gender is more strongly related to turnover of professional than nonprofessional employees. Since selling requires higher degree of professionalism, it can be hypothesised that:

H01 Turnover intentions is significantly associated with .females as compared to males.

Lee and Maurer (1999) in their study on US navy (USN) officers suggests that marital status affect a members' allocation decisions of the time and energy devoted to the job or family and this would have a testable effect on turnover intention. However, turnover

intentions are found to be negatively associated with marital status (Cotton and Tuttle, 1986; Carbery et al., 2003; Emiroğlu et al., 2015) as marital status act as a restrain to resign (Chompookum and Derr, 2004). Similar aspect hold true on account of having young children at home. Ahituv and Lerman (2011) found that having two or more children reduces the probability that a man will change jobs. Similarly, Griffeth et al. (2000) suggested that presence of children meaningfully can project one's turnover intentions. So it can be hypothesised that:

H02 Marital status is significantly related with turnover intentions.

H03 Presence of children would be significantly related with turnover intentions.

It was established that age (Cotton and Tuttle, 1986) and designation are negatively correlated with turnover intentions (Randhawa, 2007; Heavey et al., 2013). The probable justification is provided by Lewis (1991, p.147): "As people age, they generally get a clear idea of what they want to do, establish stronger ties to a community that discourage geographical moves, and become more attached to a particular employer." Therefore, it can be hypothesised that:

H04 Age is significantly associated with turnover intentions.

It was found that experience with a respective organisation, i.e., tenure is negatively correlated with turnover intentions (Cotton and Tuttle, 1986; Chen and Francesco, 2000; Emiroğlu et al., 2015; Hayes, 2015). This can be attributed to the fact that employees with longer tenure may have expertise with their role and have attained a higher level of career attainment than those employees with lower tenure. However, Kavanaugh et al. (2006) in their study found that professionals with different levels of tenure are not motivated to remain with an organisation by the same incentives. In addition, Beecroft et al. (2007) confirmed that older employees were more likely to have turnover intent if they do not get the role of their choice, which is not the case with younger workforce. Weisberg and Kirschenbaum, (1991) suggests that lower organisational levels are negatively associated with an employee's turnover intentions. Similar results were obtained by Almer and Kaplan (2002).

H05 Tenure in an organisation is significantly associated with turnover intentions.

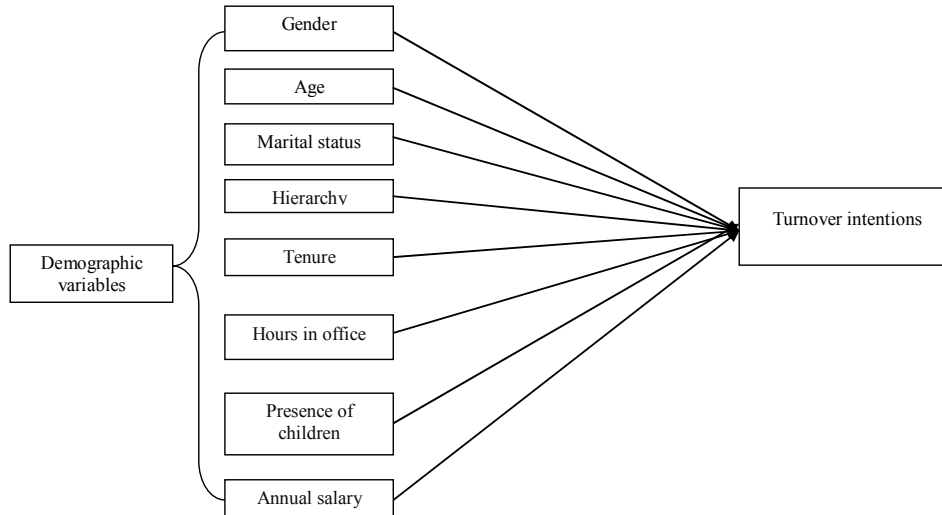
H06 Hierarchy is significantly associated with turnover intentions.

Long working time might cause fatigue, tension and burnout, which further effects turnover intention (Dawson et al., 2001; Steinmetz et al., 2014). Also, income is found to be negatively related with turnover intentions (Cotton and Tuttle, 1986; Chen and Francesco, 2000; Grzywacz and Marks, 2000; Marsh and Mannari, 1977; Hayes, 2015; Shukla and Srivastava, 2016). The following hypotheses were thus formulated.

H07 Duration of working hours is positively related with turnover intentions.

H08 Income is significantly associated with turnover intentions.

To summarise, the study aims to assess the impact of demographic factors on turnover intentions. The schema of the relationships examined in the study is given below:

Figure 1 Demographic variables and turnover intentions

3 Methodology

The study is non-experimental and quantitative in nature. Quantitative approaches are considered to be appropriate for cross-sectional studies (Creswell, 2009). The survey method using standardised questionnaires was used to collect data from sales respondents across various sectors namely, banking and financial services, IT, FMCG, manufacturing and pharmaceuticals.

3.1 Sample

Out of the 460 sales employees who were approached for the purpose of the study, 330 employees responded leading to a response rate of 82%. The sample comprised of entry level (52%) and middle management level (48%) employees working in various organisations based in Mumbai, India.

3.2 Measures

This research used a set of standard self-report questionnaires. It comprised of two parts. While sub-section 3.2.1 focused on the demographic profile of the respondent, sub-section 3.2.2 primarily captured the turnover intentions of the participants under study.

3.2.1 Turnover intentions scale

Turnover intentions represents an employee's desire to leave an organisation. It is evaluated using modified version of Mitchel (1981) scale (Ku, 2007). However since the

scale has not been tested in Indian scenario so it is tested for its validity. The results for the same will be discussed in the next section.

3.2.2 *Demographic variables*

Participants were asked to report demographic information including age, education, etc. Also, family related information like number of children, time spent in household tasks, spouse's employment, etc. was collected from the participants. Work-related demographics including occupation, number of hours worked per week and tenure in the organisation were captured from the participants.

4 **Data analysis**

To meet the defined objectives, the data were analysed using SPSS-20 and AMOS-20. The following statistical procedures were carried out for meeting the objectives of the study:

- 1 reliability testing
- 2 validation of factor structure through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA)
- 3 identifying differences in the turnover intentions based on demographic and workplace variables, thereby, testing their current status.

Reliability testing: reliability is the degree of consistency between multiple measurements of a variable, and the Cronbach's coefficient alpha is largely used to measure the internal consistency between the items in summated scales (Cortina, 1993; Hair et al., 1998). For assessing the inter-item as well as construct reliability, Cronbach alpha values were calculated.

Construct validity: it is measured through EFA and CFA (Harrington, 2009).

Testing the current status: in order to study the role of demographic variables such as gender, age, marital status, hierarchy, tenure with a respective organisation, hours in office, number and ages of children, employment status of spouse, and annual salary on turnover intentions, one-way analysis of variance (i.e., ANOVA) was done. Further, post hoc Scheffe's test was conducted to isolate the specific differences between category means that were significantly different. Calculations were done and the significance levels were determined at $p < 0.05$ as well as $p < 0.01$ levels.

5 **Results and discussions**

5.1 *Reliability*

Table 1 presents descriptive analysis and internal consistency estimates of the scale under study. Since the value of turnover intention scale is found to be much higher than the minimum threshold value of 0.70 (George and Mallery, 2003) the scale is said to be having excellent internal consistency.

Table 1 Descriptive analysis and internal consistency estimates

	<i>Mean</i>	<i>Std. deviation</i>	<i>Reliability</i>
TOI 1	4.26	1.438	0.903
TOI 2	4.34	1.291	
TOI 3	4.17	1.389	
TOI 4	4.24	1.445	

5.2 Factor analysis

Factor analysis was conducted in order to assess the underlying factor structure of turnover intention in the Indian context. It is of two types: EFA and CFA.

Firstly, EFA should be conducted for refining measures and for evaluating construct validity (Ford et al., 1986). KMO values (Tabachnick and Fidell, 2001) and Bartlett are used for preliminarily assessing the data. Table 2 gives the results of KMO and Bartlett's test.

Table 2 Values of KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy		0.827
Bartlett's test of sphericity	Approx. chi-square	626.806
	df	6
	Sig.	0.000

Table 3 Component matrix

	<i>Component</i>
	<i>1</i>
TOI 1	0.850
TOI 2	0.823
TOI 3	0.917
TOI 4	0.929

Notes: Extraction method: principal component analysis.
1 – components extracted.

Results of EFA presented in Table 3 indicate a distinct factor structure for TOI. The loadings of TOI are convincingly high. It ranges from 0.850 to 0.929.

Subsequently, CFA was conducted to confirm the psychometric properties of the TOI scale. Table 4 illustrates the CFA results of all model fit indices for the TOI scale. The Chi-square results emerged as statistically insignificant ($p > 0.05$), signifying a close model fit with the attained data with respect to one factor model. Further, the ratio of χ^2/df was used for a good model fit (Jöreskog and Sörbom, 1993). Additionally, all estimates of comparative fit indices (CFI and NNFI) for the one factor model were found to have values > 0.90 . In addition, the absolute fit indices (RMSEA and SRMR) are also found to be within acceptable limits (for RMSEA it should be < 0.8 and for SRMR it should be < 0.1). Therefore, the single factor model was accepted.

Table 4 Results of CFA

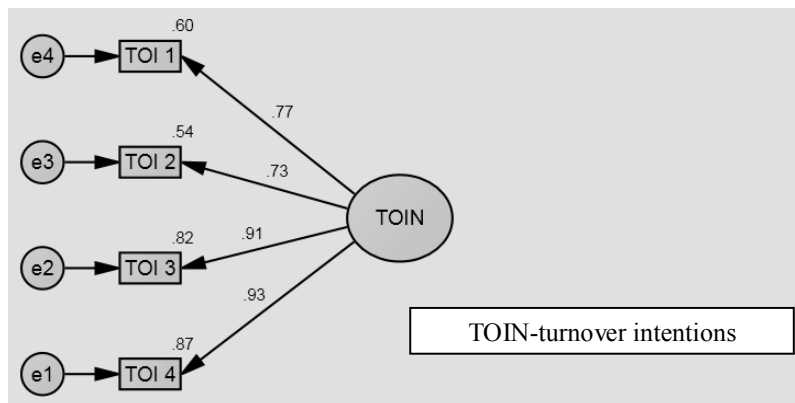
Model fit indices	df	χ^2	χ^2/df	RMSEA	SRMR	CFI	TLI
4 item 1 factor model	2	0.110	0.055	0.000	0.002	1	1

Notes: χ^2 : chi square, df: degrees of freedom, CFI: comparative fit index, TLI: Tucker-Lewis index, SRMR: standardised root mean square residual, RMSEA: root mean square error of approximation.

Table 5 Demographic characteristics of the participants

S. no.	Demographic characteristics	Frequency (N = 330)	Percentage	
1	Gender	Male	292	88.5
		Female	38	11.5
2	Age	≤ 25 years	60	18.2
		26–30 years	153	46.4
		31–35 years	59	17.9
		> 35 years	58	17.6
3	Marital status	Married	211	63.9
		Unmarried	119	36.1
4	Hierarchy	Entry	177	53.6
		Middle	153	46.4
5	Tenure in an organisation	1–1.11 years	135	40.9
		2–2.11 years	70	21.2
		≥ 3 years	125	37.9
6	Hours worked	< 55 hours	80	24.2
		55–60 hours	168	50.9
		> 60 hours	82	24.8
7	Presence of children	N	54	25.6
		Y	157	74.4
8	Annual salary	1–5 Lacs	98	29.7
		5–10 Lacs	112	33.9
		> 10 Lacs	120	36.4

Figure 2 CFA model of turnover intentions with factor loadings



Further, Table 5 shows that the sample primarily comprises of males (90.9%) as compared to females (9.1%). This indicates that in the Indian business scenario, the sales profession is primarily dominated by males.

5.3 ANOVA analysis

Table 6 indicates the impact of different demographic variables (gender, age, marital status, hierarchy in the organisation, work experience with the current organisation, working hours, number and ages of children, employment status of spouse and annual salary) on turnover intentions of sales employees.

Table 6 Turnover intentions and demographic variables

<i>Demographic characteristics</i>		<i>Sum of squares</i>	<i>Df</i>	<i>Mean square</i>	<i>F</i>
Gender	Between groups	5.739	1	5.739	0.209
	Within groups	9017.052	328	27.491	
	Total	9022.791	329		
Age	Between groups	230.752	3	76.917	2.852*
	Within groups	8792.039	326	26.969	
	Total	9022.791	329		
Marital status	Between groups	154.046	1	154.046	5.697*
	Within groups	8868.745	328	27.039	
	Total	9022.791	329		
Hierarchy	Between groups	159.808	1	159.808	5.914*
	Within groups	8862.983	328	27.021	
	Total	9022.791	329		
Tenure in an organisation	Between groups	46.826	2	23.413	0.853
	Within groups	8975.965	327	27.449	
	Total	9022.791	329		
Hours worked	Between groups	425.913	2	212.957	8.100**
	Within groups	8596.877	327	26.290	
	Total	9022.791	329		
Presence of children	Between groups	1052.988	1	1052.988	31.894*
	Within groups	6900.196	209	33.015	
	Total	7953.185	210		
Annual salary	Between groups	341.342	2	170.671	6.429**
	Within groups	8681.449	327	26.549	
	Total	9022.791	329		

Notes: * $p < 0.05$, ** $p < 0.01$.

ANOVA results show that gender is not a significant source of variance in the scores of turnover intentions at $p < 0.05$ level for the three conditions, ($F(1, 328) = 0.209$, $p = 0.648$). This indicated that both male and female sales employees have comparable views

towards turnover intentions. A probable reason for such a finding could be lesser number of females in the overall sample.

Marital status as well as presence of children are found to be a significant source of variance in the scores of turnover intentions at $p < .05$ level for the three conditions, ($F(1, 326) = 5.697, p = 0.018$) and ($F(1, 209) = 31.894, p = 0.000$) respectively. This indicates that marriage and the presence of children bring in certain responsibilities in the individual, which eventually impacts his/her turnover intentions. This is supported by Cotton and Tuttle (1986) as well as Chompookum and Derr, (2004) who confirmed that marital status prevents sales professionals from resigning. This finding could be explained by the fact that both marriage and later children bring in a lot of responsibility in the employee and, thereby, reducing the turnover intent of sales professionals in India.

ANOVA results showed that tenure is not a significant source of variance in the scores of turnover intentions at $p < 0.05$ level for the three conditions, ($F(2, 327) = 0.853, p = 0.427$). The probable reason for such a finding is that those who are into sales as a profession are always under pressure to meet the targets that are assigned to them. This target accomplishment is a primary requirement for sales professionals, irrespective of the tenure that they spend in a particular organisation. Hence, the relation of tenure spent with turnover intentions has turned out to be non-significant.

A significant effect of age on turnover intentions was observed at $p < 0.05$ level for the three conditions, ($F(3, 326) = 2.852, p = 0.037$). In addition to this, post hoc comparison using Scheffe's test (refer Table 7) indicates that mean score for age ≤ 25 years ($M = 20.82, S.D = 4.257$) was significantly different from that for age 31–35 years ($M = 18.50, S.D = 5.339$) and age > 35 years ($M = 18.34, S.D = 5.469$). This means that with increasing age, the level of turn over intention decreases. A probable justification is provided by Lewis (1991, p.147) who suggests that with increasing age, sales employees are clearer about their aims and goals and hence avoid moving from one organisation to the other, leading to lower turnover.

Table 7 Scheffe's test for age

<i>Dependent variable</i>	<i>(I) age</i>	<i>(J) age</i>	<i>Mean difference (I – J)</i>	<i>Mean</i>	<i>SD</i>
TOI	≤ 25	25–30	2.065*	20.82	4.257
		31–35	1.918		
		> 35	2.472*		
	25–30	≤ 25	-2.065*	18.75	5.359
		31–35	-0.147		
		> 35	0.407		
	31–35	≤ 25	-1.918	18.50	5.339
		25–30	0.147		
		> 35	0.553		
	> 35	≤ 25	-2.472*	18.34	5.469
		25–30	-0.407		
		31–35	-0.553		

Notes: * $p < 0.05$, ** $p < 0.01$.

Hierarchy is found to be a significant source of variance in the score of turnover intentions at $p < 0.05$ level for the three conditions, ($F(1, 328) = 5.914, p = 0.016$). This indicates that as sales employees move up in the hierarchy, turnover intentions reduce. The primary reason behind this is the reduction in the number of available jobs as hierarchy increases. Further, as sales people move up in hierarchy they tend to seek stability, which in turn reduces turnover intentions.

Hours worked were found to be a significant source of variance in the scores of turnover intentions at $p < 0.01$ level for the three conditions, ($F(2, 327) = 8.100, p = 0.000$). In addition to this, Scheffe's test (see Table 8) indicates that mean score for ≤ 55 hours worked ($M = 17.28, S.D = 5.320$) was significantly different from that for 56–60 hours worked ($M = 19.26, S.D = 5.238$) and more than 60 hours worked ($M = 20.48, S.D = 4.686$). This means that higher the number of hours worked, higher the turnover intentions of sales employees. The results are further supported by Dawson, et al. (2001) who found that long working hours result in higher turnover intentions.

Table 8 Scheffe's test for hours worked

Dependent variable	(I) hours in office	(J) hours in office	Mean difference (I – J)	Mean	SD
TOI	< 55	56–60	-1.987*	17.28	5.320
		> 60	-3.201**		
	56–60	< 55	1.987*	19.26	5.238
		> 60	-1.214		
	> 60	< 55	3.201**	20.48	4.686
		56–60	1.214		

Notes: * $p < 0.05$, ** $p < 0.01$.

Annual salary is found to be a significant source of variance in the scores of turnover intentions at $p < 0.01$ level for the three conditions, ($F(2, 327) = 6.429, p = 0.002$). Moreover, post hoc comparison using Scheffe's test (refer Table 9) indicates that mean score for annual salary of 1–5 lacs ($M = 20.56, S.D = 4.597$) was significantly different from the score for an annual salary of > 10 lacs ($M = 18.08, S.D = 5.419$). This suggested that salary plays an important role in the sales employees' turnover intentions. The result confirms the finding of Cotton and Tuttle (1986) who proposed that higher household income tends to reduce one's propensity to leave an organisation.

Table 9 Scheffe's test for annual salary

Dependent variable	(I) annual salary	(J) annual salary	Mean difference (I – J)	Mean	SD
TOI	1–5 Lacs	5–10 Lacs	1.695	20.56	4.597
		> 10 Lacs	2.486**		
	5–10 Lacs	1–5 Lacs	-1.695	18.87	5.316
		> 10 Lacs	0.791		
	> 10 Lacs	1–5 Lacs	-2.486**	18.08	5.419
		5–10 Lacs	-0.791		

Notes: * $p < 0.05$, ** $p < 0.01$.

6 Conclusions

The main focus of the present research was to measure the turnover intentions and also to examine the role of individual differences in predicting the same in Indian context.

The results of this study suggested that the modified version of Mitchel (1981) scale developed by Ku (2007) is appropriate to determine turnover intentions in the Indian context.

Further, turnover intentions are found to be significantly associated with demographic variables like age, marital status, presence of children, hierarchy and annual salary. This indicates that sales employee intent to leave an organisation is associated with both work (hierarchy and annual salary) as well as family related domains (marital status, presence of children). However contradictory results were observed with respect to gender in relation to turnover intentions. The probable reason for such a finding could be lesser number of females in the overall sample under study.

7 Limitations of the study

The present study has a few limitations that need to be taken into account in future studies on work – family balance. The study is primarily cross-sectional in nature and therefore causal conclusions cannot be drawn. Also, only Mumbai City has been chosen for data collection, though the choice of Mumbai was made as this city is considered to be the financial hub of the country and thereby having the presence of maximum business houses.

8 Managerial implications

In order to have a competitive edge over the other organisations, the turnover of sales employees has to be controlled. This can be achieved by taking measures that are favourable for the sales employees, such as those which may lead to increase in their commitment level. For the same the first step to understand the turnover intent by conducting one-on-one meetings, team meetings, skip meetings, etc. with the concerned manager. In fact a lot of informal sessions are to be conducted to understand this important workplace attitude. Even role of HR is crucial in such cases. This further becomes more relevant when the sales employees are handing crucial account or clients for the organisations. Timely and relevant know-how on turnover can assist with the planning, projection and control of resources (Shamsuzzoha and Shumon 2007).

As evident from the results, organisations need to especially focus on the requirements of entry level employees as well as those who are unmarried. Many a times, employees belonging to these two categories are prone to have higher workloads. Such employees need to be provided with requisite training and also certain provisions should be made by the company to take care of their work-life issues. Employee support policies especially for the entry level sales employees should be communicated well. In addition timely and sufficient reimbursement policies are to be necessarily included in the HR policies of the companies and corresponded to those joining the systems. Effective training on the products and about competitive products of other competitors (Westerman

and Yamamura, 2007) should also be necessitated to induce a good level of confidence in the minds of sales persons.

Further as age has emerged as a significantly associated with TOI. So when generational differences exist, human resource practitioners must determine the motivating factors concerning the employee's performance (Twenge et al, 2012). In addition scholarships and funding for the education for the children of the married employees can be considered as an important way to further escalate the stay of the employees with the organisation in today's competitive world.

Few non-monetary retention strategies like increased flexibility and work-at-home options, flexible control over work schedules and opportunities to improve skills and expertise during work time (Westerman and Yamamura, 2007) can also be considered as ways to reduce turnover intent.

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Exploring Job and Family Satisfaction: Scale Validation and Role of Demographic Variables

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Abstract

Satisfaction from job is considered as an important variable for study with respect to sales employees. By virtue of their job profile, sales employees are required to respond to multiple demands from multiple stakeholders both at work and family front which eventually lead to negative outcomes such as stress. This in turn results in lesser satisfaction both in work and family domains. Although job satisfaction gets highlighted across researches (especially in western context), family satisfaction still remains a subject of negligence in sales related researches. The present study aims to validate the Job and Family satisfaction in Indian context by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) using analysis of moment structures (AMOS) software. The results of the data analysis conform the findings of previous literature. Further, this study explored the impact of demographic variables on job and family satisfaction of sales employees. The study contributed to the sales management literature by identifying the key demographic variables that can have an effect on sales employee's job and family satisfaction. Results indicated that sales employee satisfaction from job is associated with both work (tenure in an organization, hierarchy and annual salary) as well as family related domains (marital status). However, family satisfaction is primarily dependent on family related factors. Implications of these findings are discussed.

Keywords

Job satisfaction, family satisfaction, EFA, CFA, ANOVA, sales employee, India

Introduction

In past three decades, the work and family connection has been an important field of research due to the changes in the work and employee-related demographics (Jain & Nair, 2016). This, in turn, has accelerated both academic and organisational research to focus on satisfaction that emerge from both the domains, that is, job and family satisfaction, respectively. This becomes more vital when it comes to selling profession as selling is considered one of the most critical functions for any organisation.

Sales employees act as boundary spanners between the organisation and the customers (Weitz & Bradford, 1999) and, therefore, are considered as profit centres for firms (Churchill, Ford, & Walker, 1997). Over the last 30 years

considerable research has been done to understand the job satisfaction of sales employees (Pettijohn, Pettijohn, & Taylor, 2002).

Job satisfaction among sales personnel plays a crucial role in ensuring higher productivity, as well as performance (Babakus, Cravens, Johnston, & Moncrief, 1996). In addition, many studies have confirmed the significant level of customer satisfaction resulting because of higher satisfaction of sales employees (Homburg & Stock, 2005; Schetzle & Drollinger, 2014). Conversely, studies have also validated that employees who are dissatisfied with their jobs are more likely to involve in nonconformity behaviours (Lau, Au, & Ho, 2003) and absenteeism (Hartmann, Rutherford, Feinberg, & Anderson, 2014). In fact, meta-analysis on the effects of ethical climate suggests

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that job dissatisfaction poses a significant threat to organisations due to its intensifying effects on dysfunctional behaviour (Martin & Cullen, 2006).

Judge, Hanisch, and Drankoski (1995) suggested that it is important for human resource managers to be mindful of factors that affect most employees' job satisfaction both positively and negatively as it will be fruitful for both the organisation and the employee. In addition, Jaramillo, Grisaffe, Chonko, and Roberts (2009) suggest that care and concern for the welfare of the employees by the management will lead the employees to act in the same way with customers.

Family satisfaction is largely studied as an outcome variable for work/ family conflict (Aryee, Luk, Leung, & Lo, 1999; Kalliath, Kalliath, & Chan, 2017; Karatepe & Uludag, 2008) and work/family enrichment. With work–family conflict, family satisfaction shows a negative relationship (Kossek & Ozeki, 1998), whereas with work–family enrichment, the relation is found to be positive. But its direct relationship with demographic factors has rarely been studied.

Using scarcity hypotheses (Parasuraman & Greenhaus, 2002), work–family studies have proven that if an employee is spending excessive time in the office, his ability to perform his role at home got hampered. Likewise, if an employee has too much burden at home (added responsibilities), his/her responsibilities in the office could be disrupted. Similarly, high-performance demands can make employee stress in the office. The stress at work can then be carried home and create new problems at home (Schneiderman, Ironson, & Siegel, 2005). Likewise, if an employee is experiencing stress at home, his/her performance in the office could be disrupted (Zhang et al., 2012). This indicated that understanding the role of family and the factors that affect the satisfaction is very crucial for overall satisfaction.

Although 'family' is an important institution, especially in India, there is insufficient consideration given to the concept of family satisfaction in the management-related studies, which is a critical research gap. Furthermore, there is hardly any research about the family satisfaction of sales employees working in emerging markets like India. Even though customer satisfaction is an indispensable part for any business, but if internal stakeholder, that is, employees, is not content then we cannot gratify our external customers (George, 1986). Hence, both job and family satisfaction are important to understand the overall satisfaction.

Although there are sizable numbers of studies on job and family satisfaction in Western countries, the same is rare to find in a non-Western context. One probable reason could be paucity of validated scales that measure job and family satisfaction in a non-Western context.

Therefore, this research is an attempt to validate the job and family satisfaction measure in an Indian context. Additionally, the study aims to empirically examine the

influence of demographic variables on job and family satisfaction of sales employees working in different sectors in Indian organisations.

Literature Review

Job Satisfaction

Job satisfaction is one of the most important attitudinal variables (Judge & Mueller, 2012) studied across organisational behaviour literature. Locke (1976) defined job satisfaction as 'a pleasant emotional state resulting from a person's appreciation of his or her job and job experience'. It can also be defined as 'a positive feeling about a job resulting from an evaluation of its characteristics' (Robbins & Judge, 2009, p. 83). Studies in Western context have proved that job satisfaction not only positively impacts job performance, work values and high levels of employee motivation but also helps in lowering rates of absenteeism, turnover and burnout (Ngo, 2009). Previous research studies (Lefkowitz, 1994; Tabatabaei & Gharanjiki, 2011; Wayne, Griffin, & Bateman, 1986) showed that job satisfaction is influenced by demographics, organisational reward systems and individual differences such as self-esteem and the need for achievement.

Job Satisfaction and Demographic Variables

Demographic variables are often important determinants of job satisfaction (Ngoo, Tey, & Tan, 2015). One of the major demographic variables studied by researchers with respect to job satisfaction has been gender (Hodson, 2002; Westover, 2010). Women are found to have higher job satisfaction level than men in most of the professions (Roxburgh, 1999). However, in sales it was found that female sales representatives report lower job satisfaction, lower role clarity and greater propensity to leave the organisation (Siguaw & Honeycutt, 1995). Certain studies even suggest no significant gender difference with job satisfaction (Collins & Helen, 2013; Westover, 2009). The following hypothesis concerning relationship variables can be put forward based on the general tendency seen in sales research:

H01: Job satisfaction is substantially related with females as compared to males.

Becker (1960) measured impact of age and tenure on organisation commitment and job satisfaction. The results suggest that age is positively related to job satisfaction (Salami, 2008), that is, older employees have higher levels of job satisfaction as compared to younger employees in a manufacturing environment. This aspect is supported by many research studies (Kalleberg & Loscocco, 1983; Wright & Hamilton, 1978), which indicate that older

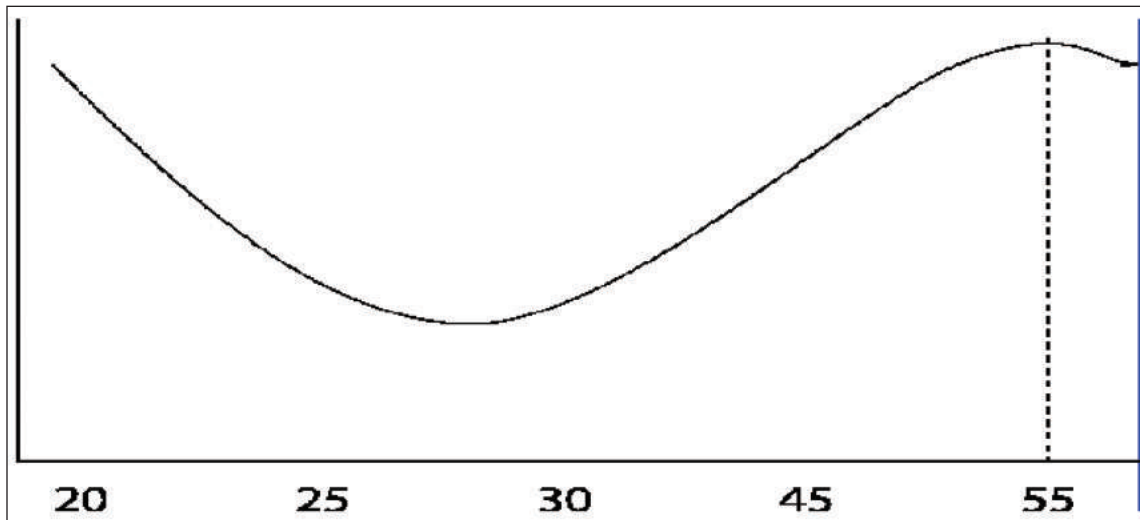


Figure 1. Relationship Between Age and Job Satisfaction

Source: Rao and Narayana (1997).

people switch to jobs that have more desirable characteristics and hence are more satisfied. Hamner and Organ (1978) suggest that when people started their jobs, they have unrealistic assumptions about it and hence the level of job satisfactions is high in the beginning, but when they notice reality it falls. Later with years of experience, people develop accurate expectations, and hence, the level of job satisfaction increases again. After an age because of fear of future, it further tends to move on the lower side (Rao & Narayana, 1997) (refer Figure 1).

Hence, we can hypothesize that:

H02: Age is significantly associated with job satisfaction.

Weaver (1978) suggested that unmarried employees are less satisfied with their jobs than their married counterparts. This is further supported by Kanter (1977) and Dolton and Makepeace (1987). Hence, it can be hypothesised that:

H03: Marital status is significantly associated with job satisfaction.

Long working hours are found to be negatively associated with job satisfaction (Trimpop, Kirkcaldy, Athanasou, & Cooper, 2000). In a cross-cultural study conducted by Spector et al. (2004), working hours were found to be significantly correlated with job dissatisfaction for English-speaking Anglos but not Chinese. However, in a survey conducted across 20 countries, Spector et al. (2007) found no relation between working hours and job satisfaction. It was found that an increase in wage results in increasing job satisfaction (Jones & Sloane, 2009). This is in sync with economic theory that suggests that job satisfaction is positively dependent on salary and negatively

dependent on the number of hours worked (Vila & García-Mora, 2005). So it can be hypothesised that:

H04: Duration of working hours is significantly associated with job satisfaction.

H05: Income is significantly associated with job satisfaction.

Marchand (2009) and Hunter (2007) in their respective studies found that tenure is positively related to job satisfaction, that is, those who are new to a job are likely to be less satisfied with the job compared to those who have experiences in doing the job. Veronique and Stephen (2006) in their study with 184 managerial employees, found that managerial levels have a direct positive impact on managerial performance and job satisfaction. So it can be hypothesised that:

H06: Tenure in an organisation is significantly associated with job satisfaction.

H07: Hierarchy is significantly associated with job satisfaction.

The study conducted by Demirel and Erdamar (2009) suggests that the number of children has a significant and negative impact on job satisfaction levels. It is supported by Frey and Eichenberger (1996, p. 188) argument that, 'having a child instead of remaining childless binds the time and financial resources of the parents for about 20 years, perhaps even for the rest of their lives'. This ultimately enhances time demands of parents, financial resources and psychological capital, and henceforth, will impact job satisfaction negatively. Also it can be inferred that the age of the younger child would also affect an

individual's job satisfaction significantly. So it can be hypothesised that:

H08: Presence of children is significantly related with job satisfaction.

Family Satisfaction

Family satisfaction refers to the response to present family functioning as compared with an individual's inner sense of what is desirable (Olson, 1986). Researchers argue that family satisfaction is an evaluative state and vary substantially over time (Ilies & Judge, 2002; Judge, LePine, & Rich, 2006).

Family Satisfaction and Demographic Variables

Family satisfaction is found to be positively associated with life satisfaction (Carlson & Kacmar, 2000; Karatepe & Baddar, 2006; Salvatore & Munoz Sastre, 2001). Life satisfaction is the satisfaction derived from job and family life (Sekaran, 1983). Also, life satisfaction is increased through involvement in activities within the family domain and receipt of emotional support from family members (Judge, Boudreau, & Bretz, 1994). So inferences with regard to demographic dimensions about family satisfaction can be drawn taking inferences from life satisfaction as a variable.

Tiedje et al. (1990) suggests that women who are low on work-family conflict experience greater satisfaction from their respective work and family roles, that is, the level of family satisfaction is higher in females having lower level of work-family conflict. However, Beutell and Wittig-Berman (1999) found that life satisfaction for males is higher than females. So it can be hypothesised that:

H09: Males will have higher family satisfaction as compared to females.

People below 24 years and over 44 years of age have been reported as more satisfied with their families than young adults (Helliwell, 2001). Consequently, it is hypothesised that:

H10: Age is significantly associated with family satisfaction

Long working hours have been found to be associated with stress in balancing work and family roles (Major, Klein, & Ehrhart, 2002). The probable reason could be that the time spent at work often comes at the cost of family time (Moen & Chesley, 2008). This, in turn, may affect the satisfaction levels at the family frontier. Thus, we hypothesise that:

H11: Long working hours are negatively associated with satisfaction from family.

The position one occupies in an organisation, that is, the level at which one is placed, tends to affect one's life satisfaction by underlying towards a sense of power and status. Redman and Snape (2006) indicates that the correlation between power and prestige of the job and life satisfaction is found to be .38. This, in turn, would have an effect on improved family functioning and, henceforth, would affect family satisfaction positively. So it can be hypothesised that:

H12: Middle level managers will have higher family satisfaction as compared to entry level employees.

Organisational tenure has been found to be significantly associated with job satisfaction (Hoath, Schneider, & Starr, 1998). There are indications in the literature that satisfaction in different life domains contributes to overall life satisfaction. In this way, satisfaction with job, home, marriage, and family are all positively associated with general satisfaction (Perrone, Webb, & Blalock, 2005). So using this logic, it can be hypothesised that:

H13: tenure in an organisation is positively related with family satisfaction.

Annual income and economic status are found to be a significant predictor of life satisfaction (Blanchflower & Oswald, 2004; Delhey, 2004). Income is also positively associated with marital quality and stability, children's health and satisfaction with childcare (Barnett & Hyde, 2001; Haas, 1999). Since all the measures are essential for having satisfaction from family life, it can be hypothesised that:

H14: Income is positively related with family satisfaction.

Marital status is also found to be positively related to life satisfaction (Argyle & Martin, 1991; Daly & Rose, 2007). Thomas, Albrecht, and White (1984) claimed that when both partners are working it leads to high level of risk. In fact, when the spouse is working it leads to enhancement of several role responsibilities, which can negatively impact the overall quality and satisfaction of the marriage (Thomas et al., 1984) and would also affect family satisfaction to a larger extent. So it can be hypothesised that:

H15: Marital status is considerably associated with family satisfaction.

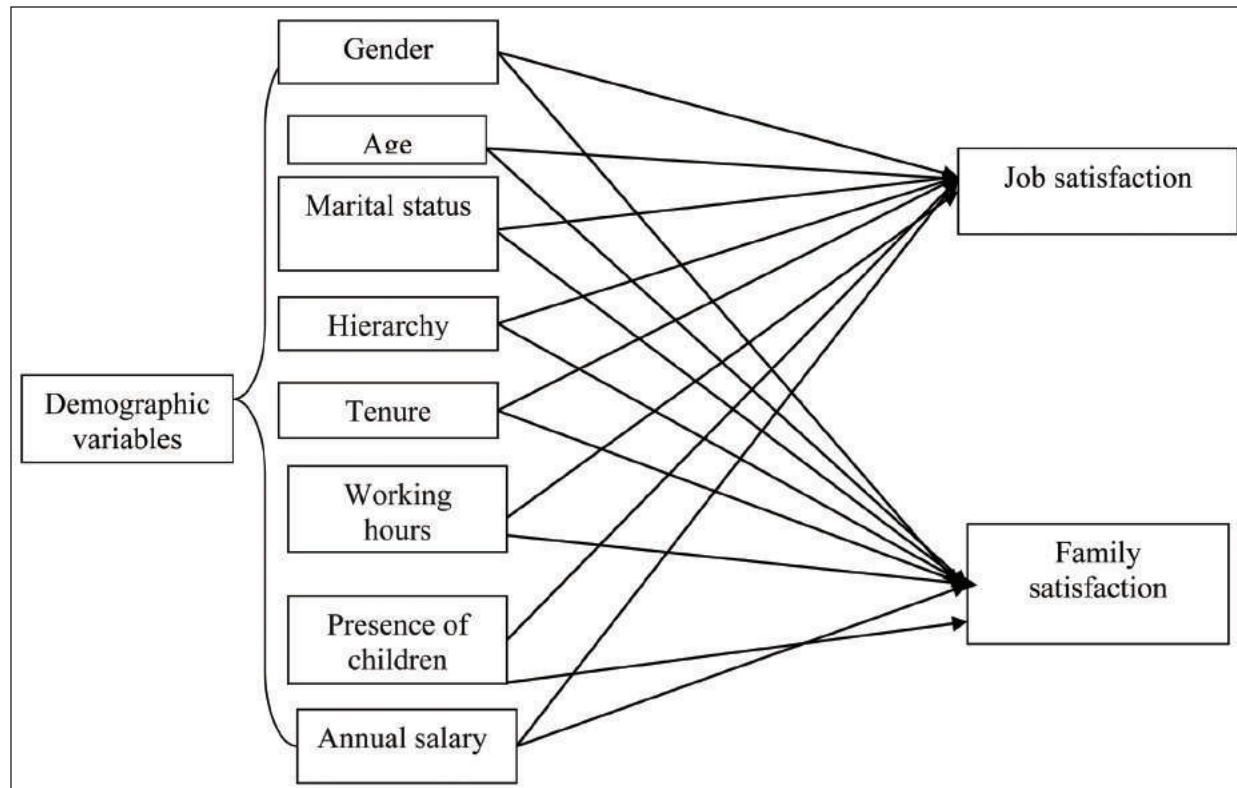


Figure 2. Demographic Variables and Job satisfaction and family satisfaction

Source: The authors.

Zimmermann and Easterlin (2006) found that there is a positive effect of children on an individual's satisfaction with family life. This aspect can be supported by the study conducted by Lu, Siu, Spector, and Shi (2009). They established that experiences in the family domain (new parental experiences, spouse support) had a significant positive impact on the positive component, that is, facilitation (enrichment) component of work–family balance. This, in turn, would improve the satisfaction at the family front. So it can be hypothesised that:

H16: Having children is considerably associated with family satisfaction.

The schema of the relationships examined with respect to demographics is shown in Figure 2.

Methodology

Research Design

The present study is quantitative in nature. A survey method was used to gather information from sales respondents among service and manufacturing segments. This method of data collection is generally adopted to understand opinions, attitudes, perceptions, preferences and behaviours of individuals (Cooper & Schindler, 2000).

Sampling

The study adopted a non-probability purposive sampling approach (Leedy & Ormrod, 2005). The sample for the study was sales employees working in different organisations based in Mumbai. The overall sample for the study was 230 sales employees. Of these 230 respondents, only 21 are females and rest 209 are males. This indicated the dominance of males in sales function.

Measures

Standardised self-report questionnaires were used in this study. The questionnaire has two sections. Section 1 concentrates on the demographic outline of the respondent, whereas Section 2 primarily captures the job and family satisfaction of the concerned respondent.

Job Satisfaction Scale

It is an attitudinal variable that reflects how people feel about their job. It is assessed using the 3-item general job satisfaction subscale, which is part of the job diagnostic survey (JDS) (Hackman & Oldham, 1975). However, since the scale has not been extensively used in the Indian context, its validity was tested. The outcomes will be discussed in the next section.

Family Satisfaction Scale

Family satisfaction is assessed using a modified version of Brayfield and Rothe's (1951) family satisfaction scale (Hennessy, 2007). Certain studies (especially in the Western countries) have used measure modification of this nature (Aryee, Luk, Leung, & Lo, 1999). However, since the scale has not been extensively used in the Indian context, its validity was tested. The outcomes will be discussed in the next section.

Demographic Variables

The demographic details aimed at understanding the characteristics of the participants. The responses to the demographic details will lead to the development of a profile of the participant's personal and organisational traits.

To a great extent the methodology was based upon the measures of previous researchers who have studied these similar variables.

Data Analysis

To meet the defined objectives, AMOS software (Arbuckle, 2011) version 20.0, which incorporates a structural equation modelling (SEM package) with maximum likelihood (ML) estimation, was used to test the measurement model. Standard statistical procedures like descriptive and inferential statistics, such as frequency, means, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (to test the construct validity of family satisfaction scale) was conducted. The following statistical procedures were done to meet the objectives of the study:

1. Assessing reliability of scales.
2. Assessing construct validity of job satisfaction and family satisfaction scale.
3. One-way analysis of variance (ANOVA) was utilised to determine the role of demographic variables on job satisfaction and family satisfaction. Calculations were done and the significance levels were determined at $p < 0.01$ and $p < 0.05$ to reduce Type I error.

The next section presents the results of the analysis undertaken for the study. First, both job and family satisfaction scale were tested for their validity. Later, the inter-correlations were presented, followed by testing the hypotheses using ANOVA.

Results and Discussions

Reliability

Table 1 denotes the Descriptive Analysis and Internal Consistency Estimates. Skewness and kurtosis for the data

Table 1. Descriptive Analysis and Internal Consistency Estimates

	Item Statistics				
	Mean	SD	Skewness	Kurtosis	Reliability
JS 1	3.90	1.462	-0.266	-0.558	0.920
JS 2	4.05	1.471	0.05	-0.568	
JS 3	4.06	1.437	-0.099	-0.331	
FSAT 1	3.29	1.327	-0.552	-0.931	0.965
FSAT 2	3.29	1.169	-0.543	-0.637	
FSAT 3	3.31	1.263	-0.477	-0.864	
FSAT 4	3.22	1.246	-0.483	-0.777	
FSAT 5	3.35	1.381	-0.573	-0.973	

Source: The authors.

are within acceptable ranges, that is, ± 2.00 (Garson, 2009). Further, the value of Cronbach's alpha for both job satisfaction scale and family satisfaction scale was greater than 0.70 (George & Mallery, 2003). Hence, the scales are said to be having excellent internal consistency.

Validation of Job Satisfaction and Family Satisfaction Scale

Factor analysis was done to evaluate the fundamental factor structure of job and family satisfaction scales. First, EFA was done to assess the construct validity (Ford, MacCallum, & Tait, 1986). Additionally, for preliminary assessment of data values, Kaiser-Meyer-Olkin (KMO) and Bartlett tests are used. Table 2 conveys the outcomes of the KMO and Bartlett's test.

Multiple criteria for determining the number of factors to retain were used including eigenvalues greater than 1.0 because they account for the variance of at least a single variable and variance explained of greater than 60 per cent (Hair, Anderson, Tatham, & Black, 1998). Furthermore, only items loaded at 0.6 or higher on the intended factor were retained as they are considered to be appropriate (Hair et al., 1998). All the 8 items were entered in a single analysis. A two-factor solution accounted for 87.20 per cent of the total variance.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.890
Bartlett's test of sphericity	Approximate chi-square df	1921.397 28
	Sig.	0.000

Source: The authors.

Table 3. Component Matrix

	Component	
	1	2
FSAT 1	0.912	
FSAT 4	0.902	
FSAT 3	0.896	
FSAT 5	0.882	
FSAT 2	0.880	
JS 1		0.766
JS 3		0.736
JS 2		0.723

Source: The authors.

Results of EFA exhibited in Table 3 specify a 2-factor structure for job and family satisfaction. The results of EFA indicated a single factor structure for all the 3 items of job satisfaction with loadings ranging from 0.701 to 0.815, whereas for family satisfaction, a single-factor 5 items with loadings ranging from 0.912 to 0.880 emerge.

To further confirm the findings of EFA, CFA was conducted. Table 4 illustrates the CFA outcome of model fit indices for the Job satisfaction and Family Satisfaction scale. The following values are found for the different indices with regard to job satisfaction. The value of $\chi^2 = 15.913$, $df = 1$, $CMIN/df = 15.913$. The values for other indices like $SRMR = 0.015$, $RMSEA = 0.002$, $CFI = 0.970$, $NNFI = 0.911$ Hence, the 3-item scale was accepted for the final analysis.

Later, the results of CFA indicate a good fit based on the model indices with regard to family satisfaction (refer Table 4). The value of $\chi^2 = 18.602$, $df = 6$, $CMIN/df = 3.100$. The other indices also result in appropriate values like $SRMR = 0.0387$, $RMSEA = 0.004$, $CFI = 0.991$, $TLI = 0.985$. The overall fit values are indicators that the single factor 5-item family satisfaction scale can be used for further analysis. Thus, the single factor structure was established.

Figures 3 and 4 embody the results of CFA for Job and family satisfaction, respectively, alongside mentioned are the consequent factor loadings. Hence, a single-factor model was established in both the cases.

Table 5 depicts the demographic descriptions of the respondents.

Table 4. Outcomes of Confirmatory Factor Analysis

Model fit Indices	df	χ^2	χ^2/df	SRMR	RMSEA	CFI	TLI
3 items 1-factor model for job satisfaction	1	15.913	15.913	.0015	0.002	0.970	0.911
5 items 1-factor model for family satisfaction	6	18.602	3.100	0.0387	0.004	0.991	0.985

Source: The authors.

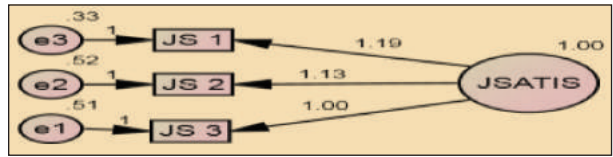


Figure 3. CFA Model with Factor Loadings for Job Satisfaction

Source: The authors.

Note: JSATIS, Job satisfaction.

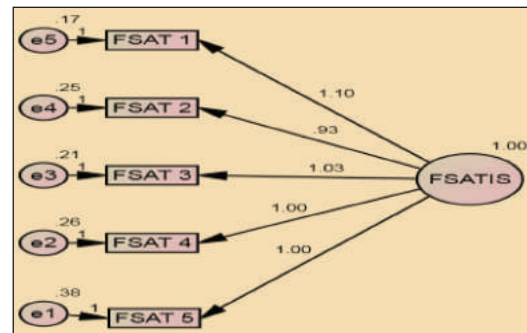


Figure 4. CFA Model with Factor Loadings

Source: The authors.

Note: FSATIS, Family satisfaction.

ANOVA Analysis

ANOVA is a statistical test used to test differences between two or more means. It can be clearly observed from Table 6 that demographic variables (age, marital status, hierarchy, tenure with current organisation and annual salary) affect job satisfaction levels for the sample under study. The significance levels are gauged at 95 per cent confidence levels.

The relationship between gender and job satisfaction is not found to be significant. Gender difference in job satisfaction has been studied by several researchers (Hodson, 2002; Roxburgh, 1999; Westover, 2010). There are many studies that suggest that women have higher job satisfaction level than men (Roxburgh, 1999; Souza-Poza, 2007). This difference lies despite of having relatively lower level jobs, lesser pay, more discrimination and more stress in workplace as compared to their male counterpart (Bielby & Baron, 1986; Loprest, 1992). However there are studies that suggest no significant gender difference with job satisfaction (Collins & Helen, 2013). Hence, it is suggested that job satisfaction is independent of the gender differences.

Age is found to be significantly associated with job satisfaction ($F = 6.341$, $p < 0.05$). This aspect is supported

Table 5. Demographic Descriptions of the Respondents

Sl. No	Demographic Characteristics	Frequency (N = 280)	Percentage
1.	Gender	Male	209 90.9
		Female	21 9.1
2.	Age	≤25 years	38 16.5
		26–30 years	111 48.3
		31–35 years	41 17.8
		>35 years	40 17.4
3.	Marital status	Married	149 64.8
		Unmarried	81 35.2
4.	Hierarchy	Entry	119 51.7
		Middle	111 48.3
5.	Tenure in an organisation	1–1.11 years	93 40.4
		2–2.11 years	46 20
		≥3 years	91 39.6
6.	Hours worked	<55 hours	77 33.5
		55–60 hours	108 47
		>60 hours	45 19.6
7.	Presence of children	No	36 24.2
		Yes	113 75.8
8.	Annual salary	100,000–500,000	59 25.7
		500,000–1 million	80 34.8
		>1 million	91 39.6

Source: The authors.

by extensive research (Kalleberg & Loscocco, 1983; Salami, 2008) which indicates that sales employee’s on higher side of age switch to jobs which have more desirable characteristics and hence are more satisfied. Hamner and Organ (1978) suggest that when people started their jobs they have unrealistic assumptions about it and hence the level of job satisfactions is high in the beginning but when they notice reality it fall. Later with years of experience people develop accurate expectations and hence the level of job satisfaction increases again (Rao & Narayanan, 1996).

Table 7 reflects the results of Scheffe’s test wherein significance difference between age groups less than 25 and more than 35; and between less than 26–30 and more than 35 years are observed. *I* refer to a particular age range and *J* indicates the different age groups. This further confirms the belief that with age the level of job satisfaction increases.

Marital Status has shown significant association with job satisfaction ($F = 4.967, p < 0.05$). The result is supported by the previous studies (Dolton & Makepeace, 1987; Weaver, 1978). So it can be suggested that unmarried sales employees are less satisfied with their jobs than their married counterparts.

Table 6. Job Satisfaction and Demographic Variables

Factor		Sum of Squares	df	Mean Square	F
Gender	Between groups	9.107	1	9.107	0.552
	Within groups	3762.876	228	16.504	
	Total	3771.983	229		
Age	Between groups	296.952	3	98.984	6.437**
	Within groups	3475.031	226	15.376	
	Total	3771.983	229		
Marital status	Between groups	84.794	1	84.794	5.243**
	Within groups	3687.189	228	16.172	
	Total	3771.983	229		
Hierarchy	Between groups	160.589	1	160.589	10.139**
	Within groups	3611.394	228	15.839	
	Total	3771.983	229		
Tenure in an organisation	Between groups	117.328	2	58.664	3.644**
	Within groups	3654.655	227	16.100	
	Total	3771.983	229		1.580
Hours worked	Between groups	51.781	2	25.890	
	Within groups	3720.202	227	16.389	
	Total	3771.983	229		
Presence of children	Between groups	39.029	2	19.514	1.167
	Within groups	2441.938	146	16.726	
	Total	2480.966	148		
Annual salary	Between groups	419.228	2	209.614	14.192**
	Within groups	3352.755	227	14.770	
	Total	3771.983	229		

Source: The authors.

Note: ** $p < 0.01$.

Hierarchy in an organisation, that is, whether an individual is at entry level or at middle level, and tenure in an organisation are found to be significantly associated with job satisfaction ($F = 7.758, p < 0.05$; $F = 3.644; p < 0.05$). Similar results are found by Veronique and Stephen

Table 7. Results of Scheffe's Test for Age

Outcome Variable	Age (I)	Age (J)	Mean Difference (I - J)
JS	≤25	26-30	-1.405
		31-35	-2.001
		>35	-3.784*
	26-30	≤25	1.405
		31-35	-0.596
		>35	-2.379*
	31-35	≤25	2.001
		26-30	0.596
		>35	-1.783
	>35	≤25	3.784*
		26-30	2.379*
		31-35	1.783

Source: The authors.

Note: *The mean difference is significant at the 0.05 level.

Table 8. Scheffe's Test for Tenure in an Organisation

Dependent Variable	Experience with Current Organisation (I)	Experience with Current Organisation (J)	Mean Difference (I - J)
JS	1-1.11	2-2.11	-0.991
		3 or more than 3	-1.586*
	2-2.11	1-1.11	0.991
		3 or more than 3	-0.595
	3 or more than 3	1-1.11	1.586*
		2-2.11	0.595

Source: The authors.

Note: *The mean difference is significant at the 0.05 level.

(2006), who suggest that managerial levels and tenure have a direct positive impact on managerial performance and job satisfaction. Also, studies by Marchand (2009) and Hunter (2007) had identified that tenure is positively related with job satisfaction, that is, those who are new to a job is found to be less satisfied with the job compared to those who have experiences in doing the job. *I* in the present context means categorisation of salesperson according to the number of years of experience in the current organisation and *J* indicates all salespersons with differing experience with current organisation.

Annual household income is found to be significantly associated with job satisfaction ($F = 12.045$; $p < 0.05$). It was supported by few studies wherein it was found that

increase in wage results in increasing job satisfaction (Jones & Sloane, 2009; Lydon & Chevalier, 2002). This is in sync with economic theory that suggests job satisfaction is positively dependent on salary (Vila & García-Mora, 2005). Table 9 indicates the results of Scheffe's test for annual salary, wherein *I* refer to the category of salesperson according to annual salary and *J* indicates all categories of salespersons with differing annual salaries. Furthermore, Scheffe's test suggests that there are significant differences in job satisfaction between employees having lower income levels vis-à-vis employees having higher income levels.

The study conducted by Demirel and Erdamar (2009) suggests that the presence of children has a significant and negative impact on job satisfaction levels. Results are supported by Frey and Eichenberger (1996) argument that responsibility of child not only consumes time of a parent but also enhances the financial liabilities too. Further the timeframe for such demands both time demands and financial resources is long lasting for the parents especially in emerging economies. Moreover, it is widely accepted that demands impact job satisfaction negatively.

Results indicate that these working hours are not found to be significantly associated with job satisfaction. Similar findings were supported by Spector et al. (2004, 2007) wherein they found no relation between working hours and job satisfaction. Furthermore, the sample primarily comprises males since males are primarily seen as bread earners. Hence, in an Indian set up and sales as a profession, the general tendency is to work for longer hours and therefore longer working hours are considered as normal for sales people.

Table 9. Results of Scheffe's Test for Annual Salary

Outcome Variable	Annual Salary (I)	Annual Salary (J)	Mean Difference (I - J)
JS	100,000-500,000	500,000-1 million	-1.027
		More than 1 million	-3.232*
	500,000-1 million	100,000-500,000	1.027
		More than 1 million	-2.204*
	More than 1 million	100,000-500,000	3.232*
		500,000-1 million	2.204*
	500,000-1 million	500,000-1 million	0.860

Source: The authors.

Note: *The mean difference is significant at the 0.05 level.

Family Satisfaction and Demographic Variables

It can clearly be observed from Table 10 that demographic variables (age, hierarchy, presence of children and annual salary) affect family satisfaction levels for the sample under study.

Table 10. Family Satisfaction and Demographic Variables

Factor		Sum of Squares	df	Mean Square	F
Gender	Between groups	33.601	1	33.601	0.939
	Within groups	8159.547	228	35.787	
	Total	8193.148	229		
Age	Between groups	542.498	3	180.833	5.342**
	Within groups	7650.650	226	33.852	
	Total	8193.148	229		
Marital status	Between groups	15.295	1	15.295	0.426
	Within groups	8177.852	228	35.868	
	Total	8193.148	229		
Hierarchy	Between groups	27.642	1	27.642	0.772
	Within groups	8165.506	228	35.814	
	Total	8193.148	229		
Tenure in an organisation	Between groups	27.712	2	13.856	0.385
	Within groups	8165.436	227	35.971	
	Total	8193.148	229		
Hours worked	Between groups	122.699	2	61.350	1.726
	Within groups	8070.449	227	35.553	
	Total	8193.148	229		
Presence of children	Between groups	336.324	3	112.108	3.323*
	Within groups	4891.529	145	33.735	
	Total	5227.852	148		
Annual salary	Between groups	355.388	2	177.694	5.146**
	Within groups	7837.760	227	34.528	
	Total	8193.148	229		

Source: The authors.
Note: * $p < 0.05$; ** $p < 0.01$.

Neither Gender nor Marital status is found to be significantly associated with family satisfaction. This is one of an important finding as it suggests that individuals who are not married are equally satisfied with their family life as do married employees. However, age shows a significant relationship with family satisfaction ($F = 5.342$; $p < 0.05$). Table 11 reflects the results of post hoc analysis for age wherein *I* refer to a particular age range and *J* indicates the different age groups. The results are in sync with the study conducted by Helliwell (2001) who suggests that people below 24 years and over 44 years of age have been reported as more satisfied with their lives than young adults. Additionally, Table 11 reflects the significant differences between age groups 26–30 and more than 35 and between 26–30 and 31–35.

Annual salary is found to be significantly associated with family satisfaction ($F = 5.146$; $p < 0.05$). Annual income and economic status are found to be a significant predictor of life satisfaction (Blanchflower & Oswald, 2004; Delhey, 2004) and hence has an impact on family satisfaction. Table 12 indicates the results of Scheffe’s test for annual salary wherein *I* refer to category of salesperson according to annual salary and *J* indicates all categories of salespersons with differing annual salaries. The result of post hoc Scheffe’s test (refer to Table 12) indicated that there are significant difference among employees having total household salary 100,000–500,000 and those having more than 1 million. Further presence of children shows relationship with family satisfaction ($F = 3.323$; $p < 0.05$).

Further hierarchy, experience with the current organisation, working hour’s shows insignificant results with

Table 11. Results of Post Hoc Analysis for Age

Dependent Variable	Age (I)	Age (J)	Mean Difference (I – J)
FSAT	≤ 25	26–30	0.053
		31–35	-3.119
		>35	-3.232
	26–30	≤ 25	-0.053
		31–35	-3.172*
		>35	-3.285*
	31–35	≤ 25	3.119
		26–30	3.172*
		>35	-0.112
		≤ 35	≤ 25
		26–30	3.285*
		31–35	0.112

Source: The authors.
Note: *The mean difference is significant at the 0.05 level.

Table 12. Results of Post Hoc Analysis for Annual Salary

Dependent Variable	Annual Salary (I)	Annual Salary (J)	Mean Difference (I-J)
FSAT	100,000–500,000	500,000–1 million	-2.259
		More than 1 million	-3.120*
	500,000–1 million	100,000–500,000	2.259
		More than 1 million	-0.860
	More than 1 million	100,000–500,000	3.120*
		500,000–1 million	0.860

Source: The authors.

Note: *The mean difference is significant at the 0.05 level.

family satisfaction. This inconsistency can be assumed to be because of the fact that the mentioned demographics are from work related domain. So it can be concluded that family satisfaction factors primarily emerge from family domain in an Indian Context for sales employees.

Conclusions

The validation of job and family satisfaction scales was the major objective of the study. The results of the study suggested that both the scales, general job satisfaction subscale, which is part of the JDS (Hackman & Oldham, 1975) and the adapted version of Brayfield and Rothe's (1951) established by Hennessy (2007) are suitable for assessing job and family satisfaction, respectively, in Indian context.

Additionally, the study also examined the role of individual differences in predicting job and family satisfaction in Indian context. The results suggest that there is a significant relationship of age, marital status, hierarchy, tenure in an organisation, and annual salary with regard to job satisfaction. Such results pointed towards the fact that job satisfaction is affected by both work as well as family related characteristics. However, certain contradictions were observed with regard to working hours and the presence of children. Furthermore, the sample primarily comprises of males as males are primarily seen as bread earners. So it can be inferred that the presence of children and employed spouse largely does not affect a male as they affect a female.

Annual salary, age and presence of children emerged as significant demographic variables associated with family satisfaction. However, contradictory result were

observed with regard to marital status. This is one of the important findings as it suggests that individuals who are unmarried are equally satisfied with their family life as do married employees. Further hierarchy, experience with the current organisation, working hour's shows insignificant results with family satisfaction. This inconsistency can be assumed to be because of the fact that the mentioned demographics are from work related domain. So it can be concluded that family satisfaction factors primarily emerge from family domain.

Limitation of the Study

The most evident limitation is the cross-sectional nature of the study. Additionally, the data were collected from the city of Mumbai only, which posed another limitation.

Implications of the Study

The estimation of a man's working conditions is reflected in his attitude, of which job satisfaction is the most prominent. Further understanding of job satisfaction of sales employees is very crucial for managers in the current context as it is considered one of the factors that have a significant impact on customer satisfaction. The validation of job satisfaction scale will surely help the managers to assess the levels of satisfaction that one draws from the job.

Since key variables such as age, marital status, hierarchy, duration in an organisation and annual salary impacts job satisfaction, following key implications are important from a managerial standpoint. Hence, managers need to work on improving the satisfaction of younger employees who are joining sales as a profession. There are lots of expectation that these people have from the job, so organisation need to embrace a more flexible approach to in all aspects like recruitment, retention and training. Similarly unmarried employees are seen to have a lower job satisfaction as compared to their married counter parts. So organisations are required to have more empathic response to the needs of unmarried sales employees in terms of HR policies that gives equal weightages to both married as well as unmarried employee's needs. In addition, the manager's well as organisational support needs to be conducive for the needs of both younger as well as unmarried employees.

The study is the first attempt to understand family satisfaction of sales employees in Indian context. Further the family satisfaction scale validated in this study will help the organisations to gauge the satisfaction that one draws from family. This will surely support in overall understanding of an individual, as job and family satisfaction constitute overall life satisfaction. Presently,

extensive research on family satisfaction is conducted in Western countries, with females as sample. It would be interesting to see the implications of family satisfaction on for male employees too in an Indian context. Also, future research can be done to understand the implications of family satisfaction on organisations.

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Questionnaire

This section is concerned with the **satisfaction** from your **current job**. Kindly indicate the extent of your agreement/ disagreement with each item by putting a tick mark (\checkmark).

	Strongly Disagree = 1 Neither Agree nor Disagree = 4	Disagree = 2 Slightly Agree = 5	Slightly Disagree = 3 Agree = 6	Strongly Agree = 7						
	Statement			1	2	3	4	5	6	7
JS1	Generally speaking, I am very happy with my work.									
JS2	I frequently think of leaving this job (Reversed scored)									
JS3	I am generally satisfied with the kind of work I do in my job.									

This section is concerned with the **satisfaction** from your **family**. Kindly indicate the extent of your agreement/ disagreement with each item by putting a tick mark (\checkmark).

	Strongly Disagree = 1	Disagree = 2	Neutral = 3	Agree = 4	Strongly Agree = 5				
	Statement				1	2	3	4	5
FSAT1	Most days I am enthusiastic about my family life.								
FSAT2	I feel fairly well satisfied with my family life.								
FSAT3	I find real enjoyment in my family life.								
FSAT4	I like my family life better than the average person does.								
FSAT5	I am often bored with my family life. (Reversed scored)								

Appendix A

Abbreviations Used

- EFA = exploratory factor analysis
- CFA = confirmatory factor analysis
- SEM = structural equation modelling
- ML = maximum likelihood
- ANOVA = analysis of variance
- KMO = Kaiser–Meyer–Olkin
- RMSEA = root mean square error of approximation
- SRMR = standardised root mean square residual
- CFI = comparative fit index
- TLI = Tucker–Lewis index
- df = degrees of freedom
- χ^2 = chi-square
- FSATIS = family satisfaction
- JSATIS = job satisfaction

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EXPLORING FACTORS OF E-LEARNING RELATED TO STUDENT ENGAGEMENT

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Abstract:

This research focuses on exploring the factors which relate learner engagement with E-Learning. It tries to explore the strength of the link between learner engagement and E-Learning. E-Learning in today's world has become a common mode of study and knowledge dissemination. E-Learning is an educational, training and learning method which is spreading widely and becoming a popular method of delivery among both educational and corporate environments. Is it beneficial for educational institutions and organisations to choose blended learning that is face-to-face learning combined with e-learning is another question, however; e-learning has become a major choice of knowledge distribution and attainment in today times due to the advantages it provides. Some advantages which are evident include, E-learning is offered on mobile devices, personal digital assistants and portable devices which enhance learner convenience, allow a digitalised learning experience to the learner, and help accommodate the learning needs of individuals in their lifestyle. Training, even if it is online goes through the phases of planning, content development, scheduling, delivery, assessment and re-training if necessary. At most training scenarios, training professionals are engaged in all the above activities, however; sometimes the trainers are engaged in only the planning, delivery and follow-up, there are other persons who have developed the content. The top driver of training effectiveness is content preparation and its adaption to the mode of delivery. The learners' thirst for the information being provided and his curiosity to learn more can be termed as 'learner engagement'. Although the trainer might have a cumbersome learning material with substantial interest in its content, the learning cycle and the rationale of E-learning will not be complete, if the learner does not absorb and comprehend the matter. The concern for learning and gaining knowledge should be visible and also manifested by the learners' actions to ensure that one has an engaged learner. This research is an effort to explore the gains and shortcomings of using this technique of online training or E-learning. It also explores the factors integral to this technique, which contribute towards learner engagement.

Key Words: Learning, Online Learning, E-Learning, Employee Engagement & Training

Research Objectives:

This research is an effort to explore the factors inherent in e-learning that relate to learner engagement.

Research Methodology:

This research is an analysis of data obtained from secondary sources. Data is obtained from books, journals and internet references.

Introduction:

Online learning or training has been a chosen alternative over live, classroom program since a long while now. Both educational and corporate sector take advantage of this for the reason that it is simple and can be used very effectively. Use of e-learning is done for online courses for students, for employees, for business partners. It is a

method which saves time, cost and reduces the inconvenience of travel. Organisations of all types and sizes today, are bent to replace live training with online training or at least reduce the number of instructor-led trainings and shift to e-learning. Most online tools are interactive and intend to drive higher engagement of learner. Today, online learning is availed for purposes of training in software, technology, business, customer handling, and much more.

Online training, not only can be utilised in multiple ways, but has multiple benefits also. There is an ever changing trend and upgradation in the tool of online training and new modes of knowledge dissemination. This update is also an effort to improve the levels of learner engagement, retention, ease and motivation. The term 'engagement' can be defined as the level of attention, attraction, interest, thought, bonding and commitment that is present between two or more entities. In case of e-learning, it is the learner's engagement towards the topic of learning, material, process, tools, instructor, attention to delivery, feeling of obligation to understand material, complete assessments and gain mastery of the matter intended to be conveyed through online learning. This research explores the factors of e-learning process which are contributing and moderating towards learner engagement.

Digitalisation:

The digital touch is the cause of revolution in all industrial sectors, and so without an iota of doubt, it has mesmerised the educational industry also. According to a McKinsey Survey, (May 2016), authors Richard Benson-Armer, Arne Gast, and Nick van Dam, 120 senior learning-and-development (L&D) officers were surveyed to gain a more in-depth understanding of the present state and probable trajectory of corporate academies. A benchmarking was also done where 'best practices towards leaning' was the topic of research, and about a dozen of Chief Learning Officers were interviewed. Apart from other findings related to formal learning, and the methods of knowledge dispersal in organisations, digitalisation learning opportunity was discussed. It is observed that younger employees—millennials and post-millennials, or Generation Z—feel the greatest level of comfort with digitization.

Integrated cloud-based platforms enable more than just new computer programs or nifty smartphone apps. Sophisticated organizations are now expanding their use of cloud-based learning to run such personalized applications as MOOCs (massive open online courses), SPOCs (small private online courses), instructional videos, learning games, e-coaching, virtual classrooms, online performance support, and online simulations. (McKinsey Survey, May 2016).

E-Learning – Its Opportunities and Challenges:

Shortcomings of E-Learning:

Faces Challenges in Terms of Recognition on Learning Programmes: It is indiscriminately argued that online courses have no value or accreditation in the job market. Bureaucratic organisations and those with set mental models of courses which the employees must be certified in, at most times do not prefer hiring candidates with non-accredited qualification. It is however not so always. Recent times have shown online courses offered by universities, to get the official recognition and the organisations displaying flexibility in accepting candidates who hold these qualifications.

It is Like Self-Learning and Hence Requires the Individual's Motivation: Online courses or any informal learning is based on the learner's whims and fancies. The learner must have a sense of responsibility, motivation and drive to self-pace and

monitor his own learning. This depends on the learner's motive or need behind gaining the requisite knowledge.

The individual may or may not answer the e-learning tests with his own abilities: It is a challenge to gauge whether the learner has himself performed the tests to assess his knowledge for the material shared with him. It is possible that an online learning system may not be truthfully and honestly answered by the one it intends to groom.

The transfer of learning to real-time application (practical) is questionable: It is highly disputable for one to believe that online learning enables transfer of skills on the job. This requires the learner himself to reproduce the principles and practices learnt while he is on the job and indulge in a repetitive behaviour using the concepts, for that behaviour to become a habit.

The learner may lose interest soon and may become disengaged: It becomes difficult to engage the user of the e-learning facility as it is not face-to-face and direct. The learner may wander in thoughts and may not have a significant attention span to absorb the nuances being delivered. The learner may be multi-tasking at the other end, which may be difficult to control by the trainer.

The learning style of the learner cannot be considered while designing e-learning courses: This is because the learners are distant and never come in contact with the programme designers and the trainers of the online course.

Learner may face difficulties due to technological glitches: Certain learning matter or plug-in in the online program may require a level of technology or software which may not exist with the learner. This may make the learner feel helpless and may cause time lag in learning.

Lack of social interaction which a physical classroom can bring to the learner: This contributes to a major part of the learner's understanding of different perspectives on topics. Interaction with others is necessary for exchange of ideas and experiences.

Perceived Anonymity: Although the learner may have access to, or may be presented with, a profile or resume, of the teacher or trainer, and may be able to see the trainer via webcam facility, there is limited access to facets like body language, eye contact, physical presence.

Online learning can have several benefits also: The benefits to online training, have by far and large superseded the shortcomings which are discussed earlier. However continuous improvements, adaptations and customisations are ongoing.

Provides learning opportunities on a continuous basis: Online learning courses are relatively easier to get registered for. These provide the mind food for thought and also help the learner to constantly be engaged with the latest developments in the topic of interests.

Provides convenient learning: The mode of learning is convenient and easy. It is accessible at all places using a personal desktop computer, laptop and today even using palmtops.

It is a self-paced learning method: It provides the learner with learning at his own speed. The learner can spend hours with the learning content and analysing the matter, researching on the topic.

Makes it easier to track the learner's progress: Learner progress and understanding can be monitored via continual online assessments, discussions on topics. The progress can be traced via the click of a button and the students who may need more coaching on the topic can be scheduled for further online sessions.

Can be applied to a diverse area- can be used in education and in corporate:

Online training and learning can be used in a diverse way. It is used to deliver formal education as well as a mode for corporate trainings. It is also used by curious minds as an informal method of exchanging thoughts and ideas, culminating into new learning on a topic. Thought communities and communities of interest have come together on the internet from all over the world. They are focussed, effervescent and passionate about their subject of discussion.

Anonymous polls and chat conversations: Virtual classrooms, webinars have the facilities like unidentified polls which helps gain opinion of the participants. The participants can show their agreement or disagreement towards a topic, without any inhibitions. There is also a facility where all the participants can enter into a chat conversation, with each other and with the trainer.

Multiple facilities and options:Has the option of sharing the screen to show presentation, documents, or a software application. Participants can use VoIP to speak to each other and the trainer. Other facilities like inserting smiley, emoticons during the session can be used by the participants to give on-going feedback to the trainer. The trainer may also receive feedback after the session through the virtual classroom application, which may have a facility to record the students' reactions after the session and prompts the student to provide a feedback.

Provides learning facilities to the workers who are working remotely: For the agents who work remotely, the organisation can provide learning and training facilities of a virtual classroom.

En-Cashing the Benefits of E-Learning:

Broadening Horizons: Online learning today, is not restricted to limited topics. Topics vary from personal ideas and themes, broad areas like management, science, history, mathematics, etc. Online learning is also not constrained for the approach exercised to reach out to individuals. It uses virtual classrooms, online forums, discussion groups, test and assessment submissions, case study methods, etc.

Has a facility like video recording lectures: Online learning not just speeds up learning and facilitates a self-paced learning, it also has facilities of recording sessions of learner and trainer interaction. This can be used as an evidence of study and also can help the learner listen and view the recording at a later date, for a refresher; or help a learner, who has missed the session listen to it.

Saves travel and increases the reach: Online learning saves time and costs of reaching to a place or institution where the training session will be held. It also introduces global standards to globally operating organisations.

Learner Engagement:

Technology can be put to good use by creating reusable content and can reduce cost of delivery for the organisations. It is just a said thing that online learning must be boring. It can be made fun too. At Google, the Googlers-Teaching-Googlers (G2G) program has already offered around 200 courses globally in the in the first half of 2009. Their G2GTV is being developed to feature short videos in which Googlers teach one another about a wide range of topics like Sales, Working, Smarter, Health and Fitness, and Engineering. Similarly, they have resources such as GWhiz, where any Googler across the world can register himself as available for questions/ mentoring on any area of expertise, allowing all other Googlers to consult him/her. This further fosters the concept of Googlers teaching one another.

Web-based learning delivers knowledge to the learner's desk. The knowledge and course materials which are delivered in a physical classroom can be replicated and

put forth on the screen of the learner. The recent advents in the e-learning scenario are increasing use of learning management systems, webinars and virtual classrooms.

Can the solution to this be blended learning? That is the knowledge delivery methods can involve face-to-face as well as online learning, and such other multiple delivery modes. However, these learning methods must be designed in such a way that they complement each other.

Dr. Reddy's Laboratories, the company has its learning webpage on the intranet, which caters to the developmental needs of the employees across the globe. The learning webpage has key features like, information on training programs running in the company, the learning blog which disseminates information and captures information about learner needs, any employee can mention his/her training requirements on the blog. The webpage is also a place where videos are shared on a weekly basis on topics like leaderships, corporate values, trust, sustainability and the old videos are archived. The video recordings feature company board members sharing their experiences, which make the individual employee relate to the topic of interest. The learning webpage also contains archives of books published over the globe to keep the employee abreast with the latest knowledge in their topic of interests.

According to the article in Focus - Education: Online vs. Offline, in the year 2005, IBM has taken a leap in academic initiatives which help plug skill gaps. One of this initiative involves offering remote access to students in United States and Canadian schools to remotely access the program housed at Marist College at Poughkeepsie, thus allowing students to get a hands-on experience to work with mainframe as a part of their computer science degrees. Another initiative in Latin America is to allow students to access via internet to an IBM server allowing them to develop their teaching and research projects without having to own large scale equipments. This is done by establishing a mainframe hub running Linux at the University of Campinas, Sao Paulo, Brazil.

Another article by Rossett (2007) states that new supervisors at IBM turn to Basic Blue (a software) for their development. Basic Blue is a blended learning system, based on online self assessments, vivid e-learning scenarios, an online community and mentor, and workshops. The new supervisors gain knowledge over time through structured learning and coaching experiences that are embedded in the challenges faced on the job.

Technology enabled learning can also occur in a semi-formal or informal manner like while a bunch of executives exchanging their ideas and experiences through the learning portal in their organisation. The medical pharmaceutical sales representative may research on the recent trends of medical problems while waiting to meet a medical practitioner.

Technology has enabled learning without barriers. Today it is possible to have a bunch of people sitting at remote offices share their ideas and knowledge with each other via online meetings. It is also an additional enhanced feature of most systems to record the discussions, which then can be used as learning for others in a similar situation. Systems that support self paced informal learning for an individual in today's times are online communities, e-coaching, blogs, wikis, knowledge bases.

To enhance learner engagement with online courses, and to better their retention of learning, the following tactics can be utilized:

- ✓ Having a robust content tutorial with theoretical framework in place so that the learner has background information to relate to. The content must consist of illustrations wherever possible for the learner to understand the content better.

- ✓ Using case studies and examples during the course of learning wherever possible. With this method learners will have simulated situations and related examples, to analyze and learn a skill.
- ✓ Having interactive learning content where learner can take a quiz, discover and uncover new facts, proactively participate in role-plays, activities with others in the learning process. The content must have FAQs section, and portions for solving misconceptions on the theory.
- ✓ The learning content should have videos and audio attached to enhance learner retention. A video may have demonstrations of the activity or skill in actual or replicated life situations.
- ✓ The learner must have the option of reaching out to the teacher or instructor via convenient modes like email, contact form present on the Learning Management System portal.
- ✓ Multiple ways of assessment like written submissions and oral, face to face presentation of matter.
- ✓ Customization of the learning content to suit the needs of the learner. The trainer must ask and not assume the learner's requirements. This is especially in context of corporate training. The trainer must not plate all ingredients which are in the realm of the trainer. Most of it may not be required by the learner, and this will cause a major disengagement. Make sure that the content has the required matter and the learning style of the learner is also taken into consideration while delivery.
- ✓ Design of the learning should have short-term goals.

Forms of Online Learning and Training:

Certain tools and mediums of online learning help individuals and corporate develop their business networks.

Social Networking – The new way of learning – Social media websites and interfaces have developed to become sources of educational and social learning. Topics of social and community interest and matters relating to social explicit knowledge are shared and discussed.

Peer Review Communities – Groups of individuals form online communities and venture towards online peers and community members with conversation topics of common interest. Conversations begun by an individual on the peer review group are commented and opinionated on by the community members. This forms threads of conversation, which can be reviewed and new knowledge can be developed.

Blogging – Micro blogging is the new way people have resorted to for network building and learning. Implicit knowledge can be made explicit by writing articles on the micro-blogging website on which people are free to like, comment and express their views and rate articles.

Autonomous Searches – All curious individuals and employees, in their thirst for learning and immediate answers to problems, divert themselves towards online searches. Websites like Google, Wikipedia are some places where the search generates meaningful output from its archives.

Understanding the learning styles of the learner is vital:

It is very important to design the learning material and delivery to suit the learning style of the learner. In a virtual setting, however; it is difficult to gauge the learning preference. To engage the learner (or learners from different backgrounds, with different learning styles), it is essential that the trainer diversifies in matter and modes of delivery. Delivery of material should include visual, auditory, kinesthetic

modes. Some material which is too boring and dry in nature, may have to be presented to the learner in an on-the-job learning scenario for it to be effective.

Learning is of Utmost Importance:

HIPO (High Performing Organisations) have associated their existence to continual learning. They have increased learning opportunities, for their employees to learn, outside classroom and in virtual worlds. They ensure a tailored learning experience is given to their employees depending on the requirement.

Companies must include la carte packages in learning models and courses. This involves designing of highly relevant content. Online learning requires a number of mediums of interaction and engagement to make up for the lack of physical interaction. It is important to make the content accessible to learners. Through online tracking system, how the learner uses the content should be trailed. Online learning content designers must analyse data and apply intelligence to make meaning of the tracking done.

Some challenges that are faced in the process are inability to customise the content, not being aware of the role for which the learning is being designed, not knowing the career development path, not knowing what the reporting managers have recommended.

Organisations need to know their learners, their interests, habits. It is indeed difficult to measure formal and informal leaning. But it is essential to know what are we measuring against, the baseline is complex, since the goal of learning is performance.

Conclusion:

E-learning is a powerful tool of giving out of knowledge and information in the educational sector and the corporate world. It has its own rewards and returns on investment. It may sufficiently be utilised for replacing a number of face-to-face training scenarios.

Although, learner engagement is debatable, however; the various factors, elements and findings explored in this research are testimony to having high possibility of learner engagement by thoroughly using all the engaging techniques to e-learning modality.

The measure of level of learner engagement by using the various combinations of factors in e-learning technique is open to further discussion.

Recommendations:

- ✓ Online learning should be such that it must involve the learner. Fresh content and guest instructors lead the learners to have an innovative outlook towards the topic.
- ✓ While running E-learning platforms in the corporate scenario, employees should be encouraged to participate by pitching in with ideas, articles, uploading photos, videos of successful projects, teamwork, etc. This keeps the learner morale high and subsequently a feeling of engagement rests.
- ✓ E-learning should be challenging for the learner. Easy targets and extremely simplified assessments will not lead to engagement. Assessments which test the knowledge of the learner will lead to a sense of accomplishment.
- ✓ Relate to content and assessment to actual work situations which can provide learners with practical understanding and hence may better the chances of retention.
- ✓ Learners should be encouraged to present their understanding in various ways like virtual discussion, holding virtual meetings, role-plays and other innovative methods.

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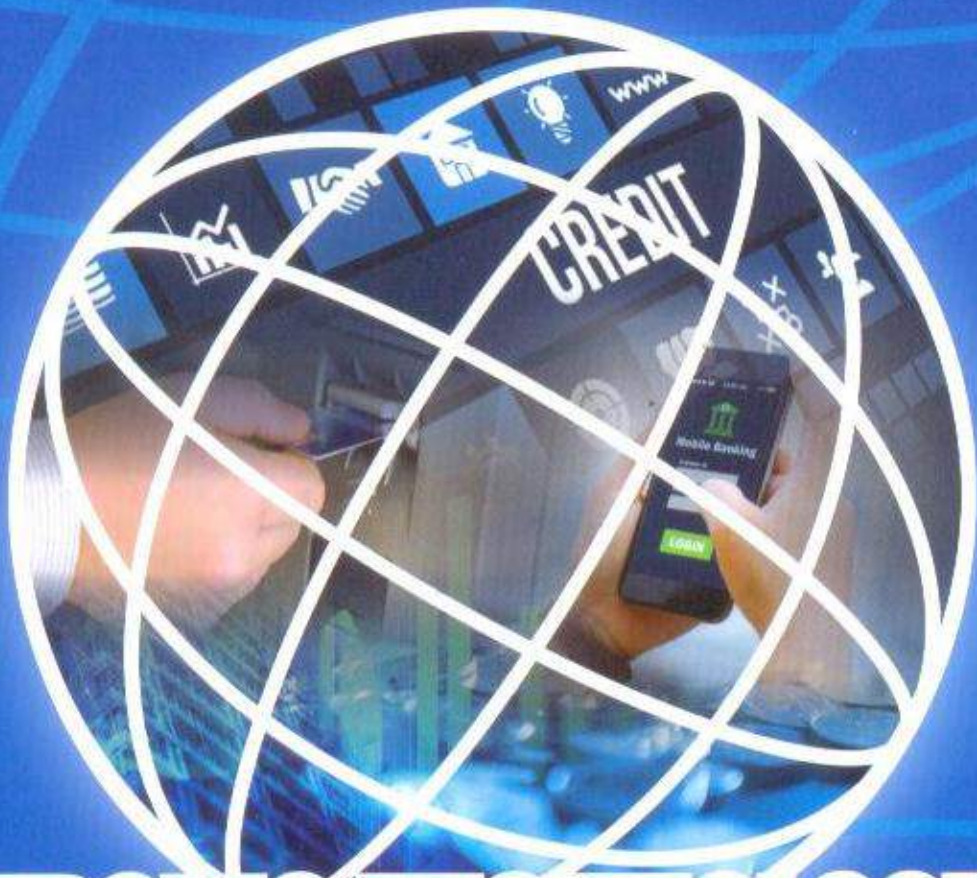
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EMERGING TECHNOLOGICAL CHANGES IN BANKING



 Dr. Sharad Kumar*

13 Attributes of Effective Managers (13 Cs)

In the era of volatile, Uncertain, Complex and Ambiguous (VUCA) business environment and with disruptive players entering into the business with new and innovative solutions, the businesses are becoming more and more vulnerable and challenging. Past success cannot guarantee future success. Organisations can replicate each and every aspect of business input like capital, technology, infrastructure, systems and processes but not the people, as every individual is different with different aptitude, abilities, personality traits, mental, emotional and temperamental frameworks. The managers have to therefore play more strategic role to swiftly adjust to the volatile environment and to adopt innovative approaches to deal with uncertainties. The technical skills learnt at B-schools become obsolete soon. There are certain personality/temperamental traits and behavioural attributes which are required to successfully deal with and manage the challenges. These behavioural attributes have been described in terms of 13 Cs which are required for managing business effectively. These characteristics are universal and do not get obsolete with changing business environment.

The **first** and foremost attribute is effective **communication**. It refers to expressing clearly and understanding others unambiguously. It is the most important inter-personal skill which is required by the manager. An effective communication is an art to lead the team and motivating its members to achieve business goals. It also helps the managers to manage

the conflicts and dealing negotiations.

The **second** important attribute to drive the business in an adverse scenario is **Confidence**. It reflects the self-belief and self-assurance. The great people who have bounced back from the adverse situation had the confidence and belief in their ability to deal with a difficult situation. With their self confidence, they have converted the weakness into the opportunity.

The **third** important attribute which help in driving the business results is **Competence**. It refers to proficiency to perform a job or task. It is the ability to handle a business situation which requires both knowledge and skills. It is required to be updated on a continuous basis. The learning can take place both at conscious and subconscious level with exposure to new ideas and methods.

The **fourth** behavioural attribute required to drive the business successfully is **Commitment** which refers to dedication to duties and responsibilities. A committed person always sees beyond his/her self interest and puts his/her best to achieve the goals.

The **fifth** essential attribute for the success is **Curiosity**. It refers to inquisitiveness to learn to gather new knowledge and develop new skills. The curiosity to learn and know what is happening around always adds to the knowledge about the new idea and the changes in business environment.

The **sixth** attribute which has become essential in the disruptive business environment is **Creativity**.

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It refers to inventing and experimenting new ways and to discover new products and services by leveraging new technologies. Many of the Start-ups have disrupted many well established businesses by bringing new innovative products with this ability.

The **seventh** important attribute the managers should possess is **Collaboration**. It refers to developing synergy, team work and leveraging mutual strengths. A collaborative work environment is more productive. The collaborative environment is created and nurtured by the managers through mutual trust, honesty, empathy, sacrifice and mutual respect.

The **eighth** managerial attribute which is in a great demand is **Courage**. It refers to the Risk-taking ability and fearless attitude. Unless a manager is prepared to take risk, the outcome will be sub-optimal. The fear factor prevents the managers to try new and innovative ways of doing their job.

The **ninth** desired attribute of a manager is **Clarity**. It refers to clarity of thoughts, clarity of goal, clarity of role and self-awareness. The managers are required to minimise the ambiguity and should be clear and focussed to their goal and role. They should be clear about their strengths and limitations.

The **tenth** desirable attribute a manager should possess is **Compassion**. It refers to concern for others, taking care and kindness. A manager has to take care of his colleagues, customers and should be responsible for the society at large by sincerely addressing their needs. He/she should be empathetic to all the stakeholders and should have helpful and service-oriented attitude.

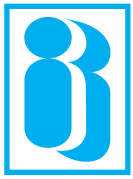
The **eleventh** attribute a manager should possess is being **Candid**. It refers to being frank, truthful and

straight forward. Managers are required to freely and frankly express themselves and share their views. Often, a junior manager does not open up before the seniors and hesitates to express his/her views if it is different or contradictory to the views of the seniors even if he/she has some valuable information/ view.

The **twelfth** attribute of a successful manager is his/her **Conscience**. It refers to ensuring integrity, morality, ethical behaviour and self-control. The conscience and ethical behaviour have become necessary for long-term success and for gaining self-respect and trust. A manager can be role model only if he/she displays conscience behaviour.

Last but not the least, the **thirteenth** attribute of a manager is being **Courteous**. It refers to being well-mannered, respectful and sober. The courteous behaviour makes the personality of the manager attractive and charming. The colleagues, customers and other stakeholders are always happy to interact with such managers.

To sum up, the above-mentioned behavioural attributes of the managers are extremely important for the successful execution of his/her job. The recruiters should look for these attributes in the candidates while selecting a manager. The organisations can also focus on development of these attributes through the training and development programs for the existing managers. The managers who possess these attributes and display in their functioning should be rewarded. These managerial attributes are going to be beneficial for the organisations to drive the results.



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International Banking

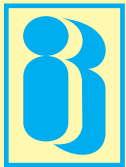


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संस्थान का ध्येय मूलतः शिक्षण, प्रशिक्षण, परीक्षा, परामर्शिता और निरंतर विशेषज्ञता को बढ़ाने वाले कार्यक्रमों के द्वारा सुयोग्य और सक्षम बैंकरों तथा वित्त विशेषज्ञों को विकसित करना है।

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Dr. J. N. Misra
Chief Executive Officer,
IIBF, Mumbai

It gives me great pleasure in informing you that your Institute has completed 90 years of service to the banking & finance industry. The occasion was celebrated in the Institute on 27th April, 2018. Mr. Rajeev Rishi, President IIBF and MD & CEO of Central Bank of India delivered the keynote address in the event. We are publishing his speech as the first article of this issue. In his address, Mr. Rishi emphasised several milestone achievements of the Institute during its long and eventful journey of 90 years.

International banking involving cross border transactions forms an integral and important business vertical in banks. Considering the intricacies and nuances involved and the fact that international banking is a key component in a globalised environment, we thought it to be a right fit to have “International Banking” as the theme for the present issue of Bank Quest.

The first article on the theme is written by Mr. Ashwini Mehra, former Deputy Managing Director, State Bank of India (SBI) & Dr. M. R. Das, former Economist, SBI on “Leashing Overseas Operations of Indian Banks”. In this article, authors have portrayed a clear picture of operations of Indian Banks having International presence.

The second article on the theme is written by Mr. Shrikrishna Mhaskar, former Vice President & Secretary & Officer on Special Duty, Foreign Exchange Dealers Association of India (FEDAI) on “Protectionism – Major challenge to International Trade & Banking”. In this article, Mr. Mhaskar has discussed the concept of Protectionism in International Trade along with its tools, advantages and disadvantages.

The third article on the theme is on “Foreign branches of Indian Banks – Raising Resources for their Operations” by Mr. S. K. Datta, Faculty, Indian Institute of Banking & Finance (IIBF). He has discussed in depth about the operations of foreign branches of Indian banks and composition of resources for foreign branches.

Besides the three articles on the theme, as per our practice, we also carry articles of contemporary interest. The article written by Dr. Sharad Kumar, Dean-Academics and Research, Durgadevi Saraf Institute of Management Studies (DSIMS), Mumbai & Mr. Pravin, Assistant Manager, Axis Bank Ltd. is on “A Comparative Study of Non-Performing Assets in Various Segments of Indian Banks with Special Reference to Priority and Non-Priority Sector Advances”. This article compares the level of NPAs in various Bank Groups viz. Public Sector Banks, Private Sector Banks and Foreign Banks during last 11 years from 2006-07 to 2016-17. The article also provides an analysis of whether the Global Crises during 2008-09 had any impact on NPAs of Banks.

The next article is written by Mr. V. N. Kulkarni, former Deputy General Manager and Principal, Management Development Institute of Bank of India on “Nurturing the MSME Lending”. This article discusses in detail the various schemes available for Micro, Small and Medium Enterprises (MSMEs).

The subsequent article written by Mr. M. G. Kulkarni, Deputy Director, IIBF, is on “Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002 (SARFAESI)— Is Section 13 (3A) Mandatory? Judicial Approach”. The author has discussed various legal aspects of SARFAESI in this article.

The article in Hindi is written by Mr. Subah Singh Yadav, Former Assistant General Manager, Bank of Baroda on “भारत में भुगतान प्रणाली का प्रादुर्भाव एवं विकास”. The author has discussed the development of Payment Systems in India.

We are also carrying a summary of the Macro Research Project 2013-14 of Dr. Partha Ray, Professor of Economics, IIM Calcutta on “Managing Current Account Deficit: Cross Country Experience from Developing Countries”.

I hope that you will enjoy reading this informative issue of Bank Quest. I invite the authors to share their knowledge and contribute articles for upcoming issues of Bank Quest.

Dr. J. N. Misra



IIBF's 90th Foundation Day-President's Address

 **Rajeev Rishi***

I am happy to be amidst all of you today.

I take this opportunity to congratulate all the successful candidates of the VI batch of the Advanced Management Programme (AMP) conducted by IIBF. Before I speak more about the AMP, I take pleasure in announcing that IIBF will be completing 90 years of existence this year. I will briefly share with you some of the important achievements and developments with which, IIBF was associated in the recent past.

Growth of IIBF

A true measurement of IIBF's growth is reflected in its membership position. In 1928, IIBF, then known as the Indian Institute of Bankers (IIB), had 109 ordinary members, 25 associates and 24 fellows. As on 31st March 2018, the Institute had 8,39,974 ordinary members, 476 associates, 310 fellows and 779 Institutional Members.

Brief highlights of important activities of IIBF

Continuing Professional Development

Envisaging that bankers need to enhance their skill sets, IIBF has been stressing on the need for continuing professional development of the banking fraternity. To this end, IIBF delivers a suite of courses covering almost all facets of banking. Its examinations range from certificate courses for the BCs/DRAs, Sub Staff, to specialised courses encompassing the areas of Credit, Treasury, Risk, Compliance Management, International Banking etc. Each of its examinations is backed by a dedicated courseware prepared by subject matter experts. Besides this, the

Institute sponsors research activities (Micro, Macro & Diamond Jubilee), conducts "Member Education Series", "Memorial Lectures" and brings out its well-read publications namely the IIBF Vision and Bank Quest.

Enrolments for different exams

I would now like to share data on the enrolments for the different examinations conducted by IIBF during 2017-18.

Around 465,839 candidates enrolled for the various examinations of the Institute in 2017-18. Thus, around 40% of the total bank staff enrolled for the examinations conducted by the Institute presumably due to the value addition offered.

Capacity Building

In 2016, RBI had mandated acquiring qualifications by bank personnel in the areas of Treasury Operations, Credit Management, Risk Management, Accounts & Audit and Foreign Exchange Operations; before being posted to these departments. IBA, on the advice of RBI, had constituted an expert group to identify reputed institutions whose courses covering the above areas could be accredited. IIBF was represented in the expert group and was one of the institutions whose courses in the areas of Treasury Operations, Credit Management, Risk Management and Foreign Exchange Operations met the requirements. Consequent upon this, IIBF had taken several initiatives for further promoting these courses among the banking fraternity. Notable among

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them was the introduction of the **virtual classroom solution** whereby the candidates could take the mandatory training in their comfort of their home/office. Due to the introduction of the virtual classroom learning, the training costs could be absorbed by IIBF and the courses in Credit Management, Risk Management could be offered to the banks at nominal costs. Owing to these initiatives, the Institute witnessed good enrolments for all the above courses. More than 10,000 candidates enrolled for the capacity building courses during the year.

90th Year Celebrations

Quiz/Bankers Meets/ Outreach Programs

As a part of the Institute's 90th year celebration, an inter-bank quiz competition was organised. This was the first time in the history of IIBF that such a quiz competition was organised. The response was indeed, overwhelming. Nearly 6000 people from different banks in different parts of the country participated in the online round. Six top teams from each of the four zones then participated in the zonal on ground semi-final rounds. The winning team from each zone then competed in the national finale held during January 2018. The team from Reserve Bank of India, was the winner of the national finale. The national finale was telecast on NDTV 24*7. The event was sponsored by SBI, Canara Bank, Union Bank of India and PNB.

Apart from the inter-bank quiz competition, the Institute also organised Bankers' Meets and outreach programs (presentations at various colleges) at Tier II and Tier III cities of the country. Such programs were held at Lucknow, Bhopal, Bhubaneswar, Patna, Hyderabad, Kochi etc.

International Footprints

Global Banking Education Standards Board (GBESTB)

The GBESTB is a *voluntary, industry-led initiative* founded by many of the world's leading banking institutes. It aims to develop clear, internationally

agreed standards for the education of Professional Bankers. These standards will inform the development of national banking education programmes delivered by banking institutes, and others, providing the foundation for high-quality and robust education and qualification of bankers. Ultimately, this should enhance and sustain global standards of ethics and professionalism in banking worldwide.

IIBF is a founder member of the GBESTB. The administrative set-up of the GBESTB comprise of a Global Council, an Executive Committee and a Global Education Standards Committee. CEO, IIBF is the Vice-Chair of the Global Education Standards Committee. This Committee has already developed a draft standard for Ethics Education and Training for Professional Bankers.

Collaboration with Chartered Banker Institute

The Chartered Banker Institute and The Indian Institute of Banking & Finance (IIBF) have signed a ground breaking new Mutual Recognition Agreement.

Under this agreement, "Certified Associates of the Indian Institute of Bankers" (CAIIB) from India will have their qualifications recognised by the Chartered Banker Institute and will be able to become Chartered Bankers by studying the Institute's Professionalism, Ethics & Regulation module, and successfully completing a reflective assignment.

International Consultancies

IIBF has successfully handled consultancy / training assignments for countries like Zambia, Botswana, Papua New Guinea, Nepal, Bhutan, Tanzania, Taiwan etc.

Advanced Management Programme

The Advanced Management Programme is meant for developing and nurturing future leaders of the industry in consonance with the Vision statement of the Institute.

The 1st AMP in the IIBF campus at Mumbai, commenced in January 2013. So far, 5 AMPs have been completed at the Leadership Centre of the Institute.

This programme is unique in as much as while, the principles underlying general management concepts are handled by IIM Calcutta, the areas covering the banking aspects are covered by IIBF. Thus, an AMP candidate has the benefit of receiving the best possible inputs from two institutions in specific areas in which these individual institutions excel.

I am sure that with the knowledge inputs received during the programme, all of you will be able to play your respective roles in your banks in a more efficient manner. What is perhaps also important is that since the world of banking will witness more paradigm shifts, bankers should take advantage of the continuous professional development programmes offered by IIBF and upgrade their skill sets. Besides this, you can also contribute to the research and publication activities of the Institute. This will help you to widen your horizon.

All the best.



Committed to
professional excellence

Indian Institute of Banking & Finance

Winners of Micro Research Papers for the year 2017-18

We thank all the participants of Micro Research Paper Competition for the year 2017-18. The following candidates are selected for prizes:

I Prize

Mr. Raj Kumar Sharma, AGM & Faculty, State Bank Foundation Institute – Chetana, Indore.

Topic: Training needs of future bankers

II Prize

Mr. Vishal Daga, Officer, Allahabad Bank, Mumbai.

Topic: Aadhaar Enabled Lending System to Boost Micro Finance and Consumer Durable Loans

III Prize

Mr. Vijosh Kumar S. V., Branch Manager, Oriental Bank of Commerce, Mahbubnagar.

Topic: Challenges and Opportunities of Peer to Peer Lending

We congratulate all the prize winners.

Mumbai

Director (Academics)



Leasing Overseas Operations of Indian Banks



Ashwini Mehra*

Dr. M. R. Das**

Should Indian Banks have so many foreign offices? The question is pertinent today, especially in view of the Government’s January advisory to Public Sector Banks (PSBs) to “rationalise their overseas operations”. The advisory becomes compelling after the recent discovery of some irregular loan-related transactions conducted via some overseas offices of some PSBs. Historically, the eighties had witnessed huge overseas loan losses which had led Reserve Bank of India (RBI) in 1985 to institute strict control and monitoring mechanisms for foreign offices.

Presence Mode

At March-end 2017, the Indian Banks had 186 branches abroad – 166 by 12 PSBs and 20 by three Private Banks (PVTBs). Traditionally, three banks, namely, Bank of Baroda, Bank of India and State Bank of India among PSBs and ICICI Bank among PVTBs have remained dominant. However, during the last decade, the yearly branch network expansion by both the groups declined indicating inadequate businesses and/or consolidation of existing operations.

The distribution of branches across the 32 countries of presence was skewed; 92/186 branches, or almost half were in five countries: UK (32), Hong Kong (17), Singapore (16), UAE (16) and Sri Lanka (11). The former four figured among India’s top 25 trading partners, and together, the five commanded 16.4% of the total trade and 22.1% of the trade with top 25 countries (2016-17).

Other modes of presence include via Subsidiaries, Representative Offices, Joint Venture Banks and

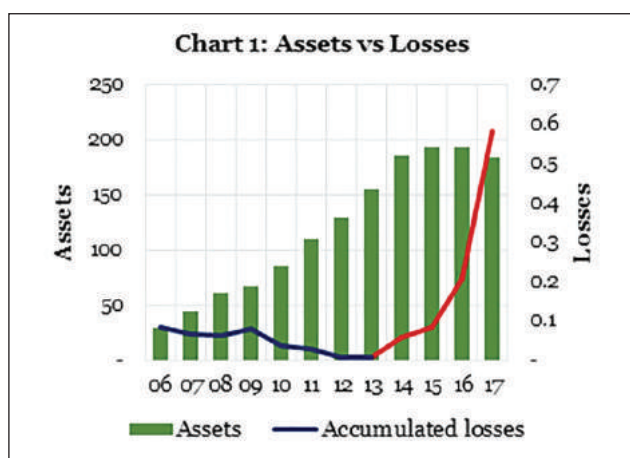
Other Offices (marketing/sub-offices/remittance centres). At March-end 2017, PSBs and PVTBs had 102 and 21 such offices respectively.

Business

According to the RBI data covering 189 offices of 19 banks, the combined balance sheet size stood at about USD 184 billion at March-end 2017. It multiplied 6.6 times during 2006-15 but, subsequently shrank by five percent during 2015-17.

The liabilities principally included customer deposits, inter-bank borrowings and other debt instruments accounting for 26.7%, 46.6% and 11.5% of the total respectively. Customer credit and inter-bank placements mostly comprised assets - 69.2% and 18.0% of the total respectively.

Besides deposits, borrowings were utilized for loans; while the credit-deposit ratio was 259.7%, credit-(deposit + borrowings) ratio was 94.4%.



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Accumulated losses of the foreign offices grew exponentially, 2014 onwards, with a trend growth rate of nearly 78.0% (red marked in Chart 1). The losses were exorbitant in 2016 and 2017.

Bank balance sheets revealed that, lately, the overseas asset quality deteriorated (Table 1). Productivity of assets remained unequivocally low; it was stagnant in respect of PSBs whereas PVTBs showed marginal increases.

Table 1: Assets Quality

Ratios to Total Assets	PSBs (12)			PVTBs (3)		
	14-15	15-16	16-17	14-15	15-16	16-17
GNPA*	1.3%	4.0%	4.5%	0.2%	0.5%	2.8%
Revenue	2.9% (2.9%)	3.0% (3.1%)	2.9% (3.0%)	4.5% (4.5%)	4.8% (4.9%)	5.2% (5.6%)

*ICICI Bank excluded as the relative data not available. Brackets gives the ratio to 'performing' assets.

Subject to minor accounting adjustments, revenue from overseas operations contributed an estimated five percent to the total income of the banks concerned during 2014-15 to 2016-17, with 2016-17 witnessing large fall.

Determinants of Overseas Banking

Basically, two principles govern a bank's overseas operations: (a) available banking opportunities and (b) the classical 'comparative advantages' principle.

About (a), "follow-the-customer" provides the first motivation. The customers include (i) traders on both sides who require several trade-related intermediary services and (ii) home country communities who need two-way remittance facilities.

Coming to (i), India's foreign trade has been sluggish over time; during 2012-13 to 2016-17, it declined by 4.5%. India's share in world trade, which is nominal, reduced from 2.28% to 2.20%; trade with the five countries which house half of the Indian Bank Branches (as mentioned earlier) declined by 5.6%,

and their share in India's total trade fell by 78 bps; and export credit by all scheduled commercial banks rose by mere 0.6% during the above-mentioned period. Although the world trade scenario has improved recently, which is reflected in India's trade increasing by 16.1% (YoY) in 2017-18, the future is being threatened by the emerging protectionist trends bordering on trade war and the Brexit uncertainty. The IMF WEO (April 2018) projects world trade volume to shrink to 4.7% in 2019 from 5.1% in 2018. Additionally, for the Indian Banks, conservatism will

rule trade finance in near future.

About (ii), no doubt, India has been the topmost destination for remittances in recent years; however, these turned sluggish in 2015 and 2016. As per the World Bank data, remittances from five major Gulf countries (i.e., Kuwait, Oman, Qatar, Saudi Arabia and UAE) to India peaked at USD 35.5 billion in 2013 [CAGR (2010-13): 12.5%] but, fell to USD 33.7 billion in 2016 [CAGR (2013-16): -1.7%]. Prolonged geopolitical tensions coupled with internal fiscal policy changes precipitated this. Although the World Bank sounds optimistic about 2017, it won't be much different. Moreover, with electronification of remittances and consequent lowering of costs thereof, many physical set-ups, which entail high cost, will not be necessary in future.

About 'comparative advantages' of the Indian banks in the overseas markets, the latter is dominated by MNC banks endowed with enormous capital, highly diversified and modern financial products, superior technology, strong global connectivity, better global

image and trust, efficient systems and procedures, and high capital and labor efficiency. The Indian banks hardly possess these sinews.

Conclusion

With capital, labour and technology becoming increasingly globally mobile, the Indian Banks can easily conduct their global businesses from home through strategic and specific collaborations with the MNC banks many of which operate in

India. Alternatively, banks can centralize their global operations in a few global financial centers depending on destination countries. Within India, the Gujarat International Finance Tec-City provides opportunities. These modes will save considerable direct and indirect monetary costs besides the onus of complying with very stringent and increasing number of cross-border regulatory and supervisory norms (mainly capital-related) and processes.



Approaches to Capital Account Liberalisation: OECD and IMF

Capital flows can be viewed as trade in assets that allows international risk sharing. As future consumption can be bought through such trade by postponing current consumption or vice versa, it allows economic entities to smooth consumption inter-temporally (Lewis and Liu 2015). However, capital flows are prone to sudden surges, stops and even reversals and, therefore, are not an unmitigated blessing. Bhagwati (1998) argued that claims of enormous benefits from free capital mobility across borders were not persuasive. In this backdrop, it would be of interest to look at the approaches of the two main international organisations dealing with Capital Account Liberalisation (CAL), viz., the OECD and the IMF.

OECD's views are reflected in its two codes introduced in 1961, viz., the Code on Liberalisation of Capital Movements (generally known as the OECD Code) and the Code of Liberalisation of Current Invisible Operations. The codes aim at encouraging members to progressively remove barriers to capital movements in quest for faster growth. In 1992, short-term capital movements were covered under the code, thus limiting the scope for Capital Flow Management measures (CFMs). In 2002, restrictions on overseas portfolio investment were made untenable under the code.

The IMF's approach to CAL has evolved over a period of time. Before the onset of the Asian financial crisis, there were moves to recognise capital account convertibility as an explicit goal. However, the overwhelming evidence from the Asian financial crisis forced IMF to backtrack. Accordingly, gradualism, with

some CFMs and Macroprudential measures (MPMs), were deemed as a legitimate policy for emerging markets to exercise. The IMF's Independent Evaluation Office (IEO) also noted in 2015 that empirical literature was unable to establish a robust positive relationship between CAL and growth. Cross-border spill-overs of capital flows have since increased and the G-20 countries were urged to take them on board while dealing with national policies.

From an emerging market perspective, the IMF's approach appears prudent and pragmatic. It also stands vindicated in the wake of the global financial crisis. While the OECD Code may have served the advanced economies, emerging markets have demanded more flexibility in the codes as they do not sufficiently provide for CFMs or MPMs. India has been of the view that adherence to the OECD code should remain a voluntary process, enabling members to decide on its appropriateness in the context of evolving macro-financial conditions. While the OECD codes are currently under revision, G-20 has asked the IMF and the OECD to converge their views, especially with respect to MPMs.

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Source: RBI Annual Report, 2016 -17



Protectionism – Major challenge to International Trade & Banking

 **Shrikrishna Mhaskar***

International Trade is the mainstay of International Banking across the globe. Cross border trade takes place between various countries working on demand supply forces. Though the physical aspect of trade is taken care of by the regulations of respective countries, the financial aspect is taken care of by Banking System across the globe. Banking Industry exists in respective country developed and monitored by Central Banks. Their business is controlled within and outside the countries with the help of prudential norms. International existence of various banks has not only given meaningful dimension to their business, but also, has helped the seamless flow of financial aspect of trade. The physical aspect of trade deals with actual movement of goods and services. The financial implication of trade is by way of funds flow, exchange rates, financing the activity and correspondent banking.

International trade and banking, some basics:

International trade and banking go hand in hand on the global platform with the help of various products and services. The traders may not ever meet across the tables, but doesn't find it as an obstacle in the business. Trust, Monopolistic situation, Demand-Supply forces are some of the impacting factors on the flow of business which are taken care of mutually. However, the banking system works as a link between the traders, regulators and various stake holders in the business. Banking business is well-knit, system driven and highly regulated by norms enabling the trade flows to establish, flourish and put all in "win win" situation. The development of correspondent

banking has paved way to various financial products and services which are used by both – market makers and market users.

Protectionism – is it a need or otherwise?

It is a concept brought into reality as required by various countries with two objectives, one to control the deterioration of domestic trade and two to write a growth story of economy in a different manner. When any country resorts to protect its economy with either of these objectives, it either disallows entry into the country or exit from the country of various things which used to take place as a normal course of business. The protectionism may have multiple aspects as regards the needs and implications. Some of the major reasons for resorting to protectionism can be summarized as under:

- To protect the Sunrise Industries for obvious reasons, considering the technology adapted by them and enabling them to stand in competition locally and globally.
- To protect the sunset Industries which are in declining trend and need some care. The world has witnessed the same with UK had done with ship building in 1950, car production in 1970 and steel industry in 1990.
- To protect strategic industries which are important from country's perspective.
- To protect industries which threatens the job opportunities for local talent. The present reference is to Trump's policy of Visa to outsiders.

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- Sometimes the protection is resorted to due to political reasons.

Some Important tools of protectionism

While resorting to protectionism various tools are used which can be summarized as under:

- **Tariffs** – They are levied on the imported products to protect the domestic products and ensure steady growth. The tariffs are levied on some products either permanently or for specific period. The percentage of duties is varied to discourage imports. The famous example of this is imposition of tariff by US (Smoot-Hawley Tariff of 1930) on agriculture products imported from Europe. Before getting approval from Congress, many items were under import tariff leading to Tariff War due to retaliation by many countries. This further aggravated the problem of great depression of 1930.
- **Quotas** – The imports are allowed with specific quantities though not totally banned. Due to limits on physical quantity of goods the supply side is restricted and leads to increase in demand for domestic products.
- **Subsidy** – Under this mechanism government makes payments to individuals or firms for the production or consumption of particular goods or services. Subsidies reduce the cost of production or increase the benefit of consumption, and therefore, lead to a greater equilibrium, quantity in the market for the subsidized good. This tool gives fair amount of competitiveness to export intensive economies. However, this gave an adverse impact on US agriculture produce in 1930 leading to reduced farm products hampering supply side. This resulted into to increase in prices and made the products very expensive.
- **Free Trade Agreements** - This is indirect manner of protecting domestic trade. The free trade agreements reduce the imbalance and can get rid of evil effects of directly protecting the domestic industries.

Impacts of Protectionism

The objectives of protectionism are obvious and clear and should bring desired results. The analysis shows the impact in either way – advantages and disadvantages.

Advantages

- The first advantage of protectionism can be experienced to those industries which are new in the country. These new industries can be protected from international competition and get time to stabilize their line of activity and make them competitive. However, in order to get benefits of competitiveness they need to establish their edge over others on three fronts – what benefits their products offer against others, what is the target market they need to focus and indentifying the “real competition” they have to face.
- The second advantage is increase in jobs for short duration, which allows domestic companies to hire more talent. Eventually, this puts pressure on the domestic job market leading to unrealistic competition. The benefits of job creations are lost once other countries also resort to protectionism.
- The third advantage emerges as an increase in demand for domestic products due to reduced imports as an effect of tariff/quotas. As a result of increased demand, the supply side gets stressed which leads to compromise with quality, delays in supplies and increased prices. The increased prices sometimes offset the benefit of imposing tariffs as imported products become more cost effective.

Disadvantages

- As a long term impact of protectionism, the local industries become weak. In absence of competition, they start ignoring innovation and new developments, resulting into deterioration in quality also the products become costlier than the imported products.
- When the job market is protected the capacity

to outsource them starts reducing in absence of competition. The expenditure on education and skill development is reduced eventually.

- In the long run it leads to trade war between the countries and adversely impacts the international trade.

Why this issue needs to be addressed?

The recent times policies of some countries have jeopardized International Trade & Banking to great extent. It has posed challenges to both, developed and emerging economies without exception. Some recent developments globally with respect to economical turmoil and political ideology have invited attention of all.

- The decision of UK to maintain its independent entity due to voting for Brexit can be called as a starting point. This decision is at par with protectionism though not directly declared so. Initially, it must have been treated as a decision of “Democratic Prudence” can prove otherwise eventually. When one country exits, alternately, it leads to “no entry” by others as a natural reaction, leaving the same impacts of “protectionism retaliation”. As a part of EU the common currency was not accepted by UK maintaining its independence. However, with exit from EU the adverse impacts with respect to employment, movement of skills and actual movement of goods and services will certainly be impacted. A study of steel industry in UK is done by Richard Selby who is Director at Pro Steel Engineering, a steel specialist firm delivering construction, installation and project management at sites including the Olympic Stadium, Crossrail Bond Street and Birmingham New Street. With the increasing protectionism the international trade would be largely disrupted because of high consumption of steel in UK than it produces. During 2015, UK produced 11 million of steel compared to china’s production of 804 million tons. If UK wants to

focus on infrastructural development, it needs to increase domestic production as a policy in view of probable impacts of Brexit.

- China, one of the biggest global economies, has resorted to liberalization in 1978 to accelerate its growth. In the recent speech at World Economic Forum, Davos, Chinese President Xi Jinping has advocated greater integration amongst world economies. In this era of protectionism China is trying to emerge as a supporter of free trade and open market. It may look as a welcome stance but, is away from the history of Chinese Liberalization. Right from beginning China has liberalized selectively taking a piece-meal approach. It has opened foreign investors only those industries which were critical to growth and development of economy. The focus of liberalization has been to enhance exports by various subsidies and exempting duties on imports. China generally takes a different perspective on globalisation and free trade by collaborating with and opening up to countries which could benefit it. According to the Information Technology and Innovation Foundation's Index which ranks countries after assessing the impact of their economic and trade policies on global innovation system, China ranks 44th out of 56 countries. This indicates that China behaves like a typical 'innovation mercantilist' by adopting policies such as forced localisation to trade and investment, export subsidies, or failure to protect intellectual property rights.
- India as an emerging economy has resorted to liberalization in the last decade of 20th century by making some radical changes in its policies, regulations and foreign exchange market in general. The wheel of liberalization has been kept moving with its own speed irrespective of political ideologies ruling the country. Interestingly, the foundation of liberalization was not laid due to any “political will” but as an inevitable measure for existence. In the last decade, India is trying

to attract direct investments in various sectors selectively and also allowing flow of funds out of country. The story of Indian growth has been well appreciated on various economic forums irrespective of various obstacles on tax amendments. The concept of “Make in India” is treated an answer and question for global protectionism.

Present challenges

“Protectionism” is no longer a concept, but has put serious threat to International Trade and Banking. The issue today is not to fight for or against its implementation, but to minimize the direct and indirect impacts of it. They can be summarized as under:

- Open and seamless international trade has proved its merits time and again by improving the standard of living of lot many, creating new opportunities of growth and providing quality products at low costs. However, the protectionism certainly poses challenges to internal economy and face global challenges.
- International banking is under tremendous pressure of “Compliances” while handling normal trade transactions. Trade has become a conduit for money laundering, challenging credibility of banking system of many countries. The banking system though high-tech has proved its limitations time and again.
- The protectionism is camouflaged in many ways which we are treating as normal business model. The capital flows across the globe, for tangible and intangible purposes are difficult to monitor and control. Trade embargos, countries under sanction, FATF non-compliant countries and other quantitative restrictions are not directly declared under protectionism policies.
- Trade not happening between countries due to war, encroachments, creating military base, threat of nuclear powers and sudden change in political ideology are adding fuel to passive international trade and banking.

Protectionism, International Trade and Banking – path ahead

The issue can't be removed in totality as it is a policy by choice. The path ahead is not simple or with some handy solutions, but is going to be more challenging. Some academic solutions can be summarized as under:

- The trend can be reversed by Political will only, as it doesn't look as economic need for most of the developed countries. This argument goes well especially with those countries who have tried to cash this issue to gain political power.
- It may not necessarily be an effective tool to protect “Domestic Jobs” as the data is not supportive.
- Protecting Domestic entities from external competition may not prove effective after some time as it eventually weakens them as they may not have proper caliber to grow. Their capacity to stand in competition is important than giving financial concessions.
- All those using this tool need to understand that it is a double edged weapon proving detrimental by becoming “reactive” than “proactive”.
- Retaliation is an antidote for protectionism can be a good argument but, does not justify mathematical equation – “minus – minus is plus”. Actually it gives cascading negative impacts.
- Better economic education is necessary to control abuse of political power. “Curbing economic power of others is not going to enhance our political power” is the mantra of time. Earliest the better – all should follow it.
- Last but not the least – Beware of so called free trade advocates who believe unilateral freedom and talk about multilateral freedom.





S. K. Datta*

Foreign Branches Of Indian Banks – Raising Resources For Their Operations

The objective of the article is to enable readers to understand as to in what ways raising resources for operations of foreign branches of Indian Banks is different from raising resources for their operations in India.

I. BACKGROUND

Indian Banks have had presence overseas, now for almost a century. The first foreign branch of an Indian Bank, viz., State Bank of India (erstwhile Imperial Bank of India) opened a branch in London in January 1921. Some other early overseas movers were Indian Overseas Bank (Rangoon in 1937), Bank of India (London in 1946) and Bank of Baroda (Mombasa and Kampala in 1953). Although for some Banks, viz., Bank of Baroda and Bank of India, overseas business (deposits and advances) constitutes a sizeable proportion of their overall business, for the Indian Banks as a sector, overseas business is quite small.

This can be seen in the Table 1 below, all figures as on 31st March 2017.

Table - 1

Bank / Sector	Overseas business (₹ 000s crs.)	Overall business (₹ 000s crs.)	Overseas business as proportion to Overall business (%)
Bank of Baroda ¹	267	985	27.11%
Bank of India ²	249	934	26.66%
All Indian Banks	1,453 ³	18,432 ⁴	7.88%

Although the overall proportion of overseas business was 7.88%, for some Banks, overseas business exceeded 25% of their overall business. Moreover, the total overseas business of Indian Banks at ₹1,453,000 crores was a fairly big number and warrants focus.

The geographical extent of overseas presence of Indian Banks has also been quite high. The presence is four forms, viz., branches, subsidiaries, representative offices and joint ventures. Of these, it is the branches and subsidiaries which bear the brunt of the business, since while many joint ventures do not constitute member banks from India alone, representative offices do not handle any banking transactions.

The presence of Indian Banks through branches and subsidiaries, as on 31st March 2017, was as depicted in Table 2.

Table - 2

Type of overseas office	Number	Business (₹000s cr.)
Branches of the Banks ³	192	1,453
Branches of Subsidiaries ³	325	127

Although the number of foreign branches of Indian Banks are fewer than those of its overseas subsidiaries, the business of the former are much larger (over 11 times). The reason for this is that in most of the larger foreign centers like USA, Singapore, UAE, Hong Kong and, to some extent, UK, Indian Banks are present in the form of branches. However, in many of the recently penetrated centers, the presence is through the vehicle of subsidiaries, primarily on account of

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the local regulators insistence for adoption of the subsidiary model – rather than the branch model. Our discussion will, therefore, focus on business handled through foreign branches, rather than any other vehicle of overseas presence of Indian Banks.

II. PECULARITIES OF FOREIGN BRANCHES

There is a fundamental difference between the functioning of a foreign branch and that of a domestic branch. While no domestic branch has to manage its assets and liabilities, most foreign branches have to do that. In fact, a large number of foreign branches operate like mini-banks because they have to manage their own treasuries.

It has to be appreciated that Indian Banks are strong players in India and, hence, they are able to mobilize most of their resources through customer (retail) deposits. They are able to do this because of their deeply rooted background, their long association with the local public and the strong reputation that they have (often with tacit sovereign support). This, however and unfortunately, is not true for foreign branches of Indian Banks operating overseas. They operate in alien territories (notwithstanding the presence of a large non-resident Indian diaspora), as small units (compared to local high street banks) and with a limited bouquet of products supported, often, with sub-optimal technology. Consequently, the potential of foreign branches in garnering a robust retail deposit base is low.

This can be seen in the proportion of deposits to borrowings (including other debt instruments) by Indian Banks in India, as against their foreign branches (Table 3).

TABLE - 3

Type of Institution	Position as on	Deposits	Borrowings / Other Debt Instruments	Deposits / Borrowings
Indian banks in India (₹ 000s cr.) ⁴	31 st March 2017	106,484	12,102	8.80
Foreign branches of Indian banks (USD Mn.) ⁵	31 st Dec 2016	48,988	106,872	0.44

Whereas the deposits of Indian Banks in India was 8.80 times their borrowings, that of the foreign branches of Indian Banks was only 0.44 times their borrowings.

III. COMPOSITION OF RESOURCES FOR FOREIGN BRANCHES

The total advances and investments of foreign branches of Indian Banks, as on 31/12/2016, was USD 139,513 mn⁵. These entities need resources to fund the assets.

The sources of funding / liabilities structure of foreign branches sector of Indian Banks, as on 31st Dec 2016, is shown in Table 4.

Table – 4⁵

Type of Liability	Amount (USD Mn)	Proportion to Total (%)
HO Funds	10,284	5.60
Customer Deposits	48,988	26.65
Inter-branch Borrowings	13,135	7.15
Interbank Borrowings	85,720	46.64
Other Debt Instruments	21,153	11.51
Other Liabilities	4,500	2.45
Total	183,780	100.00

IV. SHORT TERM FUNDING

As seen from earlier paragraphs, customer deposits form a major source of funds for banks in India. However, this is not so for the foreign branches. Reasons for paucity of customer deposits, compared to borrowings are many. These include:

- Branches shying away from retail business in a

big way, owing to the very stringent regulations governing retail business overseas, including KYC/AML regulations. This is especially in developed countries.

- Absence of large network of foreign branches of Indian Banks in most overseas countries.
- Restricted number of retail products that foreign branches can, and do, offer – although some centers offer structured deposits consisting of embedded currency options.
- Lesser developed technology platforms, compared to those of local banks.

Moreover, a large proportion of customer deposits mobilized is not in excess of 3 months and therefore, whatever core deposits are available, they are of very short tenure and need to be continually renewed.

Consequently, foreign branches are unable to leverage upon this very lucrative avenue of resources, which can be cheap as well as can lend stability to the balance sheet by lowering of concentration risk. The paucity of customer deposits is, especially, visible in developed centers where local banks function with hi-tech architectures. In lesser developed regions, however, like some African and Asian countries, our foreign branches are able to fare better, taking advantage of the banking dynamics being more akin to those in India.

Resultantly, foreign branches have to resort more to short-term money market funds and this gives a degree of volatility to their balance sheets.

Money market (interbank) borrowings are characteristically short term in nature, majorly under 3 months' tenure. These could be by way of, either, plain vanilla borrowing (overnight to maximum tenure available) or under reciprocal Lines of Credit. While reciprocal Lines of Credit are desirable owing to their relative certainty as a funding support, they are becoming increasingly scarce with many of the foreign banks shying away from such products.

Foreign branches of some Indian Banks, located in major currency areas like USD, EUR, GBP and JPY, have been able to source inter-branch and interbank deposits by entering into the correspondent banking business and, thereby, opening nostro accounts of their branches, as well as some smaller Indian Banks. Although prima facie, such entities cannot match the strength of leading foreign correspondent banks, foreign branches of Indian Banks can leverage on their familiarity with their own Indian branches, as well as smaller Indian Banks in order to garner their nostro accounts, and thereby, build up their inter-branch / interbank deposit current accounts.

V. MEDIUM AND LONG TERM RESOURCES

So far, all types of Liabilities which has been discussed, are short term in nature. However, the assets of the foreign branches, other than those related to Trade Finance, can be of long duration, these would include ECBs, participation in syndicated loans as well as investments. Such assets need to be supported by long term liabilities, failing which the asset-liability profile of the branches would become very adverse.

For raising medium and long term funds for their foreign branches, most Indian Banks, through the Head Office, resort to two modes:

- Medium Term Notes
- Syndicated Loans

Medium Terms Notes (MTN) are in the form of bonds, mostly on fixed rate of interest. The bonds are normally for tenors of 5 to 10 years, with the lower end of the maturity being more common. These bonds are available for foreign institutional and individual investors to subscribe to and commonly listed in Singapore. Most of the bonds are issued under Regulation-S (exemption S under the Securities Act of 1933) called "Reg S bonds" under which domestic US investors are not permitted to invest. In the less common and costlier type of Bond issuance, 144A bonds (issued under Rule 144A of Securities and Exchange Commission), US domestic investors are

also permitted to invest. These bonds are subject to more stringent legal compliances and are, therefore, costlier to issue. However, the geographical spread of investors being larger (since US investors can also invest), their market is deeper which, to some extent, goes to reduce the pricing of the instruments. MTNs are mostly issued in US Dollars, and being fixed rate instruments, there is a need to hedge the interest rate liability by entering into a market Interest Rate Swap.

Indian Banks also raise medium term resources for their foreign branches by borrowing through syndicated loans. Normally, the loan size is smaller than a bond issue size and the maturity of loan is 3 years as against 5 to 5.5 years for bonds. Indian Banks have been successful in raising funds through syndicated loans from banks in Gulf countries and S E Asian territories like Singapore, Taiwan and Hong

Kong. While bonds are generally issued on fixed rate basis, syndicated loans are on floating rate basis and hence, do not required to be hedged through interest rate swaps.

VI. REFERENCES

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- 3 RBI's Survey on International Trade in Banking Services: 2016-17
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BANK QUEST THEMES FOR COMING ISSUES

The themes for next issues of "Bank Quest" are identified as:

- Risk Management: July – September, 2018
- Micro Research Papers 2018: October – December, 2018
- Mutual Funds: January – March, 2019
- Ethics & Corporate Governance in Banks: April – June, 2019
- Emerging technological changes in Banking: July – September, 2019



A Comparative Study of Non-Performing Assets in Various Segments of Indian Banks with Special Reference to Priority and Non-Priority Sector Advances

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 Pravin Shukla**

ABSTRACT

The study compares the level of NPAs in various Bank Groups viz. Public Sector Banks, Private Sector Banks and Foreign Banks during last 11 years from 2006-07 to 2016-17. It also analyzes whether the Global Crises during 2008-09 had any impact on NPAs of different categories of Banks. The study also compares the bank-group wise NPAs between Priority and Non-Priority sectors during 2012-13 to 2016-17. It also tries to assess the impact of the initiatives taken by RBI for cleaning of Balance Sheets of banks on NPAs during 2015-16 and 2016-17. The study reveals that the level of Gross NPAs during the first five years under study i.e. upto 2010-11 remained in a close range of 2.0 to 3.0 percent of Gross Advances for all categories of banks but, the NPAs of Public Sector banks have grown substantially in subsequent years. The NPAs have jumped to the level of 11.7 percent in 2016-17 mainly due to very high NPAs of Nationalized Banks. The NPAs of Private Sector Banks have grown in a very narrow range. The impact of global economic crises has not impacted the domestic banks perhaps due to their low global exposure. However, the impact was significantly felt on Foreign Banks as it has doubled from 2007-08 to 2008-09 i.e. from pre-crisis to post crisis and remained more or less at the same level. It is also interesting to note that the NPAs of non-priority sectors of Public Sector Banks were lower compared to priority sector advances till 2014-15 but, have jumped significantly in 2015-16 and 2016-17. This implies that the NPAs of non-priority sectors which were under reported have come to the surface in

the process of cleaning the balance sheets of public sector banks. The NPAs of private sector banks for Priority Sector advances remained significantly lower compared to Non-Priority Sector advances during the period of study (2012-13 to 2016-17) which did not exceed beyond 2% of gross advances throughout.

INTRODUCTION

Banks play an extremely significant role in the growth of trade and commerce. The banking activities in India are regulated by the Banking Regulations (BR) Act, 1949. Under Section 5(b) of the Banking Regulations BR Act, 1949, "Banking means, the accepting, for the purpose of lending or investment, of deposits of money from the public, repayable on demand or otherwise, and withdrawal by cheque, draft, order or otherwise". Thus, the banks play a pivotal role as an intermediary between the savers of money and the users of money for various productive purposes. It helps in accelerating economic activities to benefit economic growth of the country. The money so received by the banks from the savers creates the liability on the banks whereas the money advanced or invested forms the assets of the banks. The banks lend and invest in a most prudent manner to ensure that their assets maintain their value to meet their liabilities at any point of time. The erosion of value of assets creates non-performing assets of the banks.

Non-Performing Assets

Non Performing Assets (NPAs) are defined as advances where payment of interest or repayment of installment of principal (in case of term loans) or

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The views expressed in this article are their own

both remains unpaid for a certain period. In India, the definition of NPAs has changed over time. According to the Narasimham Committee Report (1991), those assets (advances, bills discounted, overdrafts, cash credit etc.) for which the interest remains due for a period of two quarters (180 days) should be considered as NPAs. With a view to moving towards international best practices and to ensure greater transparency, Reserve Bank of India has prescribed adoption of '90 days' overdue' norm for identification of NPAs, from the year ending March 31, 2004. Accordingly, with effect from March 31, 2004, a Non-Performing Asset (NPA) is a loan or an advance where the interest and/or installment of principal remain overdue for a period of more than 90 days in respect of a loan or advance. NPAs are the primary indicators of credit risk and affect the profitability of banks.

The non-performing assets have been classified into the following three categories based on the period for which the asset has remained non-performing and the realizability of the dues:

1. Sub-standard assets: a sub-standard asset is one which has been classified as NPA for a period not exceeding 12 months.
2. Doubtful Assets: a doubtful asset is one which has remained NPA for a period exceeding 12 months.
3. Loss assets: where loss has been identified by the bank, internal or external auditor or central bank inspectors. But, the amount has not been written off, wholly or partly. Such assets are assumed to be non-recoverable.

Reasons for Occurrence of NPAs

NPAs result from what are termed as "Bad Loans" or defaults. Default, in financial parlance, is the failure to meet financial obligations, say non-payment of a loan installment. These loans can occur mainly due to usual banking operations/bad lending practices or inadequate loan appraisal process. It may also occur due to any economic crises which erodes

the value of assets or bad management policies or inadequate risk management procedures and so on.

The Problems caused by NPAs

NPAs do not just reflect badly in a bank's books of account, they adversely impact the country's economy as well. The repercussions of NPAs are vast and serious viz. (i) depositors may not get rightful returns; (ii) banks may begin charging higher interest rates on some products to compensate non-performing loan losses; (iii) bank's shareholders' returns are lowered and their capital may be eroded; (iii) bad loans imply redirecting of funds from good projects to bad ones.

Ultimately, the economy suffers due to loss of good projects and failure of bad investments; when banks do not get loan repayment or interest payments, liquidity problems may also arise.

Priority Sector Lending

The nationalisation of banks in 1969 was done with the intention to direct a significant proportion of credit to the sectors and activities which are crucial to the economy. Such economically significant sectors and activities were classified as priority sectors. The overall objective of priority sector lending programme is to ensure that adequate institutional credit flows into some of the vulnerable sectors of the economy, which may not be attractive for the banks from the point of view of profitability.

Priority sector was first properly defined in 1972, after the National Credit Council emphasized that there should be a larger involvement of the commercial banks in extending credit to the crucial sectors of national importance to boost the economic development as per the plans and priorities. Keeping these objectives, the K S Krishnaswamy Committee defined the priority sectors. As per RBI circular dated July 7, 2016, there are at present eight broad categories of the Priority Sector Lending viz. (1) Agriculture (2) Micro, Small and Medium Enterprises (3) Export Credit (4) Education (5) Housing (6) Social

Infrastructure (7) Renewable Energy (8) Others. The details of coverage in these categories are given in the Master Circular of RBI July 1, 2015 on Priority Sector Lending –Targets and Classification. The targets and sub-targets set under priority sector lending for all scheduled commercial banks operating in India are also given in RBI circular dated July 1, 2015 which are as follows:

Sector and its norms are not comparable with domestic banks. When Dr. Raghuram Rajan with regard to rate cuts, had observed that the expected monetary transmission did not take place to the desired level. So, Dr. Rajan naturally stressed on cleaning those bad debts which had impact on profitability, stock value and quantum of NPAs of various banks. The study therefore aims at:

Category	Domestic Schedule Commercial Banks and Foreign Banks with 20 branches or above	Foreign Banks with less than 20 branches
1. Total Priority Sector	40% of Adjusted Net bank Credit (ANBC)	Was 32% of ANCB in 2015-16 which will be increased by 2% and reach to 40% by 2019-20
2. Agriculture (both Direct and Indirect)	18% of ANBC	Not Applicable
3. Micro enterprises	7.5% of ANBC	Not applicable
4. Advances to Weaker Sections	10% of ANBC	Not applicable

Objectives of the Study

With some recent large-scale defaults by big borrowers, people are interested to know the extent of NPAs and its trend over the years. It is, therefore, interesting to study the comparative trends of NPAs in different categories of Scheduled Commercial Banks namely Public Sector Banks (SBI Group and Nationalized Banks), Private Sector Banks and Foreign Banks operating in India for last 11 years from 2006-07 to 2016-2017. It is also interesting to compare the NPAs between pre-economic crises and post economic crises period i.e. before 2007-08 and after 2007-08. It is also interesting to have a comparative analysis of NPAs in Priority and Non-priority Sectors during the period of 5 years viz. 2012-13 to 2016-17 for which the data are available in respect of Public Sector and Private Sector Banks. The Foreign Banks were excluded from this part of analysis as the activities covered by them under Priority

- Comparing the extent of NPAs in different bank groups during 2006-07 to 2016-17.
- Analyzing the impact of global economic crises during 2008-09 on NPAs in different bank groups.
- Comparing bank group-wise NPAs for Priority and Non-priority sectors during 2012-13 to 2016-17.
- Analyzing the impact of initiative taken by RBI for cleaning of Balance Sheets of banks on NPAs during 2015-16 and onwards.

Earlier Studies

Balasubramaniam (2001), in his study on “non-performing assets and profitability of commercial banks in India: assessment and issues” observed that the level of NPAs can be brought down by good credit appraisal procedures, effective internal control systems along with the efforts to improve asset quality in the balance sheets. Bhatia (2007),

in his Research Paper entitled, “Non-performing assets of Indian public, private and foreign sector banks: An empirical assessment”, observes that the level of NPAs is one of the drivers of financial stability and growth of the banking sector. Kaur and Singh (2011), in their study on Non-Performing Assets of public and private sector banks (a comparative study) observed that the financial companies and institutions are facing a major problem of managing the non-performing assets as these assets are proving to become a major setback for the growth of the economy. Zahoor & Jegadeehwaran (2013), concluded that level of NPA both gross and net shares an average upward trend for all nationalized banks but, growth rate is different between the banks. Bihari (2012), suggested the steps for conversion of non-performing assets in performing assets which are helpful to reduce and control NPA level viz. banks must be aware of right kind of borrower at the time of selection and the loans must be recovered timely to reduce NPA level. Shyamal (2012), studied that the prudential norms and other schemes had enabled banks to improve their performance and accordingly, resulted in orderly reduction in NPA as well as an enhancement in the financial strength of the Indian banking structure. Joseph and Prakash (2014), in their study entitled, A Comparative Study of NPAs in Public and Private Sector Banks in the New Age of Technology, attempted to highlight the factors contributing to NPAs, reasons for high NPAs, their impact on Indian banking operations and the trend and magnitude of NPAs in selected Indian Banks based on data for the period of 5 years from 2009-2013. Uppal (2009), through his research on “Priority sector advances: Trends, issues and strategies” attempted to study the priority sector advances by the public, private and foreign bank groups. The study also covered the extent of NPAs in priority sector. Kumar (2013), in his study on “A Comparative study of NPA of Old Private Sector Banks and Foreign Banks has observed that the growing NPAs is the major issues

challenging the performance of commercial banks in the recent past. Singh (2013), in his paper entitled Recovery of NPAs in Indian commercial banks says that the origin of the problem of growing NPAs lies in the system of credit risk management by the banks. Banks should continuously monitor loans to identify accounts that have potential to become non-performing. Gupta (2012), in her study “A Comparative Study of Non-Performing Assets of SBI & Associates & Other Public Sector Banks” had concluded that each bank should have its own independence credit rating agency which should evaluate the financial capacity of the borrowers. Patidar & Kataria (2012), reported that priority sector lending has significant impact on total NPAs of public sector banks rather than private sector banks and there is significant difference between NPAs of nationalized banks, SBI group, private sector banks. Vadivalagan, G. and Selvarajan, B. (2013), observed that the presence of NPAs has an adverse impact on the productivity and efficiency of Indian banks which results in the erosion of profits. To face the global challenges and to maintain the liquidity and profitability, it is essential to maintain the NPAs at low level through efficient recovery (before they become bad debts).

Coverage and Source of Data for the Study

The study is based on secondary data collected on Bank Group-wise NPAs for last 11 years from 2006-07 to 2016-17 from the RBIs website viz. Data Base on Indian Economy (DBIE). The reference period of 2006-07 has been chosen to enable comparison of NPA data of pre-crisis period with post crisis period (2008-09 and onwards). To compare the NPAs of Priority and Non-Priority Sectors, data in respect of various Bank Groups has been collected for 5 years 2012-13 to 2016-17 only as the data in respect of private and foreign banks are not available prior to 2012-13. Descriptive Statistical techniques like tables, graphs and ratios, etc. have been used for data analysis.

DATA ANALYSIS

The data related to Gross Advances, Gross NPAs and percentage ratios of Gross NPAs to Gross Advances in respect of Public Sector Banks and its components viz. State Bank of India and its Associates and Nationalized Banks; Private Sector Banks with their bifurcation into Old and New Private Sector Banks; and Foreign Banks for the 11 years period from 2006-07 to 2016-17 are presented in Tables IA to IG.

Amount in millions of Rupees

TABLE 1A- NPAs OF PUBLIC SECTOR BANKS			
YEAR	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)
2016-17	68,47,323	5,86,63,734	11.7
2015-16	53,99,563	5,81,83,484	9.3
2014-15	27,84,680	5,61,67,175	5.0
2013-14	22,72,639	5,21,59,197	4.4
2012-13	16,44,616	4,56,01,686	3.6
2011-12	11,24,892	3,55,03,892	3.2
2010-11	7,10,474	3,07,98,042	2.3
2009-10	5,73,009	2,51,93,309	2.3
2008-09	4,59,176	2,28,34,734	2.0
2007-08	4,06,000	1,81,90,740	2.2
2006-07	3,89,730	1,46,44,950	2.7

Table 1A regarding NPAs of Public Sector Banks reveals that the level of Gross NPAs during the first five years under study i.e. from 2006-07 to 2010-11, remained in a close range of 2.0 to 3.0 percent of Gross Advances. The NPAs of Public Sector banks have grown substantially in subsequent years. The NPAs of Public Sector Banks have jumped substantially from 2014-15 (5.0%) to 2016-17 (11.7%) mainly due cleaning operation of balance sheets of banks at the instance of RBI. Table 1B and 1C related to NPAs of SBI and its associates and Nationalized Banks respectively reveal a similar trend.

Though the levels of NPAs were consistently lower for Nationalized Banks compared to SBI and its associates during the initial eight years of the study till 2013-14, it has substantially increased during the last 3 years viz. 2014-15 to 2016-17. In fact, the NPAs of Nationalized Banks have increased more than 3 times from 2013-14 (4.1%) to 2016-17 (13.0%) again mainly on account of cleaning of accounts of the Nationalized Banks many of these NPAs were not formally acknowledged in their financial accounts and under reporting of such NPAs was prevalent. There has been no significant impact of global economic crises on these banks due to their relatively lower exposure to world economy.

YEAR	TABLE 1B-SBI & ITS ASSOCIATES			TABLE 1C-NATIONALISED BANKS		
	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)
2016-17	1,778,106	19,519,311	9.1	5,069,217	39,144,423	13.0
2015-16	1,219,686	19,071,728	6.4	4,179,878	39,111,756	10.7
2014-15	735,084	17,191,685	4.3	2,049,595	38,975,490	5.3
2013-14	798,165	16,087,376	5.0	1,474,474	36,071,821	4.1
2012-13	627,785	14,188,827	4.4	1,016,831	31,412,859	3.2
2011-12	456,941	10,470,151	4.4	667,951	25,033,741	2.7
2010-11	281,400	9,028,375	3.1	429,074	21,769,667	2.0
2009-10	218,306	7,729,306	2.8	354,703	17,464,003	2.0
2008-09	191,138	7,478,715	2.6	268,038	15,356,019	1.7
2007-08	154,810	6,005,200	2.6	251,190	12,185,540	2.1
2006-07	126,820	4,887,620	2.6	262,910	9,757,330	2.7

Amount in millions of Rupees

TABLE 1D- PRIVATE SECTOR BANKS			
YEAR	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)
2016-17	919,146	22,667,207	4.1
2015-16	558,531	19,726,588	2.8
2014-15	336,904	16,073,394	2.1
2013-14	241,835	13,602,528	1.8
2012-13	203,817	11,512,463	1.8
2011-12	182,102	8,716,413	2.1
2010-11	179,049	7,232,054	2.5
2009-10	173,067	5,795,349	3.0
2008-09	167,874	5,751,668	2.9
2007-08	129,220	5,236,990	2.5
2006-07	91,450	4,182,410	2.2

As regards the NPAs of Private Sector Banks are concerned, Table 1D reveals that the level of Gross NPAs remained in a very close range between 1.8% and 3.0% of Gross Advances without much fluctuation from one year to the other. It has, however, significantly increased in 2016-17 (4.1%). The analysis of NPAs of Old and New Private Sector based on the data in Table 1E and 1F also has shown a similar trend except that for old private banks, it has increased from 2014-15

Amount in millions of Rupees

TABLE 1G- FOREIGN BANKS			
YEAR	Gross NPAs	Gross Advances	Gross NPAs/ to Gross Adv's Ratio (%)
2016-17	136,210	3,436,112	4.0
2015-16	157,980	3,763,373	4.2
2014-15	107,578	3,366,090	3.2
2013-14	115,678	2,995,755	3.9
2012-13	79,256	2,604,049	3.0
2011-12	62,689	2,267,773	2.8
2010-11	50,445	1,929,719	2.6
2009-10	71,105	1,632,130	4.4
2008-09	72,487	1,660,116	4.4
2007-08	30,840	1,606,580	1.9
2006-07	23,990	1,246,770	1.9

(2.7%) to 2016-17 (4.1%), but, remained much lower compared to public sector banks. The impact of global crises during 2008-09, was not visible in private sector banks also. Similar trend has been observed in old and new private sector banks.

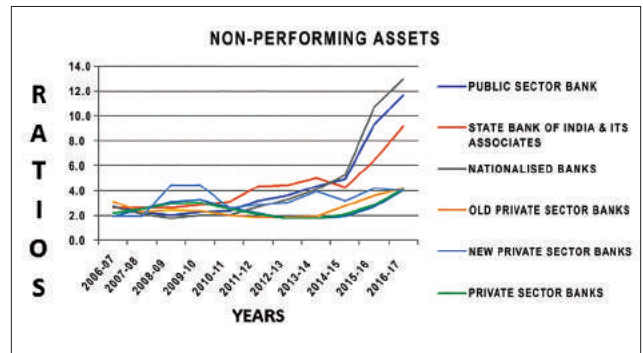
Table 1G related to NPAs of Foreign Banks operating in India reveals that the impact of global economic crises was quite visible as the NPAs of Foreign Banks have

YEAR	TABLE 1E-OLD PRIVATE SECTOR BANKS			TABLE 1F-NEW PRIVATE SECTOR BANKS		
	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)	Gross NPAs	Gross Advances	Gross NPAs/ Gross Advances (%)
2016-17	1,53,491	3,716,303	4.1	765,656	18,950,904	4.0
2015-16	1,18,474	3,296,272	3.6	440,057	16,430,316	2.7
2014-15	91,634	3,342,120	2.7	245,270	12,731,274	1.9
2013-14	59,073	3,025,296	2.0	182,762	10,577,232	1.7
2012-13	48,293	2,652,232	1.8	155,524	8,860,231	1.8
2011-12	40,955	2,241,137	1.8	141,147	6,475,276	2.2
2010-11	36,282	1,781,915	2.0	142,767	5,450,139	2.6
2009-10	35,345	1,513,506	2.3	137,722	4,281,843	3.2
2008-09	28,875	1,204,536	2.4	138,999	4,547,132	3.1
2007-08	24,930	1,112,580	2.2	104,290	4,124,410	2.5
2006-07	28,740	929,680	3.1	62,710	3,252,730	1.9

more than doubled from 2007-08 (1.9%) to 2008-09 (4.4%), due to their higher exposure to international business like export credit, etc. It has subsequently come down to the level of 3.2% during 2014-15, but, increased significantly above 4% during next 2 years perhaps, due to cleaning of bad assets from the books.

The comparative level of NPAs for different bank groups are also depicted through line graph below (Graph 1) for the entire period of study from 2006-07 to 2016-17, to gather a comparative view at a glance.

The NPA data in respect of the Priority Sector Advances in respect of Public Sector Banks with SBI Group and Nationalized separately and Private Sector Banks (combined for Old and New Private banks) is also presented from the year 2012-13 to 2016-17 in the Tables 2A to 2D. The comparative data related



Graph 1

to Priority and Non-Priority Sectors for different bank groups have also been depicted through line graphs (Graph 2A to 2D) to give a clear visual comparison of NPAs between Priority and Non-priority Sectors for different bank groups from 2012-13 to 2016-17.

Advances and NPAs of Banks by Priority and Non-Priority Sector

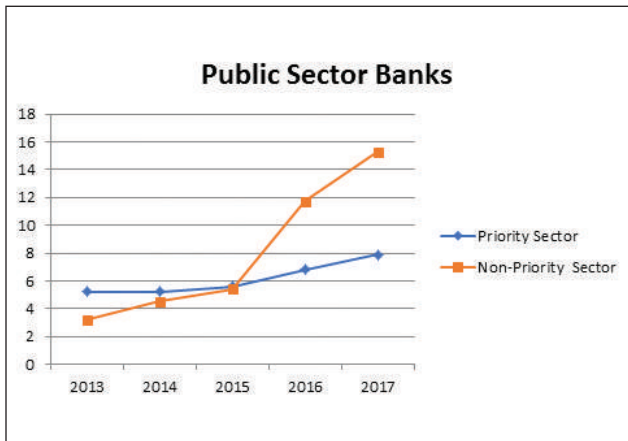
Amount in Billions of Rupees

YEAR	Priority Sector			Non-Priority Sector			Total		
	Gross Advances	Gross NPAs	RATIO	Gross Advances	Gross NPAs	RATIO	Gross Advances	Gross NPAs	RATIO
TABLE 2A- Public Sector Banks									
2017	19,599	1,543	7.9	31,823	4,868	15.3	51,422	6,411	12.5
2016	18,675	1,271	6.8	32,146	3,749	11.7	50,822	5,021	9.9
2015	16,860	937	5.6	31,593	1,691	5.4	48,453	2,627	5.4
2014	15,193	792	5.2	30,712	1,375	4.5	45,905	2,167	4.7
2013	12,790	669	5.2	27,769	890	3.2	40,559	1,559	3.8
TABLE 2B-Nationalised Banks									
2017	14,062	1242	9.0	20704	3459	17.0	34,765	4700	14.0
2016	13,356	979	7.3	21,062	2,900	13.8	34,418	3,879	11.3
2015	12,507	680	5.4	21,718	1,239	5.7	34,224	1,919	5.6
2014	10,711	530	5.0	21,249	877	4.1	31,960	1,407	4.4
2013	8,891	405	4.6	19,170	554	2.9	28,061	959	3.4
TABLE 2C-SBI Group									
2017	5,538	301	5.0	11119	1409	13.0	16,657	1710	10.0
2016	5,320	292	5.5	11,084	849	7.7	16,404	1,142	7.0
2015	4,353	257	5.9	9,875	451	4.6	14,228	709	5.0
2014	4,482	261	5.8	9,463	499	5.3	13,944	760	5.5
2013	3,899	264	6.8	8,599	335	3.9	12,498	600	4.8

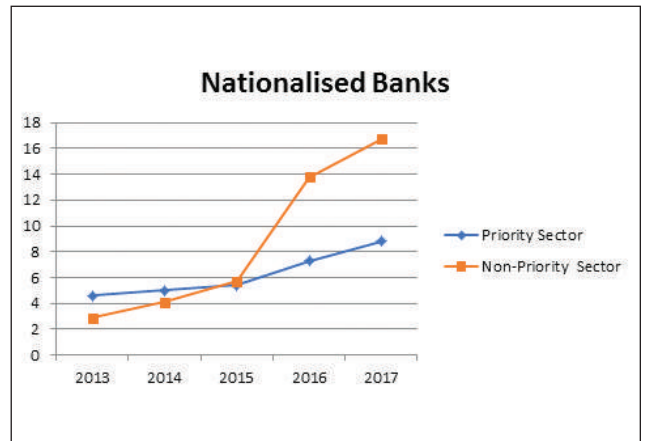
Amount in Billions of Rupees

YEAR	Priority Sector			Non-Priority Sector			Total		
	Gross Advances	Gross NPAs	RATIO	Gross Advances	Gross NPAs	RATIO	Gross Advances	Gross NPAs	RATIO
TABLE 2D-Private Sector Banks									
2017	6,520	133	2.0	14,529	605	4.0	21,049	738	4.0
2016	5,620	101	1.8	12,297	382	3.1	17,917	484	2.7
2015	4,428	72	1.6	9,946	244	2.4	14,373	316	2.2
2014	3,831	61	1.6	8,287	167	2.0	12,117	227	1.9
2013	3,157	52	1.6	7,309	148	2.0	10,467	200	1.9

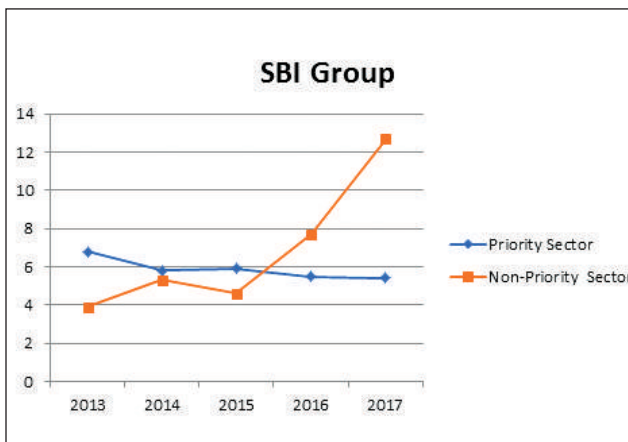
Source : Reserve Bank Of India-Database on Indian Economy



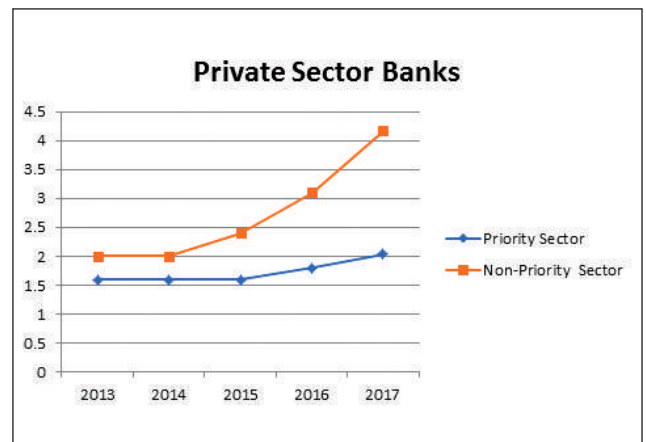
Graph 2A



Graph 2C



Graph 2B



Graph 2D

It may be observed from the Tables 2A, 2B and 2C for NPAs in priority and non-priority sector for Public Sector, SBI and Associates, and Private Sector Banks respectively and their corresponding graphical representations (Graph 2A to 2D) that the NPAs for 2012-13 and 2013-14, were consistently lower for Non-Priority Sector advances as compared to Priority Sector Advances which had come closer in 2014-15. However, the NPAs for Non-Priority Sector Advances shot up rapidly to (15.3%) during 2016-17, and became almost double than the Priority Sector Advances (7.9) perhaps due to large scale defaults of big accounts of public sector banks.

As regards private sector banks are concerned, their gross NPAs for Priority Sector were considerably lower compared to non-priority sector advances and remained below 2% of their advances. The main reason for low NPAs of Private Sector banks in priority sector could be their lower exposure to direct agriculture loans due to their lower presence in the rural areas. They could have covered targets for Priority Sector by lending to indirect agriculture activities like financing to agricultural equipments, funding to agro industries, etc. or by depositing the shortfall with NABARD under Rural Infrastructural Development Fund (RIDF). The overall NPAs of Private Sector Banks were significantly lower compared to the Public Sector Banks both for Priority and Non-Priority Sector Advances.

SUMMARY OF FINDINGS AND CONCLUSIONS

- Gross NPAs during the first five years under study i.e. upto 2010-11, remained in a close range of 2.0 to 3.0 percent of Gross Advances for all categories of banks but, the NPAs of Public Sector banks have grown significantly in subsequent years.
- The NPAs of Public Sector Banks have substantially jumped to the level of 11.7 percent in 2016-17, mainly due to very high NPAs of Nationalized Banks (13%).
- The NPAs of Private Sector Banks have grown in a very narrow range during the 11 years under study.
- The impact of global economic crises has not impacted the domestic banks perhaps, due to their low global exposure. However, the impact was significantly felt on Foreign Banks as the NPAs have doubled from pre-crises to crises period i.e. from 2007-08 to 2008-09, and remained more or less at the same level subsequently.
- It is also interesting to note that the NPAs of Non-Priority Sectors of Public Sector Banks were lower compared to Priority Sector Advances till 2014-15 but, have jumped significantly in 2015-16 onwards. This might be due to under reporting of NPAs of non-priority sectors which have come to the surface in the process of cleaning the balance sheets of public sector banks.
- The NPAs of private sector banks for Priority Sector Advances remained significantly lower compared to Non-Priority Sector Advances during the period of study (2012-13 to 2016-17), which throughout remained below 2% of gross advances.

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Revised Prompt Corrective Action Framework for Banks

The Prompt Corrective Action (PCA) framework for banks was introduced by the Reserve Bank in December 2002 as an early intervention mechanism. The sub-committee of the Financial Stability and Development Council (FSDC-SC) in its meeting held in December 2014 decided to introduce the PCA framework for all regulated entities. Subsequently, the Reserve Bank reviewed the existing PCA framework keeping in view the recommendations of the working group on resolution regimes for financial institutions in India (January 2014), the Financial Sector Legislative Reforms Commission (FSLRC, March 2013) and international best practices. The Board for Financial

Source: RBI Annual Report, 2016 -17

Supervision (BFS) decided to implement the provisions of the revised PCA framework with effect from April 1, 2017, based on the financials for March 31, 2017.

Capital, asset quality and profitability continue to be the key areas for monitoring under the revised framework. However, common equity Tier-1 (CET 1) ratio will constitute an additional trigger and leverage will also be monitored. The revised PCA defines certain risk thresholds, breach of which would lead to invocation of PCA and invite certain mandatory and discretionary actions. The PCA framework will apply to all banks operating in India including small banks and foreign banks operating through branches or subsidiaries.



 **V. N. Kulkarni***

Nurturing the MSME Lending

To keep the wheels of economic growth, a sustainable lending activity is an important element. However, loan growth slumped to at least a 62-year low of 5.1 per cent year-on-year basis for 2016, down from 10.6 per cent compared to earlier year, as per the Reserve Bank of India data. With a view to have a focused attention, banks were asked to open specialized branches to deal with the funds requirements of MSME sector. However, lending to SME sector by over 3000 specialized branches has been luke warm. As against the total requirement of funds to the tune of ₹ 26 lakh crore, banks have been able to provide just 40 % only. Funds crunch is hitting the production and consequently the employment opportunities in the country.

Rising defaults from the farm sector and stress from Small and Medium Enterprises (SMEs) have added to the woes of lenders which were already reeling under the rising Non-Performing Assets (NPAs) from corporate sector. There is an unequivocal deterioration in the credit quality in the first quarter of 2017-18. The additions in the NPAs in the first quarter are the sharpest increase in the last three years because, loans from SME and farm sector have joined the corporate NPA basket. The question therefore, before the bankers, is it prudent to stop lending activity? Certainly not. To give comfort to the lenders and instill confidence the Government has initiated certain important steps by providing credit guarantee through specially created vehicle for undertaking lending activity to certain newly created categories.

Having regard to the fact that fund requirements of the MSME sector is quite large and also to provide

comfort to the bankers in lending to this sector, a new trustee company was established by the Government of India known as National Credit Guarantee Trustee Company Ltd. (NCGTC). NCGTC was incorporated under the Indian Companies Act, 1956 on March 28, 2014 with a paid-up capital of ₹ 10 crores. This Company was entrusted with the task of managing and operating various credit guarantee trust funds. Presently NCGTC manages 6 Trust funds viz.

Credit Guarantee Fund for Education Loans (CGFEL), Credit Guarantee Fund for Micro Units (CGFMU), Credit Guarantee Fund for Skill Development (CGFSD), Credit Guarantee Fund for Factoring (CGFF), Credit Guarantee Fund for Stand-up India (CGFSSI) and Credit Guarantee Fund for Start-ups (CGSS).

In this article except the cover available for education loan all the remaining schemes are discussed in brief.

CREDIT GUARANTEE FUND FOR MICRO UNITS (CGFMU)

"Micro Loan" means any financial assistance by way of collateral free / third party guarantee free loan/limit (currently ₹10 lakh). The scheme is for the purpose of providing guarantees to loans extended under Pradhan Mantri Mudra Yojana (PMMY).

The loans covered under the said scheme are as under:

- a. Shishu - covering loans upto ₹ 50,000/- (Interest rate as stipulated by Mudra; presently not to exceed 12% p.a.).

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- b. Kishor- covering loans above ₹50,000/- and upto ₹ 5 lakhs.
- c. Tarun- covering loans above ₹5 lakhs and upto ₹10 lakhs.

The scheme also covers overdraft facility of ₹ 5,000/- sanctioned under PMJDY accounts scheme.

Guarantee cover and conditions to be fulfilled

- a. The guarantee cover is available for micro loans sanctioned on or after 8th April, 2015 under PMMY Scheme.
- b. Guarantee cover is available provided loan is sanctioned without obtaining any collateral security and or guarantee.
- c. The account should be a standard asset while applying for the guarantee cover.

Guarantee Fee and sharing of amount of default

The trust has discretion to charge risk based pricing i.e., different guarantee fees for different Member Lending Institutions depending on their credit-rating, NPA levels, claim payout ratio, geographical spread, etc.

Fees for Scheduled Commercial Banks (SCBs) is at Standard Basic Rate (SBR) of 1.00% of sanctioned amount and the risk premium and claim payout ratio is as under

Risk premium on NPAs in guaranteed portfolio		Risk premium on claim Payout ratio	
NPA Percentage	Risk Premium	Claim Payout percentage	Risk Premium
0-2 %	Nil	0-2 %	Nil
>2-3 %	5 % of SBR	>2-3 %	5 % of SBR
>3-6 %	10% of SBR	>3 -6 %	10 % of SBR
>6 -9 %	15% of SBR	>6-9 %	15 % of SBR
>9-12 %	20 % of SBR	>9-12 %	20 % of SBR
>12-15 %	25 % of SBR	>12-15 %	25% of SBR

Fees for Regional Rural Banks (RRBs) & Co-operative Banks (RRBs) is at Standard Basic Rate (SBR) of 1.00% of sanctioned amount and the risk premium and claim payout ratio is as under:

Risk premium on NPAs in guaranteed portfolio		Risk premium on claim Payout ratio	
NPA Percentage	Risk Premium	Claim Payout percentage	Risk Premium
0-2 %	Nil	0-2 %	Nil
>2-3 %	10 % of SBR	>2-3 %	10 % of SBR
>3-6 %	20% of SBR	>3 -6 %	20 % of SBR
>6 -9 %	30 % of SBR	>6-9 %	30 % of SBR
>9-12 %	40 % of SBR	>9-12 %	40 % of SBR
>12-15 %	50 % of SBR	>12-15 %	50% of SBR

The guarantee cover is in the nature of 'First Loss Portfolio Guarantee', wherein, first loss to the extent of 5% of the crystallized portfolio of the Member Lending Institution (MLI), will be borne by the MLI and therefore, will be excluded for the claim. Out of the remaining portion, the Trust will pay maximum of 50% of 'amount in default' or such other percentage as may be specified by the Fund from time to time on a pro-rata basis.

CREDIT GUARANTEE FUND SCHEME FOR SKILL DEVELOPMENT (CGFSD)

Skill development programmes have been launched by the Government under National Policy for Skill Development and Entrepreneurship 2015, Pradhan Mantri Kaushal Vikas Yojana (PMKVY) scheme and Skill Loan Scheme. Trainees under the scheme can get loans ranging from ₹ 5,000-1.5 lakhs who attend skill development programmes at notified Institutes.

This Skill Loan Scheme has replaced earlier Indian Banks Association (IBA) Model Loan Scheme for Vocational Education and Training. The Indian Banks Association (IBA) has already circulated the scheme to the Chief Executives of All Member Banks for implementation of the Scheme.

Guarantee cover and conditions to be fulfilled

- a. Loans sanctioned on or after July 15, 2015 are only eligible for the guarantee cover.
- b. Loan should have been sanctioned without any collateral security and/or third party guarantee.
- c. The Interest Rate on loan should not be more than 1.5 % p.a. over the Base Rate.
- d. Loan sanctioned in respect of courses run by Industrial Training Institutes (ITIs), Polytechnics or a school recognized by central or state education Boards or a College affiliated to recognized university, training partners affiliated to National Skill Development Corporation (NSDC)/Sector Skill Councils, State Skill Mission, State Skill Corporation, preferably leading to a certificate / diploma / degree issued by such organization as per National Skill Qualification Framework (NSQF) only are eligible for the cover.

Guarantee Fee and sharing of amount of default

Member Lending Institution has to pay Guarantee Fee of 0.125% per calendar quarter (i.e. 0.50% p.a.). The guarantee should not be recovered from the borrowers; it should be borne by the Member Lending Institution.

The Fund provides guarantee cover to the extent of 75% of the amount in default.

CREDIT GUARANTEE FUND FOR FACTORING (CGFF)

Factoring is a financing arrangement for suppliers by making prepayments against invoices. This provides liquidity to MSMEs and facilitates collection of receivables. India's factoring volume is below ₹ 20,000 crore. The Factoring Regulation Act, 2012 provides the legal framework for factoring. To promote "factoring without recourse" the Government of India has established a Fund for guaranteeing factored debts.

Guarantee cover and conditions to be fulfilled

- a. Credit guarantees cover on the amount in default covering factoring transactions is as under-
 - i. First loss of 10% of the amount in default to be borne by Factors.
 - ii. The remaining 90% of the amount in default will be borne by NCGTC and factors in the ratio of 2:1 respectively.
- b. Only the assigned factored debts would be covered under guarantee scheme.
- c. The Credit Guarantee Fund Scheme for Factoring (CGFSF) is confined to domestic factoring of receivables of MSMEs in India.
- d. The exposure limit for purchaser would be up to 10% (relaxable up to 20% in case of AAA rated purchasers) of the corpus of Credit Guarantee Corpus Fund for Factoring as per the last audited figures for factoring without recourse' only.

Guarantee Fee and sharing of amount of default

The guarantee fee is 0.75 percent per quarter of the guaranteed factored debts for the amount of guarantee cover. For factoring transaction, the interest rate to be charged from the MSMEs is left to Factors.

With a view to facilitate wider coverage of the Fund and its sustainability, the guarantee fee chargeable from the MLIs is 0.10% per month for "factoring with recourse" and 0.12% per month for "factoring without recourse" on the outstanding balance at the previous month end.

The amount equivalent to the guarantee fee payable by the factor may be recovered at its discretion from the eligible borrower.

CREDIT GUARANTEE FUND FOR STAND UP INDIA (CGSSI)

The Stand Up India scheme is based on recognition of the challenges faced by SC, ST and women

entrepreneurs in setting up enterprises, obtaining loans and other support needed from time to time for succeeding in business. The objective of the Stand Up India scheme is to facilitate bank loans between ₹10 lakh and ₹1 crore to at least one Scheduled Caste (SC) or Scheduled Tribe (ST) borrower, and at least one woman borrower per bank branch for setting up a greenfield enterprise i.e. first time venture of the beneficiary in the manufacturing, services or the trading sector. Loan sanctioned by banks is in the nature of composite loan (inclusive of term loan and working capital). In case of non-individual enterprises, at least 51% of the shareholding and controlling stake should be held by either an SC/ST or Woman entrepreneur.

The scheme provides for collateral free loan up to 75% of the total cost. The loan is repayable within a maximum period of 7 years with a moratorium of 18 months. The Interest Rate to be charged by the Member Lending Institution should be the lowest applicable rate for the category (as per rating) and should not in any case, be more than 3% p.a. over the Base Rate + tenor premium, if any, for the loan.

Guarantee cover and conditions to be fulfilled

The guarantee cover under the scheme is to the extent of 80% of the amount in default for credit facility above ₹10 lakh and up to ₹50 lakh, subject to a maximum of ₹40 lakh. For credit facility above ₹ 50 lakh and upto ₹100 lakh - ₹40 lakh plus 50% of amount in default above ₹50 lakh subject to overall ceiling of ₹65 lakh of the amount in default.

Guarantee Fee and sharing of amount of default

The Member Lending Institution has to pay a risk based guarantee fee of the sanctioned amount as per details given below.

The Guarantee Fee Structure on differential rates will be based on the existing database of CGTMSE and in accordance with the Circular No. 107/ 2015-16 dated January 28, 2016 issued by CGTMSE.

Standard Basic Rate – 0.85% p.a. on the sanctioned amount.

Risk premium on NPAs in guaranteed portfolio		Risk premium on claim Payout ratio	
NPA Percentage	Risk Premium	Claim Payout percentage	Risk Premium
0-5%	SR	0-5%	SR
>5-10%	10% of SR	>5-10%	10% of SR
>10-15%	15% of SR	>10-15%	15% of SR
>15-20%	20% of SR	>15-20%	20% of SR
>20%	25% of SR	>20%	25% of SR

The Risk premium structure which is floating one will be changed by the Trust based on NPA level and payout ratio of the concerned bank. The risk premium will be reviewed every year and would be applicable from the beginning of the financial year.

CREDIT GUARANTEE SCHEME FOR START UPS (CGSS)

With the intention to build a strong eco-system for nurturing innovation and Startups in the country, the Government through this initiative aims to empower Startups to grow through innovation and design and to accelerate spreading of the Startup movement. The Government has started Startup Intellectual Property Protection Scheme for innovators. The scheme provides for, 80% rebate on patent filing fees, Fast-tracking of startup patent applications, 50% fee rebate for trademark filing. Apart from this Start up get, Tax Exemptions on Capital Gain, Income Tax Exemption for 3 years out of 7 years (Finance Act'16).

Government has formulated a Credit Guarantee Scheme for Startups (CGSS) with a corpus contribution of ₹2000 crores that will enable Startups to raise loans without any collateral for their business purposes. The scheme will provides credit guarantee up to ₹ 500 lakhs per case inclusive of term loan, working capital or any other instrument of assistance extended by Member Lending Institutions (MLIs) to finance an eligible borrower i.e. a Startup

recognized by Department of Industrial Policy and Promotion (DIPP).

Invocation of guarantee and subrogation of rights and recoveries on account of claims paid

NCGTC, has specified the rules for invocation of credit guarantee scheme wise, it has also specified norms for sharing of recoveries and also submission of details regarding the efforts made for recovery by the lending institution.

CONCLUSION

Flagging economy needs a big push. Bankers by lending to the micro and small sector will be in a position to create employment opportunity and help in improving the productivity. At the same, it will serve the twin objectives:

- a) reaching the priority sector targets, and
- b) increasing the profits.

Lending to micro and small enterprises will not only increase the profits, but also, will result in better risk management. Added to this the various credit guarantee schemes discussed above should add to the comfort level of bankers.

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Supervisory Enforcement Framework

An effective system of banking supervision, *inter alia*, depends on effective enforcement of supervisory policies which, in turn, needs a unified and well-articulated supervisory enforcement policy and institutional framework. Taking cognisance of such a need, the Board for Financial Supervision approved a Supervisory Enforcement Framework for action against non-compliant banks. Following a subsequent announcement in the 6th

bi-monthly monetary policy statement of February 2017, a separate Enforcement Department was established in April 2017.

Over time, the framework is expected to make the Reserve Bank's enforcement actions more transparent, predictable, standardised, consistent and timely, leading to improvement in the banks' overall compliance with the regulatory framework.

Source: RBI Annual Report, 2016 -17



Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002 (SARFAESI)-Is Section 13 (3A) Mandatory? Judicial Approach

 M. G. Kulkarni*

Introduction

In a rapidly developing economy, financial sector has been one of the key drivers in an effort for achieving success. Notwithstanding progressively complying with international prudential norms and accounting practices there are still certain areas in the field of banking and finance which warrants immediate attention vis-a-vis other participants in the financial sector. It was imperative to have a legal frame work relating to commercial transactions to keep pace with changing commercial practices and financial sector reforms in tune with global practices. In the absence, it would affect not only in recovery of defaulting loans but also the mounting level of non-performing assets of banks and financial institutions. The banks and financial institutions in India had no power to take possession of securities and sell them unlike international banks. Immediate attention was felt for facilitating securitization of financial assets of banks and financial institutions and a power to enforce assets offered as a security to secure the loan by the borrowers, by taking possession and selling them to realize the dues of the borrower. The mounting NPAs was a biggest challenge for the Banks/Financial Institutions.

To address the above concerns, Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act 2002 (SARFAESI) was enacted. The sole intention/concern of the legislation was for Securitization of Assets, Reconstruction and Enforcement of Security without the intervention of the Courts. The thrust primarily was for- speedier

enforcement of security or asset to recover the dues of the borrowers by the secured creditors. Many procedural hurdles were addressed and a swifter mechanism was brought in place in the said Legislation, so that the lenders should not entangle in intricacies or technicalities, interalia, entailing multifarious litigations but for the extant general laws and procedures. Option is left open for the lenders to choose either of the forum/ route (Debt Recovery Tribunal/SARFAESI) keeping in mind the limitation and other aspects of the law.

Recovery - Brief Features

When a borrower commits default in repaying the instalments; subject to the provisions enshrined in the Act, the non-payment of said dues by the borrower will be treated as a default interalia, terming the same as Non-Performing Asset (NPA). The secured creditor (section 13(2) of the Act) by a written notice has to call upon the borrower to discharge his/her liabilities within 60 days from the date of notice. A duty is cast upon the secured creditor to clearly mention in the said notice:

- (i) the outstanding dues/debt owed by the borrower
- (ii) and that on failure to discharge the debt in full,
- (iii) their intention to enforce the security interest created in their favour by the borrower/ guarantor.

On failure of the borrower to pay the outstanding dues within the stipulated time pursuant to said Notice, this secured creditor can proceed with any of the following measures as per section 13(4):

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- a. Take Possession of the security or secured asset.
- b. Sell, Lease or Assign the Security.
- c. Manage the same or appoint any person for the management of the same.

Constitutionality

Although the intent of the legislation was to tackle the issue of NPAs in banks and financial institutions and to stand on par with international standards and practices, the same (Legislation) was called in question before the Supreme Court. The very constitutional validity of SARFAESI Act was challenged before the Supreme Court in an important case *Mardia Chemicals v/s Union of India* (2004) 3 SCC 311. Although the constitutional validity of the said Act was upheld, the Apex Court felt that the interest of the borrower also needs protection. It was a sheer judicial activism and the Court asserted that the reasons, indeed, need to be communicated to the borrower for non-acceptance of representation/objections sent in reply to notice calling upon to clear the dues by the creditor. Right to know is an important aspect and as such, duty flows out of jural relation. The court remarked that the fair play, transparency and right to know are cardinal principles and that the same are more relevant and cannot simply be ignored. After the decision of the Apex Court in the said matter on 8th April, 2004, Government introduced Section 13(3A) in the SARFAESI Act by way of an amendment vide The Enforcement of Security Interest and Recovery of Debts Laws (Amendment) Act, 2004 w.e.f 11th November, 2004.

Post Amendment - Proviso

Section 13(3A) reads as under:

If, on receipt of the notice under sub-section (2), the borrower makes any representation or raises any objection, the secured creditor shall consider such representation or objection and if

the secured creditor comes to the conclusion that such representation or objection is not acceptable or tenable, he shall communicate within fifteen days of receipt of such representation or objection the reasons for non-acceptance of the representation or objection to the borrower:

PROVIDED that the reasons so communicated or the likely action of the secured creditor at the stage of communication of reasons shall not confer any right upon the borrower to prefer an application to the Debts Recovery Tribunal under section 17 or the Court of District Judge under section 17 A.

It could be seen on the bare reading of above provision that - when a secured creditor issues notice u/s 13(2) calling upon the borrower to repay the dues within 60 days from the date of notice, if the borrower makes any representation or raises any objection under section 13(3A) in response to secured creditor's notice; then the secured creditor shall consider such representation and objection. The superadded proviso further adds that the reasons so communicated or any action at this state (i.e. stage of communication of reasons) shall not itself give any right whatsoever to the borrower to approach Debt Recovery Tribunal or District Judge u/s 17 (Jurisdiction, Powers and Authority of Tribunals) and 17A (Power of Chairperson of Appellate Tribunal) respectively.

Question may arise on the legal obligations of the secured creditor to follow the amended proviso. So then, if the secured creditor on receipt of such representation or objection (13(3A)) if any from borrower in response to notice u/s 13(2), is it duty bound to communicate to the borrower the reason for non-acceptance of such representation or objections. Is the said proviso mandatory in nature casting a legal duty on the secured creditor to reply/communicate to borrowers with reasons? Is the said Proviso merely a directory in nature without any such legal duty on the secured creditor to respond?

The **Supreme Court** had an occasion to deal with above aspects in a latest case of **ITC Limited v/s Blue Coast Hotels Limited & Others (decided on March 19, 2018)** and the facts briefly are as under:

Industrial Finance Corporation of India (hereafter IFCI/ secured creditor) had sanctioned a sum of ₹ 150 Crore as a Corporate Loan to Blue Coast Hotels Limited (hereafter BCL/Debtor) in February 2010. Necessary Agreements were entered into between IFCI and BCL; and to secure the said loan, BCL mortgaged whole of its hotel property- including the agricultural land on which the debtor was to develop villas. The debtor since failed to stand by its commitment and having defaulted, the account became a Non Performing Asset (NPA) on 30/09/2012.

IFCI by several notices intimated the debtor as to the amount due from it. On the failure of debtor to remit the dues, IFCI by a Notice (Dt. 26/3/2013) u/s 13 (2) of SARFAESI called upon the debtor to pay the dues within 60 days. However, Debtor in response to the said notice, sought extension of time in May 2013 to pay off the dues. But instead IFCI, took symbolic possession of the secured/mortgaged property of Debtor in June 2013 and further published, notice of auction sale, of the property.

However, against the action of taking symbolic possession of the property by the IFCI, BCL challenged the same before Debt Recovery Tribunal in July, 2013. The lis (litigation) before finally reaching the High Courts at Goa/Bombay was heard by Debt Recovery Appellate Tribunal and the Court of District Magistrate. In the meantime, IFCI published a First Auction Sale notice in September, 2013 although the same was postponed due to negotiations between the parties. In 2014, a second sale notice was published due to failure in the negotiations between the IFCI and BCL and had set a Reserve price of ₹ 403 Crores.

One of the main contentions of **BCL** before the High Court was, IFCI **did not reply** nor gave reason for rejection of their representation/letter dated the May, 2013 seeking extension of time hence, further steps

on the part of IFCI vitiates and is bad in law. **The High Court**, came to the conclusion that failure on the part of creditor to deal with representations made by the debtor violates mandate of Section 13(3A) of SARFAESI Act. High Court further ruled that the auction/sale of the property consequent upon symbolic possession of the property by the IFCI is contrary to the very scheme of the Act and Rules made thereunder. A portion of land mortgaged and upon which security interest has been created is an Agricultural Land; and such, cannot be recovered since the Act is not applicable to Agricultural land.

ITC was an auction purchaser of the property mortgaged by the BCL to IFCI. ITC, having purchased property pursuant to the auction sale, called in question the said order of the High Court before the Supreme Court.

The moot question for the **Apex Court** to answer was, whether is it mandatory for the secured creditor to reply and give reasons to the representations made by the borrower in response to Section 13(2) notice? What is the real intent of the Parliament to amend the Act to introduce section 13(3A) and non-compliance, whether invalidates the action of secured creditor?

Supreme Court answered the question in affirmative, interalia, holding that the Section 13(3A) is **mandatory**.

“The purpose of serving a notice upon the borrower under sub-section (2) of Section 13 of the Act is; that a reply may be submitted by the borrower explaining the reasons as to why measures may or may not be taken under sub-section (4) of Section 13 in case of non-compliance with notice within 60 days.

The creditor must apply its mind to the objections raised in reply to such notice and an internal mechanism must be particularly evolved to consider such objections raised in the reply to the notice. There may be some meaningful consideration of the objections raised rather than to ritually reject them and proceed to take drastic measures under sub-section (4) of Section 13 of the Act.

Once, such a duty is envisaged on the part of the creditor, it would only be conducive to the principles of fairness on the part of the banks and financial institutions in dealing with their borrowers to apprise them of the reason for not accepting the objections or points raised in reply to the notice served upon them before proceeding to take measures under sub-section (4) of Section 13”.

Communication of Non acceptance of the objections of the borrower may not be taken to give occasion to such proceedings which are not permissible under the Act. However, it would be for the knowledge of borrower who has a right to know the reasons for rejections by the secured creditor who can proceed with the harsh steps of taking over the management/business of namely secured assets without intervention of the court.

Prior to amendment, there was no provision that the borrower could make such representation in reply to Section 13(2) notice and the legislative intent is to provide for the same and a mandatory duty has been accordingly cast on the secured creditor.

There is no need to dilute or marginalize the usage of ‘shall’ to read as ‘may’ as the word ‘shall’ raises a presumption that it is imperative, mandatory and requiring compliance. When a provision mandates communication of reasons, the court observed that “such a provision is an integral part of the duty to act fairly, reasonably and not fancifully. Under the circumstances there is no need to interpret the silence of the Parliament in not providing for any consequence for noncompliance with a duty to furnish reasons. The provision must nonetheless be treated as ‘mandatory’”.

Failure to Reply the Representations of Borrower by the Creditor/IFCI- Effect

The Court had observed that the compliance of the provision in sending reply by the creditor to the representations of debtor is mandatory. And that it is a fact that IFCI did not reply to the debtor’s representation dated 27th May, 2013. But, the Court went on to opine amongst other as under:

(a) IFCI had in fact on several occasions considered the request/representations of the borrower after issuing 13(2) notice (26/3/2013) and had granted extensions in paying the outstanding loan.

(b) Borrower sent repeated proposal to IFCI for extension of time.

(c) The debtor was in possession of the hotel and running the business and the possession taken by the IFCI was purely symbolic.

(d) Borrower sends a letter to IFCI in June 2013 requesting for a time and encloses six cheques for upfront payment of ₹ 33.16 Crores without making any reference to notice of taking over of possession. But the cheques were dishonored.

(e) Borrower in response to the notices of sale published by the IFCI, requests for time to clear the dues and to defer the sale till that time. IFCI defers the sale by public notice while considering the borrower’s proposal.

(f) Further borrower submits a letter of undertaking to IFCI, to clear the dues within a stipulated time as laid down by IFCI.

The debtor thus, induced the creditor not to take action with the assurances. Borrower acknowledges in a letter, the right of IFCI to sell the assets in case of default. The Court hence, ruled that there is sufficient compliance with the provision and observed that:

“We have no doubt that the failure to furnish a reply to the representation is not of much significance since, we are satisfied that the creditor has undoubtedly considered the representation and the proposal for repayment made therein and has in fact granted sufficient opportunity and time to the debtor to repay the debt without any avail. Therefore, in the fact and circumstances of this case, we are of the view that the debtor is not entitled to the discretionary relief under Article 226 of the Constitution which is indeed an equitable relief”.

The court also dismissed the objections as to the bar on creating interest over Agricultural land u/s 31(i) of the Act, inter alia, holding that the said bar has no application to the case on hand. Noting that, although the adjoining lands of the hotel premises even though categorized as Agricultural but having regard to the character of the land and the purpose for which it is set apart, the land in question is not an agricultural land merely because it stood so in the revenue records.

The Court on the right of IFCI to approach District Magistrate u/s 14 observed that; IFCI had taken symbolic possession and ITC purchased the property as an auction purchaser. But the property is still in actual possession of Debtor-BCL enjoying usufruct like hotel rent etc. despite auction sale of property. 'The transfer of the secured asset by the creditor, therefore, cannot be construed to be a complete transfer as contemplated by Section 8 of the Transfer of Property Act. The creditor nevertheless had a right to take actual possession of the secured assets and must therefore, be held to be a secured creditor even after the limited transfer to the auction purchaser under the agreement'.

The court having answered the important issues and setting aside the order of High Court, directed BCL to hand over the property to ITC the auction purchaser within six months.

Epilogue

The Apex Court has indeed, given a broader interpretation of the provision 13(3A) unlike literal

legis (literal rule/ go by the word in the rule). The court has trod the path of purposive interpretation to uphold declared object and purpose of the Act. Court has viewed security (Agricultural land) under the touch stone of Character and Purpose. The Court further, has gone beyond the words, to uphold Real Legislative Intent in order to advance the justice and suppress or remedy the mischief if any. While interpreting the word, it is apparent that the Court was cautious enough of the fact to give an interpretation of the provision or a particular word therein, in a manner, 'to sub serve the object of the statute and to give true meaning in the context it has been used'.

A case is, though, only an authority for what it actually decides but the decision based on the facts in arriving at an actual decision assumes importance as ratio (reason for the decision) and could be applied for all the future cases of similar type and all the courts in hierarchy shall have to follow the same as a binding precedent. The decision indeed, will be a shot in the arm for secured creditors with the facts of the kind in place.

Sources

- (a) Supreme Court Cases
- (b) Website - Government of India
- (c) Precedent in English Law- Sir Rupert Cross and H.W. Harris



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भारत में भुगतान प्रणाली का प्रादुर्भाव एवं विकास

☞ सुबहसिंह यादव*

भुगतान तथा निपटान प्रणाली एक कंपायमान अर्थव्यवस्था की वित्तीय प्रणाली का आवश्यक भाग है। वित्तीय आधारभूत ढांचे का विकास एवं किसी देश की ऐसी भुगतान एवं निपटान प्रणाली में सुधार, जो सुरक्षा तथा कार्यकुशलता जैसे दोहरे उद्देश्य को पूरा करती है, ने दुनियाभर में केन्द्रीय बैंकों एवं वित्तीय संस्थाओं का ध्यान आकर्षित किया है। भुगतान तथा निपटान प्रणालियां बाजारोन्मुखी अर्थव्यवस्थाओं के उचित तरीकों से काम करने के लिए आवश्यक बुनियादी आधारभूत संरचनाओं का एक अंग है, वस्तुओं, सेवाओं और वित्तीय आस्तियों के लिए अपरिहार्य हैं और केन्द्रीय बैंक की मौद्रिक नीति का कार्यान्वयन करने तथा अर्थव्यवस्था में मौद्रिक स्थायित्व कायम करने के लिए इनका कुशलतापूर्वक काम करना अत्यंत आवश्यक है। इस प्रकार भुगतान और निपटान प्रणालियां किसी अर्थव्यवस्था की रीढ़ होती हैं। यह व्यापार, वाणिज्य और आर्थिक कार्यकलापों के अन्य रूपों के संचालन के लिए जिसमें किसी देश में विप्रेषण करना शामिल है, नलिकाएं या धमनियां होती हैं। एक दक्ष भुगतान प्रणाली की कल्पना उस स्नेहक के रूप में की जा सकती है जो अर्थव्यवस्था के नकदी प्रवाह को तेज कर देती है और जिसके चलते आर्थिक वृद्धि को प्रोत्साहन और बल मिलता है। भुगतान प्रक्रिया वित्तीय मध्यस्थता का एक महत्वपूर्ण पहलू होता है, यह भिन्न-भिन्न आर्थिक एजेंटों के बीच चलनिधि के सर्जन और अंतरण को समर्थ बनाती है।

भुगतान प्रणाली का महत्व :- भुगतान प्रणाली का महत्व घरेलू वित्तीय क्षेत्र सुधारों और वैश्विक वित्तीय एकीकरण के संदर्भ में, जिसमें अधिकांश विकासशील देश इस समय से गुजर रहे हैं, बढ़ जाता है। विदेशी निवेश (प्रत्यक्ष एवं संविभाग) को प्रोत्साहन एक दक्ष भुगतान प्रणाली से मिलता है और इसके लिए यह भी आवश्यक होता है कि प्रवासियों को कम लागत वाली विप्रेषण सुविधा मिल सके ताकि वे देश के भीतर अपने सगे-सम्बन्धियों को धन भेज सकें। भुगतान प्रणाली के माध्यम से उन्नत और तीव्रतर धन अन्तरण करना भी उभरते बैंकिंग परिदृश्य का एक अंग होता है। निःसंदेह एक कुशल, मजबूत, सुरक्षित, किफायती और

प्रभावशाली भुगतान प्रणाली सामान्यतः अर्थव्यवस्था के लिए और विशेषकर वित्तीय बाजारों के संचालन के लिए महत्वपूर्ण होती है जिसमें वित्तीय बाजारों के कामकाज में प्रणालीगत स्थिरता बनी रहती है। इसी सन्दर्भ में भुगतान प्रणाली को खुदरा ग्राहकों की सेवाएं प्रदान करनी पड़ती है। अतः भुगतान प्रणाली का जनता की दैनिक आवश्यकताओं की पूर्ति करने का एक समावेशन अधिदेश भी होता है। शायद इसी उद्देश्य से जनता को नकदी से दूर रखने और उन्हें क्रेडिट कार्ड, डेबिट कार्ड, मोबाइल बैंकिंग आदि जैसे नकदी रहित साधनों की ओर प्रेरित किया गया है।

भारत में भुगतान प्रणाली का प्रादुर्भाव तथा विकास

यह कहने में कोई अतिशयोक्ति नहीं है कि मुद्रा के विकास के साथ ही भुगतान प्रणाली का प्रादुर्भाव हुआ। भुगतान का सर्वाधिक प्राचीन स्वरूप संभवतः विनिमय व्यापार के प्रारंभिक दिनों में ढूँढा जा सकता है जब मूल्य का भुगतान शंख-सीपियों, वस्तुओं, पशुओं और पण्य के विनिमय के द्वारा किया जाता था। विनिमय के माध्यम से मुद्रा की अनुपस्थिति में इस प्रकार की प्रणाली का चलन में होना वास्तव में बहुत जटिलताओं से युक्त था क्योंकि इसमें विनिमय के लेन-देन के लिए प्रायः दोहरे संयोग का अभाव पाया जाता था। तत्पश्चात् औपचारिक भुगतान के तरीके लिखित रूप में जैसे-सिक्के, विकसित हुए। भारत में सर्वप्रथम भुगतान लिखितों के रूप में सिक्कों का प्रचलन प्रारम्भ हुआ जो छिद्रित होते थे अथवा उनकी ढलाई चांदी एवं तांबे के रूप में होती थी, यहाँ तक कि चमड़े के सिक्कों के भी चलन में रहने का उल्लेख मिलता है। अतः समयपर्यंत भारत में भुगतान प्रणाली विश्व के अधिकांश भागों जैसी ही नकदी आधारित प्रणाली के रूप में शुरू हुई। वाणिज्य तथा व्यापार में हुए विकास ने भारत में विभिन्न प्रकार के भुगतान लिखितों को प्रेरित किया। मुद्रा के संस्थागत रूपों के आविष्कार के साथ ही प्रारंभ में सिक्कों के रूप में और इसके पश्चात् कागजी मुद्रा के रूप में वस्तु विनिमय व्यापार समाप्त हो गया और करेंसी के प्रचलन के युग का सूत्रपात हुआ। नकदी की प्रणाली के वर्चस्व के बावजूद

*सहायक महाप्रबंधक (से. नि.), बैंक ऑफ बड़ौदा।

नकदी से भिन्न की कुछ अन्य पूर्ववर्ती भुगतान प्रणालियां विद्यमान थी—जैसे कि विनिमय पत्र का पूर्ववर्ती रूप हुण्डी, जो कि देश के अनेक भागों में किसी न किसी रूप में आज भी प्रचलित है। आधुनिक सन्दर्भ में पत्र मुद्रा का उद्गम 18वीं शताब्दी में पाया जाता है जब निजी बैंकों तथा साथ ही साथ अर्द्ध-सरकारी बैंकों ने नोट जारी किए। सर्वप्रथम जारी नोटों में वे नोट थे जो बैंक ऑफ हिन्दुस्तान (जो 1770 में प्रथम स्थापित जॉइंट स्टॉक बैंक था), बंगाल और बिहार में स्थित दि जनरल बैंक और बंगाल बैंक के द्वारा जारी किए गए थे। बाद में 1809, 1840, 1843 में स्थापित तीन प्रेसीडेंसी बैंकों के स्थापित होने के साथ ही नोटों के जारी करने का काम इनके हाथ में आ गया और प्रत्येक प्रेसीडेंसी बैंक को एक निर्धारित सीमा के अन्दर नोट जारी करने का अधिकार था। निजी बैंकों और प्रेसीडेंसी बैंकों ने भारतीय मुद्रा बाजार में अन्य भुगतान लिखितों का सूत्रपात किया और बैंक ऑफ हिन्दुस्तान द्वारा चेकों को प्रचलन में लाया गया। बैंक ऑफ बंगाल ने 1839 में विनिमय विपत्रों की खरीद और बिक्री का कारोबार अपने कारोबार में सम्मिलित किया। पेपर करेन्सी एक्ट, 1861 के द्वारा भारत सरकार को नोट जारी करने के लिए एकल अधिकार सौंप दिए गए जिसके परिणामस्वरूप निजी और प्रेसीडेंसी बैंकों के नोट जारी करने के लिए एकल अधिकार समाप्त हो गए। 1881 में परक्राम्य लिखित अधिनियम (एन.आई. एक्ट) अधिनियमित किया गया जिसके द्वारा चेक, विनिमय विपत्र और प्रोमेसरी नोट जैसे लिखितों के प्रयोग और चारित्रिक विशेषताओं को औपचारिक बना दिया गया। एन. आई. एक्ट भारत में गैर नकदी, कागजी भुगतान लिखितों के लिए कानूनी प्रारूप उपलब्ध कराता है और आज भी इसका विधान प्रचलन में है। यद्यपि भारत में आधुनिक चेकों का प्रचलन 19वीं शताब्दी में हुआ है। हुण्डियों का उपयोग विप्रेषण करने, ऋण और व्यापारिक लेनदेनों के लिए लिखितों के रूप में दिया जाता था और ये विभिन्न प्रकार की होती थी तथा इनकी अपनी विशिष्ट पहचान होती थी। तथापि व्यापार और वाणिज्य की मात्रा में निरंतर वृद्धि के साथ और चेक जैसी लिखित में जनता के बढ़ते विश्वास के कारण इन लिखितों के माध्यम से भुगतान लेनदेनों में त्वरित वृद्धि हुई। बैंकिंग प्रणाली के विकास और लेनदेन में चेकों की उच्च मात्रा के कारण बैंकों के बीच एक संघटित चेक समाशोधन प्रसंस्करण की आवश्यकता उभर कर सामने आयी। प्रेसीडेंसी शहरों में बैंकों के द्वारा समाशोधन एसोसिएशन की स्थापना की गई और सदस्य बैंकों के बीच भुगतान का अन्तिम निपटान प्रेसीडेंसी बैंकों पर चेक लिखकर प्रभावी किया जाने लगा। 1921 में जब तीनों प्रेसीडेंसी बैंकों का विलय कर इंपीरियल बैंक की स्थापना हुई तो भुगतान का निपटान उक्त बैंक पर चेक लिखकर किए जाने लगा। 1935 में रिज़र्व बैंक की स्थापना के बाद प्रेसीडेंसी शहरों में अवस्थित

समाशोधन गृहों को रिज़र्व बैंक ने अपने हाथ में ले लिया। इसके परिणामस्वरूप नए माइकर (M.I.C.R) आधारित चेक प्रसंस्करण केन्द्रों की स्थापना का काम वाणिज्य बैंकों को सौंप दिया। समाशोधन गृहों के प्रबंधन को भी काफी हद तक विकेन्द्रीकृत किया गया तथा कई शहरों में वाणिज्य बैंकों को समाशोधन गृहों के प्रबंधन का भार सौंप दिया। भारत में इलेक्ट्रॉनिक युग, 1990 के दशक से प्रारंभ हुआ जब वैश्वीकरण के साथ अर्थव्यवस्था में खुलापन और रिज़र्व बैंक ने प्रौद्योगिकी आधारित भुगतान और निपटान प्रणालियों का विकास किया और इन प्रणालियों के पर्यवेक्षण का कार्य शुरू किया। कागज से कागज रहित प्रणालियों में हुए तेजी से अंतरण को सिद्ध करने के लिए यह तथ्य पर्याप्त है कि कुल आर्थिक मूल्य लेनदेनों के कुल मूल्य में चेकों का हिस्सा (नकदी माध्यम सहित) क्रमशः घट गया, वहीं सम्पूर्ण भुगतान प्रणालियों में इलेक्ट्रॉनिक माध्यम से हुए निधि अंतरण के मूल्य का अंश उल्लेखनीय रूप से बढ़ा। भारत में भुगतान प्रणाली का आधुनिक स्वरूप 36 वर्षों पूर्व अस्तित्व में आया जब एमआईसीआर (M.I.C.R.) समाशोधन की शुरुआत हुई। इसका क्रमवार ब्यौरा इस प्रकार है :-

1. 1980 के आरंभ में चेक समाशोधन प्रणाली यंत्र चालित करने हेतु एमआईसीआर समाशोधन की शुरुआत हुई अर्थात् अस्सी के दशक के प्रारंभ से ही समाशोधन गृहों को कम्प्यूटरीकृत करना प्रारंभ कर दिया था। भुगतान प्रणाली का आधुनिकीकरण अस्सी के दशक के मध्य से माइकर आधारित चेक समाशोधन प्रणाली अपनी परिपक्व अवस्था में पहुँच गई थी। 1986 में रिज़र्व बैंक ने सम्पूर्ण देश में समाशोधन गृहों के काम-काज के तरीकों को विनियमित करने के लिए बैंकर्स समाशोधन गृहों के लिए एक समान विनियम और नियमावली (URR) का एक सेट तैयार किया गया। यह बैंकिंग उद्योग में बढ़ते हुए कम्प्यूटरीकरण और समाशोधन गृहों के कार्य करने के तौर-तरीकों में आए परिवर्तनों के परिप्रेक्ष्य में आवश्यक हो गया था। देश में भुगतान प्रणाली के लिए औपचारिक संस्थागत फ्रेमवर्क प्रदान करने की दिशा में यह एक महत्वपूर्ण कदम था।
2. 1990 में भारतीय रिज़र्व बैंक ने बैंकों द्वारा क्रेडिट कार्ड और डेबिट कार्ड जारी करने की अनुमति दी गई। डेबिट कार्ड से ग्राहक अपने बैंक खाते में (चाहे वह अपने बैंक में हो अथवा किसी दूसरे बैंक में) ऑनलाइन पहुँच सकते हैं। डेबिट सह एटीएम कार्ड से व्यावसायिक प्रतिष्ठानों में खरीददारी भी कर सकते हैं। इस कार्ड का उपयोग ऑनलाइन शॉपिंग, रेल, हवाई टिकट, मूवी टिकट की बुकिंग तथा जनोपयोगी सेवाओं के भुगतान के लिए भी कर सकते हैं। इस कार्ड को वित्तीय

स्थिति पर नियंत्रण रखने में भी किया जाता है, क्योंकि हर ट्रांजेक्शन के बाद खाते में शेष से खर्च की सीमा का भी पता चलता है। आजकल डेबिट कार्ड का प्रयोग विभिन्न पीओएस (POS) मशीन युक्त दुकान से खरीददारी करने हेतु भी किया जाता है। क्रेडिट कार्ड का प्रयोग भी भुगतान के लिए किया जाता है, लेकिन उपयोगकर्ता को एक ऋण सीमा के अन्तर्गत भुगतान करना होता है। ग्राहक को बिल के माध्यम से बकाया राशि की सूचना प्रदान की जाती है और इसे जमा करने की एक निर्धारित तिथि होती है। बकाया राशि को जमा करने के पश्चात् प्रदान की गई राशि दोबारा उपयोग हेतु उपलब्ध कराई जाती है। आवश्यकता पड़ने पर हम क्रेडिट कार्ड से एटीएम द्वारा राशि निकाल सकते हैं। क्रेडिट कार्ड मुख्यतः वीसा या मास्टर कार्ड द्वारा संचालित होता है।

3. 1995 में इलेक्ट्रॉनिक समाशोधन सेवा (ECS) और इलेक्ट्रॉनिक निधि अंतरण (EAFI) जो समयपर्यन्त राष्ट्रीय इसीएस और राष्ट्रीय इएएफटी। एवं आरटीजीएस (RTGS) जैसे प्रभावी भुगतान उत्पादों के रूप में रूपान्तरित हुए, ने भुगतान संसाधनों के नए तरीके आरम्भ किए हैं।
4. 1996 में एक विश्वसनीय संप्रेषण नेटवर्क तथा तकनीकी उन्नयन और विकास के उद्देश्यों को दृष्टिगत रखते हुए बैंकिंग प्रौद्योगिकी विकास एवं अनुसंधान संस्थान (IDBRT) की स्थापना की गई।
5. 1999 में इण्डियन फिनान्शियल नेटवर्क (INFINET) की स्थापना रिजर्व बैंक की निगरानी में की गई। स्विफ्ट के जैसा ही इफिनेट भी इलेक्ट्रॉनिक रूप से अंतर बैंक संदेश प्रेषण का देशी मंच है। रिजर्व बैंक द्वारा भारत में लागू की गई चेक छंटाई प्रणाली, जो कि उस स्तर की है, जो कि विश्व में कहीं भी देखने को नहीं मिलती, भुगतान और निपटान प्रणाली में एक महत्वपूर्ण घटना है। इस प्रणाली से ग्राहकों और उनके चेकों की वसूली शीघ्र मिलने और अद्यतन प्रौद्योगिकी उन्नत होने में मदद मिलती है। यह उल्लेख करना भी आवश्यक है कि भारत में अधिकांश खुदरा भुगतान प्रणालियों की विशेषता अद्यतन प्रौद्योगिकी है। अन्तरराष्ट्रीय नेटवर्क आधारित वित्तीय संदेश प्रणालियों से बहुत पहले ही हम 1999 से ही इफिनेट का प्रयोग करते हुए इलेक्ट्रॉनिक लेन-देनों में जनता की बुनियादी ढांचागत आधारित सुरक्षा का प्रयोग करते आ रहे हैं—जैसा कि स्विफ्ट का इस प्रौद्योगिकी में हुआ था।
6. जून, 2001 में बैंकों को इंटरनेट बैंकिंग पर विस्तृत दिशा-निर्देश जारी किए गए। बैंकों को बोर्ड द्वारा अनुमोदित इंटर बैंकिंग नीति के आधार पर इंटरनेट बैंकिंग सुविधाएं देने की अनुमति

प्रदान की गई तथा उन्हें अब रिजर्व बैंक का पूर्व अनुमोदन प्राप्त करने की आवश्यकता नहीं रही। अब इंटरनेट बैंकिंग के माध्यम से अनुमत निहित लेनदेनों के लिए विदेशी मुद्रा सेवाएं भी दी जा सकती हैं। भारत में बैंकों में रखे गए ओवरसीज बैंकों और विदेशी मुद्रा गृहों को वोस्ट्रो खातों के परिचालन की अनुमति इंटरनेट आधारित परिचालनों के माध्यम से दी गई है। लेकिन इंटरनेट बैंकिंग उपलब्ध कराने की सबसे बड़ी चिंता बैंकों द्वारा अभिगृहित वृद्धिकारी परिचालनगत जोखिमों, जो बैंकिंग सेवाओं के लिए इस वैकल्पिक सुपुर्दगी माध्यम के उपयोग में लाने के कारण है, का प्रभावी प्रबंधन करना होगा। सन् 2001-2004 के लिए भुगतान प्रणाली विजन डॉक्यूमेंट तैयार किया गया जिसमें देश में भुगतान प्रणालियों के समेकन विकास और एकीकरण के लिए रोडमैप दिखाया गया था। इन उद्देश्यों की प्राप्ति के बाद मई, 2005 में 2005-08 के लिए एक विजन डॉक्यूमेंट प्रकाशित किया गया जिसमें भुगतान और निपटान क्षेत्र में आने वाले चार वर्षों के लिए रिजर्व बैंक के विजन को सुस्पष्ट किया गया था। देश के लिए सुरक्षित, विश्वसनीय, ठोस और कुशल भुगतान और निपटान प्रणालियों के उन्नयन के लिए प्रयास करना, भुगतान और निपटान प्रणालियों में सुरक्षा का संबंध जोखिम कम करने से है जबकि विश्वसनीयता का सम्बन्ध अखण्डता से है।

7. सन् 2003 में राष्ट्रीय वित्तीय स्वीच प्रारम्भ करना जिसके फलस्वरूप देशभर में एटीएम की इन्टरकनेक्टिविटी संभव हुई। यह अखिल भारतीय अस्तित्व के साथ एक राष्ट्रीय आधारभूत संरचना है, जो बैंकों के एटीएम में संयोजकता सेवा प्रदान करती है। यह ग्राहकों को एनएफएस नेटवर्क के अन्तर्गत एटीएम का उपयोग करते हुए, कार्ड जारी करने वाले बैंक को बिना बताए, अपना वित्तीय/वित्तेतर दोनों लेनदेन करने में समर्थ बनाता है। एनएफएस सबसे बड़ा स्विचिंग नेटवर्क है और इसकी सेवा भारतीय राष्ट्रीय भुगतान निगम (NPCI) द्वारा की जाती है।
8. मार्च, 2004 में तत्काल सकल निपटान (RTGS) प्रणाली आरंभ की गई। अर्थव्यवस्था के विस्तार के साथ-साथ बड़े मूल्य वाले भुगतान संबंधी लेनदेनों की मात्रा बढ़ती है। उस स्थिति में पूरी प्रणाली के पूरक के रूप में, बड़े मूल्यों के मूल्य की भुगतान प्रणालियों के लिए भी आधुनिकीकरण महत्वपूर्ण हो जाता है। इसी तथ्य को ध्यान में रखते हुए भारतीय रिजर्व बैंक ने सकल अंतर बैंक तथा ग्राहकों के दो लाख रुपये से अधिक मूल्य वाले लेनदेनों के निपटान के लिए मार्च, 2004 में आरटीजीएस प्रणाली की शुरुआत की। उन्नत चलनिधि प्रबंध कार्यों, भावी दिनांक की क्रियाशीलता, मापनीयता आदि

से युक्त आईएसओ (ISO) 2022 मानकों पर निर्मित अगली पीढ़ी-आरटीजीएस (NG-RTGS) क्रियान्वयन के अधीन है। एनजी-आरटीजीएस के पास बैंकों के लिए उनकी चलनिधि स्थिति का प्रबंध करने के अनेक कार्य हैं, अर्थात् इस उत्पाद में अधिक चलनिधि की बचत वाली विशेषताएं तथा अधिक तेजगति से और अधिक मात्रा में प्रसंस्करण की क्षमताएं, ग्रीडलॉक समाधान की उन्नत व्यवस्था, परिचालनात्मक विश्वसनीयता कारोबार निरंतरता जैसी सुविधाएं सन्निहित हैं। वहीं यह अन्तरराष्ट्रीय मानकों के अनुरूप है। इसमें अन्य प्रणालियों के साथ अन्तर परिचालनीयता को बढ़ावा मिलेगा। इस नई प्रणाली में अद्यतन प्रौद्योगिकी, वित्तीय पर्यावरण के परिवर्तनों एवं अन्य आवश्यकताओं में हुए परिवर्तनों के अनुरूप विस्तार तथा लचीलेपन की काफी गुंजाइश है तथा इसमें वित्तीय लेनदेनों के वैश्वीकरण तथा निपटान संबंधी ढाँचों की नेटवर्किंग जैसे वित्तीय माहौल में बदलाव से निपटने के लिए उन्नत पहुँच की सुविधा होगी।

9. वर्ष 2005 में राष्ट्रीय इलेक्ट्रॉनिक निधि अंतरण (NEFT) प्रारंभ की गई जो भारतीय रिज़र्व बैंक का एक अन्य नवोन्मेषी उत्पाद है। इसका प्रारंभ नवम्बर, 2005 में, देश में नेटवर्क आधारित बैंक शाखाओं के बीच बैंक ग्राहकों द्वारा निधियों के सुविधाजनक अंतरण और राष्ट्रीय स्तर पर अधिक सुरक्षित खुदरा इलेक्ट्रॉनिक प्रणाली के रूप में किया गया। यह आस्थगित विशुद्ध निपटान प्रणाली है और सुरक्षा तथा प्रसंस्करण कार्यक्षमता के संदर्भ में अन्य विधियों से उन्नत रूप है। जुलाई 2017 से महिने के दूसरे और चौथे शनिवार को छोड़कर प्रतिदिन प्रातः 8 बजे से शाम को 7 बजे तक आधे घंटे के आधार पर 23 बैचों के निपटान का प्रावधान है। यह भी परिकल्पना की गई थी कि आरटीजीएस युक्त सभी शाखाएं एनईएफटी युक्त भी होंगी और ग्राहक को इन दोनों में से एक प्रणाली के चयन का विकल्प होगा, जो समयबद्धता, लेनदेन के मूल्य और दोनों प्रणालियों के लिए अलग-अलग भुगतान करने की उसकी इच्छा पर आधारित होगा। एनईएफटी की बढ़ती हुई लोकप्रियता और ग्राहकों के मध्य इसकी स्वीकार्यता का प्रमाण इस प्रणाली द्वारा संचालित मात्रा और मूल्य में प्रतिबिंबित हुई है। इससे प्रतीत होता है कि व्यक्तियों, कम्पनियों और सरकारों की आवश्यकताओं को एक समान ढंग से पूरी करती हुई एनईएफटी देश में एक अग्रणी विप्रेषण प्रणाली बन गई है। इस प्रणाली में समय-समय पर अनेक कुशलतावर्धन भी किए गए हैं। जमा संदेश लगातार जारी करने की विशेषता लागू करने के साथ ही इन लेनदेनों का प्रसंस्करण करने के लिए सहभागियों को अतिरिक्त पटल दिया गया है। दिसम्बर, 2007 में ससंद द्वारा भुगतान एवं

निपटान प्रणाली अधिनियम अधिनियमित किया गया। यह अधिनियम रिज़र्व बैंक को भुगतान एवं निपटान को विनियमित करने और उसका पर्यवेक्षण करने हेतु अधिकार सुपुर्द करता है और बहुपक्षीय नेटिंग और निपटान के लिए कानूनी आधार उपलब्ध कराता है। यह अधिनियम उच्च उद्देश्यों के प्रारूप में नीति निर्धारित करने में उनकी स्थापना/निरंतरता, निर्देश जारी करने, मानक तय करने, सूचना/डाटा मंगाने, अधिनियम के प्रावधानों, विनिर्णयों और निर्देशों इत्यादि का उल्लंघन करने के लिए मुकदमा चलाने/आर्थिक दण्ड लगाने का अधिकार रिज़र्व बैंक को सौंपता है।

10. वर्ष 2008 में रिज़र्व बैंक द्वारा जिस सर्वाधिक नवीनतम इलेक्ट्रॉनिक उत्पाद का प्रचलन किया गया, वह है चेक ट्रंकेशन प्रणाली। यह प्रणाली राष्ट्रीय राजधानी क्षेत्र में 1 फरवरी, 2008 को 10 बैंकों की भागीदारी से पायलट आधार पर चालू की गई। वर्तमान में सभी बैंक इस प्रणाली में भागीदारी करते हैं। सीटीएस (CTS) का मुख्य उद्देश्य है भुगतान प्रणाली की कार्यक्षमता में उन्नयन करना और चेक प्रसंस्करण समय को महत्वपूर्ण रूप से कम करना। परम्परागत समाशोधन प्रणाली, जिसके भुगतान तथा निपटान के लिए समाशोधन गृहों में चेकों को भौतिक रूप में प्रस्तुत करना होता है, में वांछित समाशोधन समय और आधारभूत संरचना के संदर्भ में निश्चित रूप से खामियां छुपी होती हैं। भौतिक चेक समाशोधन के लिए वांछित सहायक व्यवस्था की आवश्यकता होती है, जो C. T. S. प्रणाली के पश्चात कम हो गई है। चेक ट्रंकेशन का सबसे बड़ा लाभ यह है कि इसमें चेकों को भौतिक रूप से प्रस्तुत करने की आवश्यकता नहीं होती, इसके स्थान पर चेकों की इलेक्ट्रॉनिक इमेज को समाशोधन गृहों में भेज दी जाती है।

11. वर्ष 2009 में भारतीय राष्ट्रीय भुगतान निगम (NPCI) स्थापित किया गया। इस संस्था की स्थापना भारतीय रिज़र्व बैंक के विजन डॉक्यूमेंट 2005-08 के आधार पर की गई। यह संगठन खुदरा भुगतान प्रणालियों के शीर्ष संगठन के रूप में कार्य करता है जिसकी स्थापना के पीछे मुख्य उद्देश्य था खुदरा भुगतानों के लिए एक समन्वयक संगठन की सुविधा प्रदान करना ताकि देश में चेकों और इलेक्ट्रॉनिक भुगतान के लिए समाशोधन गृहों को एकीकृत व समेकित किया जा सके। इसके अतिरिक्त यह निगम ऐसे नये भुगतान अनुप्रयोगों को आरंभ करने के दायित्व का भी निर्वहन करता है जिनमें इलेक्ट्रॉनिक भुगतानों पर भी ध्यान केन्द्रित किया गया हो। एनपीसीआई "रूपे" आरंभ कर चुकी है जो एक स्वदेशी घरेलू कार्ड योजना है। इस निगम ने अंतर बैंक

मोबाइल भुगतान प्रणाली (IMPS) का भी परिचालन प्रारंभ किया है जो मोबाइल फोन के माध्यम से तत्क्षण 24 X 7 आधार पर अंतर बैंक इलेक्ट्रॉनिक निधि अंतरण सेवा देती है। एनपीसीआई को यह सुनिश्चित करना है कि आधार समर्थित भुगतान प्रणाली (AEPS) के अन्तर्गत इन कार्डों का उपयोग कारोबारी प्रतिनिधि (BC) के संबंध में भारतीय रिज़र्व बैंक के दिशा-निर्देशों की अनुपालना की जाए।

12. वर्तमान में घरेलू मैसेजिंग के लिए एक ही मैसेजिंग समाधान (SFMS) उपलब्ध है। एक वैकल्पिक मैसेजिंग ढाँचे की उपलब्धता की दृष्टि से स्विफ्ट को निर्दिष्ट शर्तों के अधीन घरेलू मैसेजिंग के लिए सिद्धांत के रूप में मंजूरी दी गई है। सहभागियों के पास बैंक के केन्द्रीय सर्वर में लेनदेनों को भेजने के लिए विभिन्न चैनलों के चुनाव का विकल्प होता है। यह विभिन्न चैनल हैं— इन्फिनेट/एसएफएमएस, स्विफ्ट तथा इंटरनेट।
13. भारत में भुगतान प्रणाली विजन 2012-14 में ग्राहकों तथा कार्पोरेटों द्वारा किसी एक सीमा से अधिक राशि के चेक को निरूत्साहित करने के लिए एक रणनीति तैयार करने की बात कही जिसमें समाशोधन गृह व्यवस्था के माध्यम से पारित किए जाने वाले चेकों के लिए एक निश्चित सीमा तय करने की आवश्यकता शामिल की जा सकती है। इससे पहले भारतीय रिज़र्व बैंक 2012-15 के लिए एक विजन डॉक्यूमेंट लेकर आया था जिसके अधिकांश उद्देश्य पूरे हो चुके हैं। रिज़र्व बैंक का विजन यह सुनिश्चित करता है कि “देश में सभी भुगतान एवं निपटान प्रणालियां सुरक्षित, समक्ष, अन्तःप्रचलनीय, प्राधिकृत, सुलभ, समावेशी और अन्तरराष्ट्रीय मानकों के साथ अनुपालन योग्य हैं।”
14. रूपे, एक घरेलू कार्ड प्रणाली है जो मार्च, 2012 में लॉन्च की गयी थी, ने क्रमशः लोकप्रियता अर्जित की है तथा जनधन योजना के अन्तर्गत उसकी सहलग्नता से यह एक पारिवारिक नाम बन गया है। पीएमजेडीवाई योजना ने बैंक रहितों को बैंकिंग प्रणाली के दायरे में लाकर आश्चर्यजनक सफलता हासिल की है।
15. भारतीय रिज़र्व बैंक जब कागज आधारित लेनदेनों के आधुनिकीकरण का काम कर रहा था, तो उसके साथ-साथ थोक भुगतान संबंधी लेनदेनों (क्रेडिट और डेबिट) के लिए इलेक्ट्रॉनिक भुगतान पद्धतियों पर भी काम कर रहा था। कुछ स्थानों तक सीमित इलेक्ट्रॉनिक समाशोधन सेवा (ECS) अपने स्वरूप का विस्तार करके नया रूप धारण कर चुकी है, (अ) एक निश्चित स्थान/क्षेत्र तक सीमित ईसीएस जो स्थानीय

समाशोधन गृह की बैंक शाखाओं की जरूरतों को पूरा कर रही हैं, (ब) एक क्षेत्रीय ईसीएस जिसके अन्तर्गत एक राज्य या कई राज्यों की बैंक शाखाएं शामिल होती हैं, और (क) एक राष्ट्रीय ईसीएस जिसके अन्तर्गत पूरा देश आता है। इसके साथ ही ईएफटी ने अपने स्वरूप का विस्तार करके अखिल भारतीय स्तर के एनईएफटी का रूप धारण कर लिया है। इन दो उत्पादों ने सम्मिलित रूप से, देश में इलेक्ट्रॉनिक खुदरा बाजार परिदृश्य में क्रांति ला दी है। वस्तुतः इलेक्ट्रॉनिक समाशोधन सेवा भारत की भुगतान प्रणाली को अन्तरराष्ट्रीय मानकों के अनुरूप उन्नत करने की दिशा में एक प्रगतिशील कदम है। यह 1990 के मध्य स्थापित की गई जो कतिपय अन्य देशों में प्रचलित आटोमेटेड क्लीअरिंग हाउस (ACH) के समकक्षीय है। इसके दो संस्करण हैं— ईसीएस क्रेडिट, क्लीअरिंग और ईसीएस डेबिट क्लीअरिंग। क्रेडिट क्लीअरिंग का संचालन “एकल नाम बहुपक्षीय जमा सिद्धांत” पर किया जाता है और इसका उपयोग वेतन, पेंशन, लाभांश और ब्याज इत्यादि के भुगतान के लिए किया जाता है तथा डेबिट क्लीअरिंग का संचालन “एकल जमा बहुपक्षीय नाम सिद्धांत” पर किया जाता है और इसका उपयोग विद्युत, टेलीफोन बिल इत्यादि जैसी सेवा के प्रदाताओं द्वारा भुगतान वसूल करने और साथ ही साथ बैंकों द्वारा उधारकर्ताओं से हाउसिंग और व्यक्तिगत ऋणों पर मूलधन/ब्याज की चुकौती प्राप्त करने के लिए किया जाता है। इसके अन्तर्गत टी+1 आधार पर निपटान किया जाता है और निपटान चक्र टी+1 पर पूरा होता है।

16. भुगतान बैंकों की परिकल्पना वर्तमान भुगतान प्रणाली को और मजबूत करके वित्तीय समाशोधन को सफल बनाने हेतु की गई है। इसका अभिप्राय है डिजिटल बटुआ अथवा मोबाइल मुद्रा ताकि इसका प्रयोग बाजार करने, बिल भुगतान करने तथा अन्य कई प्रकार के सम्प्रेषण हेतु हो सकता है। भारतीय रिज़र्व बैंक ने अगस्त, 2015 में भुगतान बैंकों के 11 आवेदनकर्ताओं का लाइसेंस जारी करने को सैद्धांतिक अनुमति दी है। इन बैंकों की सेवा और गतिविधियों की पहुँच सामान्य लोगों एवं छोटे कारोबारियों तक है। यह बैंक उन लोगों को वित्तीय परिचालन की परिधि से जोड़ता है, जिन्हें बैंकिंग सेवाएं उपलब्ध नहीं हैं।
17. इलेक्ट्रॉनिक भुगतानों को प्रोत्साहन दिया जाना भुगतान एवं निपटान प्रणाली की एक अन्य प्रमुख विशेषता है। आज हमारी भुगतान प्रणालियां सुविधा की मांगों तथा उपयोग और पहुँच की सुलभता द्वारा संचालित हैं। इसके लिए एकीकृत समाधान निर्माण और प्रौद्योगिकी के माध्यम से नवोन्मेष,

क्षमताओं और विभिन्न प्रणालियों के समेकन के संबंध में उन्नयन द्वारा ई-भुगतान उत्पादों का अभिसरण आवश्यक हो जाता है। भारतीय रिजर्व बैंक के भुगतान विजन डॉक्यूमेंट 2012-15 में एक कम नकदी/कम कागज वाले समाज, "हरित" पहल को बढ़ावा देने की दिशा में समग्र विनियामक नीतिगत रुख की अभिमुखता को स्पष्ट रूप से व्यक्त किया गया है। **खुदरा भुगतान के अन्य कतिपय माध्यम**

(अ) **पूर्वदत्त लिखित** :- भारतीय रिजर्व बैंक नकदी लेनदेन के साथ स्थानापन्न के रूप में प्रीपेड भुगतान लिखितों की सशक्तता को स्वीकार करता है। वर्ष 2009 में इस हेतु दिशा-निर्देश जारी करने के बाद प्रीपेड भुगतान लिखित लोकप्रिय होते जा रहे हैं। इस लोकप्रियता में वृद्धि को दृष्टिगत रखते हुए इन वैकल्पिक भुगतान उत्पादों का जारी किया जाना, स्वीकार किया जाना और सुलभ बनाने के लिए इस नीति को और भी गतिशील बना दिया गया है। रिजर्व बैंक के नीतिगत निर्देशों के जारी होने के बाद पूर्वदत्त लिखित उदीयमान बाजार की व्यवस्थित वृद्धि के लिए एक ढांचा प्रदान किया गया है। बाद में रिजर्व बैंक द्वारा किये गये उपायों की घोषणा के बाद बैंकों को यह अनुमति दी गई कि निर्धारित मानदण्डों का पालन करने के बाद कार्पोरेटों को भुगतान लिखित जारी करें जो आगे इसे अपने कर्मचारियों को जारी करेंगे।

(ब) **मोबाइल सेवाएं** :- विश्वभर में मोबाइल के माध्यम से सेवाएं उपलब्ध कराने के लिए दो मॉडलों का प्रयोग किया जाता है :- बैंक नेतृत्व वाला मॉडल (भारत, दक्षिणी अफ्रीका और फिलिपींस में) अथवा गैर बैंक नेतृत्व वाला मॉडल (केनिया और फिलीपींस में भी)। भारत में बहुत कारणों से बैंक नेतृत्व वाला मॉडल चुना गया। मोबाइल भुगतान प्रणाली केवल प्रेषण सुविधा प्रदान करती है, वे वित्तीय समावेशन के अन्तर्गत ओवरड्राफ्ट, क्रेडिट और माइक्रो इंशुरेंस जैसी अन्य सुविधाएं प्रदान नहीं कर सकती तथा हमारे बैंकों का व्यापक विनियमन विद्यमान है। इस क्षेत्र को विनियमित करने के लिए अक्टूबर, 2008 में सर्वप्रथम उपाय किए थे। इसलिए भारत में बहुत सोच-समझकर बैंक नेतृत्व वाला मोबाइल बैंकिंग मॉडल अपनाया है। इसी क्रम में 22 नवम्बर, 2011 को आरंभ की गई अंतर बैंक मोबाइल बैंकिंग भुगतान प्रणाली उन ग्राहकों के लिए सुविधाजनक है जिन्होंने सुरक्षित ढंग से तत्काल पुष्टिकरण लक्ष्यों के साथ अन्तर बैंक निधि अंतरण के लिए मोबाइल उपकरणों का प्रयोग करने के लिए अपने बैंक में पंजीकरण कराया है। सूचना प्रौद्योगिकी के इस युग में डिजिटल बैंकिंग के अन्तर्गत मोबाइल एप (जिसे अनेक बैंकों ने मोबाइल के लिए अपनी इंटरनेट बैंकिंग के विशेष एप

के रूप में तैयार किए हैं) भी प्रभावशाली भूमिका का निर्वहन कर रहे हैं। इस मोबाइल एप को डाउनलोड कर ग्राहक आसानी से बैंकिंग सेवाएं प्राप्त कर सकता है। एम वालेट, एम पास बुक, एम पैसा एवं पेटीएम इत्यादि मोबाइल एप इन दिनों काफी लोकप्रिय होते जा रहे हैं। इन एप्स के माध्यम से जनोपयोगी बिलों का भी तुरंत भुगतान हो सकता है, खातों को देखा जा सकता है तथा लेनदेन भी किया जा सकता है। अब "क्यू" प्रणाली से छुटकारा पाया जा सकता है एवं समय की भी बचत हो गई है। इससे ग्राहकों की सुविधा तथा नकदी के रख-रखाव से भी मुक्ति मिल गई है। यह आशा की जाती है कि जब डिजिटल बैंकिंग पूरी तरह से प्रयोग में आ जाएगी तो नकदी मुक्त समाज की परिकल्पना करना आसान हो जाएगा। विमुद्रीकरण के दौर में इसका काफी महत्व है।

(क) **भारत इन्टरफेस ऑफ मनी (BHIM)** :- इस ऐप की सहायता से कोई भी ऐसा मोबाइल प्रयोगकर्ता, जिसका बैंक में खाता है, वह इस ऐप में अपने आपको रजिस्टर करके किसी भी दूसरे सत्यापित प्रयोगकर्ता के खाते में मोबाइल नंबर, वी पी ए अथवा क्यू आर कोड की सहायता से पैसा हस्तान्तरित कर सकता है तथा साथ ही किसी से पैसे के लिए निवेदन भी कर सकता है।

(ड) **यूनिफार्म पेमेंट इन्टरफेस (UPI)** :- यूपीआई एप्लीकेशन तुरन्त ऑनलाइन भुगतान की एक प्रणाली है जिसके तहत आप जिसे पैसा भेजना चाहते हैं, उसका यूपीआई आईडी आपको पता होना चाहिए। यह ईमेल पते की तरह होता है। यह आपका फोन नंबर भी हो सकता है। यूपीआई के तहत आप अपने विभिन्न बैंकों के लिए अलग-अलग यूपीआई आईडी तैयार करवा सकते हैं। डेटा की सुरक्षा के लिए भुगतान प्रक्रिया के समय आपका खाता नंबर आपके बैंक के अलावा कहीं भी उजागर नहीं होता है।

(य) **सैटेलाइट बैंकिंग** :- देश के कुछ हिस्सों में (विशेषकर दुर्गम-दूरस्थ और पहाड़ी क्षेत्रों में) विश्वसनीय संप्रेषण के अभाव में, सैटेलाइट कनेक्टिविटी ही एक ऐसा तरीका है जिसके द्वारा शाखाओं को जोड़ा जा सकता है और साथ में इसको फालबैक प्रणाली के रूप में रखा जा सकता है। इसके उपयोग से ग्रामीण शाखाओं को बैंक कोर बैंकिंग सोल्यूशन प्लेटफार्म से जुड़ने में भी सहायता मिलेगी और ग्रामीण क्षेत्र की शाखाएं अपने ग्राहकों को निधि अंतरण सुविधा कुशलतापूर्वक दे सकेगी। सैटेलाइट संचार लिंक सर्वाधिक आपदा रक्षित है क्योंकि सैटेलाइट की अवस्थिति व्योममंडल में होने के कारण पृथ्वी पर आई भारी-भक्कम

प्राकृतिक आपदाओं तथा बाढ़ अथवा जलजला या भूकंप में भी यह अपना काम लगातार करता रहता है। अतः सैटेलाइट संचार लिंक में, जहां टेरिस्ट्रियल कनेक्शन पूरी तरह से चौपट हो सकते हैं, प्रमुख केन्द्रों के लिए बैकअप (Backup) संचार लिंक के रूप में आदर्श तरीके से काम करता है।

(र) **भुगतान आधारित संरचना :-** इसमें त्वरित सुधार होने के कारण भुगतान सुसाध्यकों, प्रौद्योगिकी समाधान प्रदाताओं और वणिक् अधिग्राहकों द्वारा प्रदान की गई सेवाएं उद्योग में अपनी जड़ जमा रही है। इसका कारण विगत वर्षों में भुगतान प्रणाली की आधारिक संरचना में हुआ विस्तार ही है जहां नये भुगतान परिचालकों का प्रवेश, नये सुपुर्दगी माध्यम से स्वीकार्यता में वृद्धि, नये उत्पाद एटीएम की संख्या में वृद्धि, पीओएस टर्मिनल्स, भुगतान संसाधन आधारिकी में संवर्द्धन आदि हैं।

(ल) **गैर-बैंक संस्थाओं की भूमिका :-** यह एक सामान्य धारणा है कि गैर बैंक संस्थाएं नवोन्मेषी भुगतान उत्पाद उपलब्ध कराती हैं तथा बाजार में प्रतियोगिता को बढ़ावा देती हैं। इसी कारण से रिजर्व बैंक ने खुदरा भुगतान के क्षेत्र में प्रवेश के लिए गैर बैंक संस्थाओं को प्राधिकृत किया है। इसके साथ ही यह सुनिश्चित करने पर भी ध्यान दिया है कि इस क्षेत्र में जो भी गैर बैंक संस्थाएं आए, वे केवाईसी (KYC)/एएमएल (AML) संबंधी दिशा-निर्देशों का पालन करें। चूंकि निपटान का क्षेत्र और इन गैर बैंक संस्थाओं के पास नहीं है (इनके पास भुगतान सेवाओं और उत्पादों की विशेषता है), इसलिए बकाया शेषों को एक एस्करो (ट्रस्ट) खाते में रखने की जरूरत है, ताकि दिवालियेपन से सुरक्षित हो सके। एटीएम क्षेत्र में भी गैर बैंक संस्थाओं के प्रवेश की अनुमति मिल गई है।

गैर बैंक संस्थाओं का प्रवेश क्यों?

गैर बैंक संस्थाओं की सर्वव्यापी उपस्थिति के कुछ कारण इस प्रकार हैं :-

- अधिक दक्ष और तेज प्रणालियों की मांग के साथ-साथ ग्राहकों का बदलता व्यवहार।
- प्रौद्योगिकी के चलते भुगतान सेवाओं में नवोन्मेष सुविधाजनक बना।
- आउटसोर्सिंग की प्रवृत्ति :- संभवतः पूंजी के निवेश को कम करने के उद्देश्य से बैंकों द्वारा ऐसा किया जा रहा है, क्योंकि

यह कार्य शुल्क के आधार पर आउटसोर्स किया जा सकता है।

(iv) वित्तीय समावेशन के प्रयास :- विशेष रूप से मोबाइल बैंकिंग के क्षेत्र में जहां गैर बैंक महत्वपूर्ण भूमिका निभा रहे हैं।

(व) **रिजर्व बैंक में कोर बैंकिंग सोल्यूशन :-** इसके कार्यान्वयन के बाद सरकार, बैंक, प्राथमिक व्यापारी, वित्तीय समावेशन (FI) और आम नागरिक को काफी लाभ हुआ है। इस सीबीएस (CBS) से कहीं भी बैंकिंग (विशेषकर भुगतान) की सुविधा - सरकारी विभागों, कोषागारों, उपकोषागारों को ऑनलाइन पहुँच तथा ई-भुगतान तरीका/सुपुर्दगी माध्यम के जरिए प्राप्त होगी। (इससे सरकार के सभी तरीकों के भुगतान एक ही बैंक से आरटीजीएस (RTGS) एनईएफटी (NEFT) एनईसीएस (NECS) और अन्य इलेक्ट्रॉनिक सुपुर्दगी माध्यमों के जरिए कर पाने की सुविधा हो गई है।

(स) **क्षेत्रीय ग्रामीण बैंकों में भुगतान प्रणाली :-** एक सीबीएस समर्थित क्षेत्रीय ग्रामीण बैंक उत्पादों और सेवाओं के संदर्भ में अपार संभावनाओं के द्वार खोलता है। प्रायोजक बैंकों द्वारा क्षेत्रीय ग्रामीण बैंकों के सीबीएस को अपने सीबीएस से एकीकृत करने से आरआरबी के ग्राहकों को कहीं भी कैसे भी बैंकिंग का लाभ प्राप्त होगा और वे विविध सुपुर्दगी माध्यमों यथा, आरटीजीएस, एनईएफटी, इन्टरनेट, टेलीबैंकिंग और एसएमएस बैंकिंग, आदि का उपयोग करने में समर्थ होंगे।

वित्तीय समावेशन के उन्नयन में भुगतान प्रणाली का महत्व :-

भुगतान प्रणाली एवं वित्तीय समावेशन के मध्य धनात्मक एवं सशक्त सहसंबंध है। वित्तीय समावेशन का सर्वाधिक महत्वपूर्ण अंग बैंकिंग समावेशन ही है जहां बैंकिंग द्वारा जनसंख्या को उनके बैंक खाते खुलवाकर औपचारिक बैंकिंग प्रणाली से जोड़ने का प्रयास किया जाता है। लोगों के बीच बैंकिंग और बचत की आदत डालने के लिए यह जरूरी है कि हर व्यक्ति का बैंक खाता हो, जहां पैसा रखा जा सकता है। यह प्रक्रिया अपने शुरुआती दौर में केन्द्र/राज्य सरकार योजनाओं के अन्तर्गत प्रत्यक्ष लाभ अंतरणों के रूप में हो सकती है। वित्तीय समावेशन को केवल सामाजिक उत्तरदायित्व के रूप में ही नहीं देखा जाना चाहिए क्योंकि यह एक विशाल अप्रयुक्त बाजार को बैंकिंग सेवाओं के घेरे में लाने वाला है। भारत के ग्रामीण क्षेत्र सहित 145 मिलियन परिवार ऐसे हैं जिन्हें बैंकिंग में शामिल नहीं किया गया है। इस प्रकार "पिरामिड का तल", जिसमें भारत का बड़ा भाग शामिल है, एक विशाल अप्रयुक्त बाजार को सामने लाता है जिसमें जबरदस्त संभावनाएं निहित हैं।

सरकारी लेनदेन-लाभ अंतरण योजनाएँ :-

भारतीय रिज़र्व बैंक द्वारा "इलेक्ट्रॉनिक लाभ अन्तरण (EBT)" के संबंध में जारी दिशा-निर्देशों में इस ईबीटी के कार्यान्वयन और वित्तीय समावेशन योजना के साथ इसके सह-सम्बन्ध में यह आशा की जाती है कि वित्तीय समावेशन प्रक्रिया को प्रभावपूर्ण प्रोत्साहन मिलेगा और एक उर्ध्वमुखी एवं टिकाऊ वित्तीय समावेशन मॉडल की ओर देश अग्रसर होगा। इस संबंध में केन्द्रीय वित्त मंत्रालय ने सरकारी स्वामित्व वाले सभी बैंकों और वित्तीय संस्थाओं को सूचित किया था कि सितम्बर, 2011 से केवल इलेक्ट्रॉनिक अन्तरण के माध्यम से भुगतान करें न कि चेकों के माध्यम से। यह कार्यवाही कागज रहित निधि अन्तरण प्रणाली की ओर अग्रसर होने के लिए ई-गवर्नेंस पहलों का ही एक भाग है। बैंकों के लिए भी यह एक मितव्ययी प्रस्ताव है क्योंकि इससे कागज की हैंडलिंग लागत में कमी आएगी। सरकार की वर्तमान योजनाओं के कारण लेनदेनों की संख्या बढ़ जाएगी। इस समय दैनिक आधार पर किए जाने वाले लेनदेनों से, यह संख्या भुगतान प्रणाली में 10 से 15 मिलियन अधिक होगी।

कागज आधारित भुगतान तथा इलेक्ट्रॉनिक भुगतान की तुलना दक्षता की दृष्टि से चेकों से भुगतान की तुलना में इलेक्ट्रॉनिक भुगतान अधिक सुविधानजक है। इसके 7 कारण हैं :-

1. चेकों की छपाई तथा प्रोसेसिंग की लागत अधिक है।
2. चेकों की एनकोडिंग व विवरण भरने का काम हाथ से करना होता है।
3. प्राप्य एवं देय राशि के निर्धारण के लिए मिलान संबंधी काफी चुनौतियां आती हैं।
4. कानूनी तथा विनियामक जरूरतों के अनुसार लंबे समय तक चेकों का अनुसरण करना होता है।
5. चेकों के समाशोधन एवं प्रसंस्करण का चक्र लम्बा होता है।
6. चेकों के साथ चलनिधि एवं जोखिम तत्व भी जुड़ा होता है।
7. इन सबके विपरीत इलेक्ट्रॉनिक भुगतान में कठिनाइयां नहीं होती और यह प्रणाली में कम लागत, लेनदेनों की तेज, दक्ष एवं सुरक्षित व्यवस्था उपलब्ध कराई जाती है। इलेक्ट्रॉनिक भुगतान क्रेडिट प्रेरित होते हैं, अर्थात् इसमें क्रेडिट, चलनिधि तथा प्रणालीगत जोखिम काफी कम होता है और लाभार्थी निधि की उपलब्धता के बारे में पर्याप्त रूप से सुनिश्चित हो सकते हैं।

आगामी भुगतान क्रांति

एक रणनीतिक कारवाई के रूप में अगली भुगतान क्रांति के स्वरूप में पारिस्थितिक चुनौतियां भी निहित है। यह स्थिति देश के टियर-I और टियर-II केन्द्रों पर डिजिटल चैनलों की प्रचुरता से स्वयंसिद्ध है। यह भी सुनिश्चित करना जरूरी है कि डिजिटल चैनल पर्याप्त रूप से उपलब्ध हो और सुविधा प्रदाता जैसे डेबिट कार्ड, इन्टरनेट बैंकिंग पंजीकरण आदि टियर-III एवं टियर-IV तक के केन्द्रों पर भी उपलब्ध हों। यह अत्यधिक जरूरी है कि देश 6.38 लाख गांवों में रहने वाले लोगों के पास अल्टरनेट डिलीवरी चैनल्स (ADC) मौजूद हों। एक अनुमान के अनुसार ब्रिक देशों के औसत तक पहुँचने के लिए भारत को 20 मिलियन पीओएस टर्मिनल (POS Terminal) चाहिए जो हमारी वर्तमान उपलब्धता से कई गुना ज्यादा हैं। वास्तव में यह बहुत बड़ी आवश्यकता है। आगामी भुगतान क्रांति के अन्य तत्व हैं-सरकारी प्रत्यक्ष लाभ अंतरण को इलेक्ट्रॉनिक चैनल प्रदान किया जाए जो एक कुशल भुगतान प्रणाली को बढ़ावा देने की स्पष्ट रणनीति है। (इसके अन्तर्गत लगभग 950 मिलियन आधार कार्ड जारी किए जा चुके हैं।) इस रणनीति का एक और भाग डिजिटल चैनल की परस्पर परिवर्तनशीलता है अर्थात् डिजिटल चैनल यथा परिभाषित कही भी और कभी भी उपलब्ध होने चाहिए। आखिर में यह कहना भी उचित होगा कि ग्राहकों को डिजिटल चैनल आसानी से चलाना आना चाहिए।

उपसंहार

आज भारत में भुगतान प्रणाली का आधुनिकीकरण हो गया है। भुगतान एवं निपटान प्रणाली तेजी से बढ़ता हुआ ऐसा क्षेत्र है जिसमें, बाजार शक्तियों और प्रौद्योगिकी की सहायता से तेज गति से नवोन्मेष देखने को मिल रहे हैं। हमें भारत में विश्व की सर्वोत्तम प्रथाएं एवं उत्पाद ले जाने की जरूरत है, लेकिन हमें अपनी परिवेश और परिस्थितियों के अनुसार उसमें संशोधन करके उन्हें अपनाना होगा। विशेष रूप से भुगतान उत्पादों और प्रणालियों की लागत कम करके और साक्षरता में सुधार लाने पर ध्यान केन्द्रित करना चाहिए। हमें मुख्यतः नकदी आधारित अर्थव्यवस्था से कम नकदी वाली अर्थव्यवस्था और पूर्णरूपेण इलेक्ट्रॉनिक व्यवस्था की ओर अग्रसर होना होगा। हमें यह भी सुनिश्चित करना होगा कि वित्तीय नवोन्मेष से वित्तीय समावेशन को बढ़ावा मिले। भुगतान के गैर नकदी तौर-तरीकों को लोकप्रिय बनाने में बैंकों का योगदान प्रशंसनीय है। बैंकों ने हाल के वर्षों में ऐसे अनेक भुगतान उत्पाद आरंभ किए हैं जिनके परिणामस्वरूप इलेक्ट्रॉनिक उत्पादों में भारी वृद्धि हुई है। लेकिन भुगतान प्रणालियों से जुड़ा मुद्दा एक अनवरत

कार्यक्रम है तथा वित्तीय समावेशन और त्वरित दक्ष, सुदृढ़, सुलभ तथा सस्ते आधुनिक भुगतान तरीकों के दोहरे लक्ष्यों को प्राप्त करने के लिए हम सभी को योगदान करना होगा। देश में विश्वसनीय भुगतान प्रणाली स्थापित करना एक लम्बी, दुर्गम परन्तु रोमांचक यात्रा है जिसमें हमें निरंतर अपने भूतकाल को सुधारते रहना है। इस दिशा में बैंकिंग उद्योग व्यवस्थित एवं समर्पित प्रयास करता रहेगा और निरंतर संभावित मांगों की तुलना में बहुत आगे रहेगा। बैंकों को चाहिए कि वे भुगतान उत्पादों की कीमत कम रखे जाने और सुलभता के उद्देश्य को ध्यान में रखते हुए, विशेष तकनीकी के व्यापक प्रयोग वाली प्रणाली में, भुगतान उत्पादों की कीमत निश्चित करने की अपनी योजना पर चिंतन करें। भुगतान उत्पादों की कीमत लेनदेन संपादन करने की लागत के अनुरूप होनी चाहिए। भुगतान प्रणाली में तकनीकी के बढ़ते

प्रयोग का उद्देश्य ही लागत को कम करना, लेनदेन को अधिक सुविधाजनक बनाना, सेवा में सुधार करना और जोखिमों को न्यून करना है। अब बैंकों को लेनदेन की लागत को कम करने की दृष्टि से, प्रौद्योगिकी का लाभ ग्राहकों को उपलब्ध कराने के उपाय ढूँढने होंगे। इस सम्बन्ध में मोबाईल नेटवर्क ऑपरेटर (एमएनओ), पेमेंट एग्रीगेटर्स और पेमेंट गेटवेज, जो आवश्यक विशेष प्रौद्योगिकी प्रदाता है, की भूमिका को सशक्त करना होगा क्योंकि इन्होंने भुगतान उद्योग में उपयुक्त जगह बनाने के लिए ही पर्दापण किया है। बैंक अपने भुगतान संसाधन कार्यकलापों में मदद के लिए इन संस्थाओं की सेवा लेना सुविधाजनक पाते हैं, जबकि ये संस्थाएं भी महत्वपूर्ण भूमिका अदा करती हैं।



Indian Institute of Banking & Finance

Winners of Macro Research Proposals for the year 2017-18

The following researchers are selected for award of Macro Research for the year 2017-18.

S.No	Name	Designation/Institution	Title of Proposal
1	Dr. Prakash Singh	Professor in Finance & Accounting Indian Institute of Management, Lucknow	A Research Proposal to study the Ethics and Corporate Governance in Indian Banking Sector
2	Dr. Swati Raju	Associate Professor, Mumbai University, Mumbai	Non Performing Assets of Banks in India: Efficiency in Management
3	Dr. Jaslene Bawa & team of 2 others	Assistant Professor, Finance and Accounting, FLAME University, Pune	Shadow banking in India: Do bank run Asset Management Companies (AMCs) perform liquidity transformation through exposure to Non-Banking Finance Companies (NBFC) in their debt oriented schemes and will this increase the systemic risk of a bank due to a possible joint exposure to NBFCs?

The following researcher has been given provisional approval. Final approval will be given subject to approval of revised proposal:

S.No	Name
1	Dr. Vipul K Singh & Dr. Santosh Kumar

We thank all the researchers who have participated in Macro Research Competition.

Mumbai

Director (Academics)

Summary of Macro Research Project

Title of Macro Research Project: Managing Current Account Deficit: Cross Country Experience from Developing Countries

Researcher: Dr. Partha Ray, Indian Institute of Management, Calcutta.

Year of Study: 2013-14

This research makes an attempt to understand the causes of Current Account deficit, and in its light narrate the experiences of select countries and suggest the course of actions in the Indian policy space. In particular, the research focuses its attention to three Latin American economies (viz., Argentina, Mexico, and Brazil) and three Asian economies (viz., Thailand, Malaysia and Indonesia) and in light of their experience looks at implications for India.

As far as Latin American economies are concerned, the following broad policy lessons may be discerned. First, since a priori it is difficult to establish what is the sustainable CAD, large CAD over should be avoided over the medium term. Second, as far as exchange rate is concerned the message is more cluttered. Exchange rate flexibility could have some inflationary effect but at the same time greater exchange rate flexibility also diminishes the risk of declines in output and employment. Third, in so far as public debt is concerned, it is advisable to avoid the "original sin", a phenomenon referring to a country's inability to borrow abroad in its own currency. Finally, importance of accumulated reserves as a self-insurance mechanism can hardly be overemphasized.

The typical experience of Emerging Markets in Asia has been marked by the East Asian crisis period wherein, somewhat unexpectedly, major Asian economies like South Korea, Thailand, Indonesia or Malaysia witnessed attacks on their currencies leading to financial meltdown in the late 1990s. There was also contagion in the region. Three broad messages from the Asian experience may be highlighted. First, the agility with which these countries acted on crises

resolution was remarkable. In fact, all these Asian countries incurring CAD could turn themselves into current account surplus countries. Second, the crisis prompted the global community to take a look at the facets of financial globalization. While the standard neo-classical trade theory gives ample rationale for international trade in goods being a positive sum game and a win-win situation for both the parties, similar results for financial globalization are yet to be obvious. Third, the East Asian experience also opened up the Pandora's Box of desirability and options of capital control. Fourth, another message of the East Asian experience is the imperative of having forex reserves as a self-insurance mechanism.

In light of these country experiences what are the lessons for India? Since issues relating to CAD are intimately interlinked to issues related to its financing, often policy prescription in this sphere becomes heavily biased towards ideology of the exponent. From this standpoint, there seems to be three distinct (perhaps caricatured) philosophies: (a) continuation of the status quo coupled with some calibrated incrementalism; (b) making the reform / liberalization process much faster in the external front of the Indian economy; and (c) overhauling the structure of the economy so that possibilities of incurring CAD are done away with. Taking the pros and cons of these three distinct approaches, it seems that as long as CAD exists, depending upon the state of the economy and its institutional development, a nation can be conservative / liberal in terms of its financing from capital flows. But in order to get rid of CAD all together, the best route is to develop manufacturing and start having trade surplus. ☯

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of organization, telephone and fax numbers, and e-mail address (if any), or last position held, in case of retired persons. Passport size photograph should also be sent along with the submission.

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Essential figures, charts and diagrams should be referred to as 'Figures' and they should be numbered consecutively using Arabic numerals. Each figure should have brief title. Diagrams should be kept as simple as possible. In the text, the position of the figure should be shown by indicating on a separate line with the words: 'Insert figure 1'.

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Words to be emphasised should be limited in number and italicised. Capital letters should be used only at the start of the sentences or for proper names.

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01.01.2018

Dr. J. N. Misra
Signature of Publisher

Modifications in Permissible Activities of IFSC Banking Units (IBUs)

The scheme for setting up of IFSC banking units aims at enabling banks to undertake activities largely akin to those carried out by overseas branches of Indian banks. Certain activities are, however, not allowed in view of the fact that IBUs are functioning from the Indian soil and the legal and regulatory framework is still governed by domestic laws and there is no separate financial sector regulator for IFSC. Nevertheless, IBUs were allowed progressively to undertake more activities as recently as in April 2017 as summarised below:

1. IBUs may undertake derivative transactions including structured products that the banks operating in India have been allowed. However, IBUs shall obtain the Reserve Bank's prior approval for offering any other derivatives products.
2. Fixed deposits accepted by IBUs from non-banks cannot be repaid prematurely within the first year. However, fixed deposits accepted as collateral from non-banks for availing credit facilities from IBUs or deposited as margin in favour of an exchange, can be adjusted prematurely in the event of a margin call or a default in repayment.

3. An IBU can be a trading member of an exchange in the IFSC for trading in the interest rate and currency derivatives segments that banks operating in India have been allowed to undertake.
4. An IBU can become a professional clearing member of the exchange in the IFSC for clearing and settlement in any derivatives segment.
5. IBUs are allowed to extend the facilities of bank guarantees and short term loans to IFSC stock broking/ commodity broking entities.
6. Any financial institution or a branch of a financial institution including an IBU operating in IFSC can maintain special non-resident rupee (SNRR) accounts with a bank (authorised dealer) in the domestic sector for meeting its administrative expenses in Indian rupee. These accounts must be funded only by foreign currency remittances through a channel appropriate for international remittances which will be subject to extant FEMA regulations.

A Task Force (Chairman: Minister of State for Finance) is monitoring the progress in the development of IFSCs. The Reserve Bank is a member of the task force.

Source: RBI Annual Report, 2016 -17

Social and Economic Impact Analysis of Vadinar Refinery of Essar Oil: The Case of a Mega Refinery

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Sumana Chaudhuri¹
Shovan Ray²

Abstract

The article is a case study on Essar Oil's Vadinar Refinery in Gujarat. In the wake of the decision to divest the stake to Rosneft group of Russia, the Ruia's-led Essar Group were interested to present a portrayal of the financial profitability and socio-economic importance of their refinery project at Vadinar. The project was assigned to the authors towards evaluation. The analysis assumes significance as refinery is a strategic sector, and there lies immense potential for Indian refiners to attain sustainable competitive advantage through economies of scale and adoption of most advanced technologies to process sour crude of the highest complexity, thus, producing the cleanest fuels in multiple distillates. Using a social cost–benefit approach, the article evaluates the financial viability and socio-economic contribution of the refinery at Vadinar at the local and regional level, focusing on multiplier effect of income, tax and savings generated, including other externalities. The present findings would assist in policy implications for the strategic investment in refinery operations as well as building a template for future researchers interested to explore the economic aspect of oil refineries from welfare perspective.

JEL: B41, D60, D61, D62, H23, H43, L71, O22, Q43

Keywords

Social cost–benefit analysis (SCBA), economic impact, multiplier effect, externalities, oil refinery

I. Introduction

Petroleum, Oil and Lubricants (POL) commands a strategic and critical role in the growth and development of nations. These constitute a major part of energy used in India's economy, second only to coal as a source of primary energy, and can spur growth in most sectors. India has been traditionally a

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net importer of POL products. In the recent past, there has been a growing concern to boost production of petroleum and natural gas from domestic sources. At present, India imports nearly three-fourths of its crude requirements. Investing in domestic oil and natural gas exploration is a long-term solution that will help quench India's growing energy demands. After Government of India allowed private participation in petroleum refining in India, Essar Oil set up a 9 MMTPA oil refinery at Vadinar in Gujarat, which started commercial production on 1 May 2008. The current capacity of the refinery now stands at 20 MMTPA. With state-of-the-art technology, it has the capability to produce petrol and diesel that meets the latest Euro IV and Euro V emission standards. The refinery produces LPG, Naphtha, light diesel oil, Aviation Turbine Fuel (ATF) and kerosene. This comes with an increase in its complexity from 6.1 to 11.8 on the Nelson index, making it India's second largest single-location refinery and amongst the most complex globally.

Context

Essar Group is a diversified global conglomerate with businesses spanning across core sectors of metals and mining, energy, infrastructure and services. The chronic anaemic phase for the past five years of the steel industry in India, in general, and Essar Steel, in particular, has made the company face an economic crisis. The Essar Group debt burden was around ₹1.05 trillion crores, out of which Essar Steel alone accounts for ₹43,000 crores. However, the Essar Oil's Vadinar Refinery has been one of the most profitable ventures of the group. In a bid to pay off the debts and restructure the debt portfolio, the group embarked upon an exercise to divest its stake to external agencies. Oil refining occupies its position as one of the most strategic sectors of the economy. Any disinvestment decision, particularly by private or international players calls for a thorough review on all aspects of financial, economic and social justice. Essar Group was analysing the business verticals which could pull them from the slackening profitability and eroding group margins. Essar Oil's Vadinar Refinery came as a respite for the group. In the wake of government's bid to attract foreign direct investment, potential investor countries were getting explored. Essar Oil could connect to this economic resurgence. Rosneft, Russian oil refining major, was keen to expand its footprint in Indian territory, where its presence has been largely insignificant. Essar Group sensed the opportunity to work on to improve the financial health of the group through portfolio divestment. The most profitable venture, Essar Oil's Vadinar Refinery was considered for this strategic dilution of equity base. In the fiscal year 2015–2016, Essar Oil posted a record of ₹2,162 crores net profit on the back of robust gross refining margins (GRM). In the wake of this decision-making context, the Ruia's-led Essar Group were interested to present before the Indian government and Rosneft a portrayal of the financial profitability and socio-economic importance of their refinery project at Vadinar. Professional consulting firms were requested to look at the aspect, however, as an applied research project; the authors were assigned to take up the issue as an independent project. The objective was to review the financial profitability of the Essar Oil's refinery arm and broadly purview the long-term socio-economic impact of the group's refinery business in India. Based on the authors' independent field survey and analysis, a comprehensive report (Chaudhuri & Ray, 2016) was presented to the leadership team at Essar Oil Limited (EOL) in June 2015. Rosneft agreed to buy 49 per cent stake in July 2015. Progressing further, it was realised that cost–benefit analysis (CBA), particularly social cost–benefit analysis (SCBA) of oil refineries, has been hardly documented in the extant literature. Realising the importance of the research project not just as a public policy initiative but also of considerable research interest, the project is presented here as a case-theoretic analysis of SCBA of Essar Oil's Vadinar Refinery project.

Vadinar Refinery: Description and Significance

Description in Brief

Essar Refinery was built by Essar Projects from a Greenfield area, which was a large piece of barren land, and Essar Projects India Limited (EPIL) developed all allied units, associated utilities and captive power plant with addition of several units to produce higher grades of fuels. In spite of a number of unfortunate delays due to required environmental clearances and natural calamities such as severe cyclone in 1998 and massive earthquake in 2001, the first phase of 10.5 MMTPA of the project was successfully commissioned by November 2006 and commercial production started in May 2008. Refinery Train 1 expansion was commissioned in March 2012 and then augmented and achieved 20 MMTPA refinery capacity.

Significance

National Level

Stability and continued growth of the oil sector is essential to an expanding economy like India where energy demand has been escalating with economic growth and diversification, intensifying with global reach and changed lifestyles. Oil and natural gas (hydrocarbons), in general, and refinery operations, in particular, have both direct and intermediate uses for various sectors of the economy, both as fuel and inputs to industrial and manufacturing processes. Its universal intermediate character adds weight to its impact on the national economy.

Local and Regional Level

During the construction, commissioning and operations of the refinery, massive skilled and unskilled labour employment was generated. The project also generated secondary employment for other businesses, which helped the local economy to gravitate to better and higher standards of living.

Residents of the surrounding villages were paid a premium by EOL on the price of their land, over and above the standard market tariff. They also benefited from the secondary businesses such as consumer retail initiatives and derived demand-led commercial activities. Apart from these, employment opportunities to the villagers also materialised. Facilities such as primary and secondary education, health care and alternative livelihood opportunities for the local stakeholders were developed alongside.

Economics of Refinery Operations: A Global Overview

The motivation behind the research is to understand the socio-economic contribution of the project, so as to validate the financial as well as economic significance of Vadinar Refinery of EOL. In this direction, it was deemed necessary to propel the course of the project to make a systematic study of the global oil refining sector. A geography-based analysis would perhaps reveal a pattern of similarities and differences of oil refineries and their socio-economic manifestation.

At the beginning of the new millennium, global oil industry was witness to the emerging trends that shaped the landscape of the petroleum business (Iyer, 2016). First, the growing presence of sulphites in large quantities in global crude made the intermediate increasingly sour or heavy, which could not be addressed by the refining capacities of the existing refineries around the world.

Second, growing concerns about a more sustainable planet, coupled with escalating cost of installation of more complex refining capacities, made the whole investment strategy prohibitive, particularly in Europe and North America.

Third, Asian economies were increasingly looked upon as fuel of global economic growth, which inevitably increased the demand of petroleum refinery products.

In surveying contemporary evidence on the state of petroleum refining in developed and developing economies (Millington, McWhinney, & Walden, 2014), it is amply clear that many refineries in developed economies failed to withstand the test of time as they grew. The major reason behind this lack of performance was lesser complexity of the refineries resulting in poorer crude processing as well as escalating cost of production. These in turn made many refinery operations unviable across different parts of the world.

A testimony to this fact was Australian refineries. The infrastructural bottlenecks and the inability to process the wide variety of crude oil at the rising cost of Australian dollar put Australia at a competitive disadvantage. There was strong apprehension that Australian refinery capacity shall decrease by 30 per cent, and from being a net energy exporter, Australia shall soon turn into a major energy importer (House of Representatives, Standing Committee on Economics, Australian Government, 2013). Rather than productive efficiency, refineries across the world are judged by their complexities, that is, their ability to generate a wide variety of distillates from not so superior crude and making the end products cleaner as demanded by growing environmental concerns. The declining capacities of the domestic refineries had their negative impact on the energy security, employability and general economy as a whole. However, the proximity to the refineries in Asia provided Australia an access to the surplus refining capacities in Asia for their own crude, which supposedly made the Australian oil supply chains stronger.

Similar infrastructure bottlenecks persist in sub-Saharan African (SSA) refineries. The suboptimal refining capacities do not enable them to produce cleaner fuels as per AFRI-4 standards. The World Bank and the African Refineries Association (World Bank, 2009) in their report highlight this issue and recommend for substantial investment in the refinery sector. Though the costs to modernise the refineries would be high, but the benefits generated out of enhanced GRM more than compensates the escalated investment. There is huge health benefit due to reduced environmental pollution; also, the potential for increased export opportunities of cleaner fuel outweighs the cost of modernisation of refineries. To validate the recommendation, the World Bank used CBA (Chawla, 1987) methodological framework to demonstrate the findings over a 10-year timeline, ranging from 2011–2020.

The hundred odd refineries in European Union (EU) are burdened with excess capacity, but are grossly underutilised. After the United States, EU is the second largest consumer of petroleum products (British Petroleum, 2014), with about 14.5 per cent of the global consumption. However, due the increasing demand for fuel, EU has been witnessing high import dependency of about 45 per cent for refined petroleum products (MOSES, 2018). In 2011–2012, the total direct and indirect contribution of EU refining sector is about 1 per cent of EU's GDP. It is interesting to observe here that there is a growing reliance on Asian countries towards processing more complex crude to yield better and cleaner fuels. This has been amply evident in the findings of US Energy Information Administration (2014) report.

The prevailing situation is almost the same in the United States. Over the years, the US refinery industry is under pressure, with increasing demand for cleaner petroleum products, eroding GRMs and decreasing production of refined crude. There has also been no major refinery construction in the United States in the past 25 years, which could address the increasing complexity of crude refining (DOE, 1998; EPA, 2001, 2007). The increasing demand in turn is forcing US administration to tap refined distillates from economically favourable locations, particularly from Asian economies. The stringent environmental regulations also call for high investment in refineries to ensure environmental compliance. This further accentuates the erosion in refining margin and increased dependence on imports.

The common thread that connects to the refineries in SSA, Europe and North America are their diminishing returns on profit margins. It is evident that larger refinery facilities with higher complexity indices are more efficient, as they are capable to distribute fixed costs, over a larger number of barrels. The global trend is technologically advanced larger refineries, with better capacities to produce more cleaner fuels from typically sour crudes.

Nearly all the new refinery capacity built in India since 2003 is made up of more complex operations. The Jamnagar refinery belonging to Reliance Industries Limited is now one of the most complex refineries in the world with a Nelson Complexity Index of 14. The World Oil Outlook (2013) also opines global investments of \$650 billion in refinery projects over the period 2012–2035 to align refinery capacity and complexity with future market conditions.

The second interesting observation in the global refining sector is that for most cases, including EU as well as SSA, the standard adopted methodological approach to examine the welfare impact is SCBA.

It has also been observed that increasing refining capacities improves the socio-economic and institutional outcomes (Tornell & Lane, 1999). The forward and backward linkages increase the multiplier effect in the economy (Bazilian et al. 2013; El-Katiri & Fattouh, 2015; Luong & Weinthal, 2010). An increasing refinery capacity therefore positively correlates with socio-economic growth as can be seen in the case of India, China and the Middle East (OPEC, 2012).

Cost–Benefit Analysis As a Tool for Evaluating Economic Impact

Large-scale infrastructure projects like oil refineries demands a comprehensive tool like CBA towards decision-making in efficient allocation of finite resources. CBA entails measuring results, valuing results and comparing results with costs, and hence is highly relevant to the appraisal of refinery projects. This classic tool of project evaluation has endured the test of time, revisited several times by various proponents of this approach to project appraisal and holds its position of eminence and esteem to theoreticians and practitioners interested for evaluating the benefits and costs of a project like a large oil refinery.

The traditional approach to CBA (Mishan, 1971, 1976; Mishan & Quah, 2007) is based on the grounding theory of applied welfare economics (Dupuit, 1844) which states that the purpose of CBA is to identify potential Pareto improvements (Drummond, 1981). Some of the traditionalists in the domain of CBA include M. E. Beesley, J. L. Carr, O. Eckstein, M. J. Farrell, M. S. Feldstein, R. N. McKein, E. Mishan, A. T. Peacock, M. H. Peston and C. S. Shoup, amongst others (Prest & Turvey, 1965).

However, there were several drawbacks in the traditional approach. Ashford (1981) highlights the issue of monetising the benefits associated with a project. Further extending the argument in favour of weakness with the traditional approach of CBA, Beesley (1973) flags the choice of discount rate and income distributional effects, which points to some crucial dilemmas confronting decision-makers.

The rigid and prescriptive nature of traditional CBA (Ninan, 2008) led to the development of modern approach (Stern, 1974) to project selection which implemented the goals of efficiency and distributional equity as characterised in the Little and Mirrlees (1969) and United Nations Industrial Development Organization (UNIDO; 1972) methods of project appraisal.

In the perspective of developed countries, EU member nations are mandated to have CBA as a common requirement if they are aspiring for investment in projects eligible under EU funds (Commission of the European Communities, 2008).

The main point of difference between the European Commission (EC) approach and other approaches to CBA is that in the former approach the applicability of the framework is limited to EU member

countries only, which are mostly developed economies. On the contrary, the approaches to CBA by the World Bank, UNIDO (Dasgupta, 1972, Dasgupta, Marglin, & Sen, 1972) and OECD (1969) appeal mainly to the developing and less developed economies. The EC guidelines for member countries act as a generic template for CBA of projects, with the standard conversion factors (SCF) for most of the project's inputs and outputs provided. This is not observed in the case of UNIDO or OECD manuals which due to their widened scope and coverage does not necessitate such SCF towards estimation of projects benefits and costs.

The World Bank approach (1975, 2004, 2010) too noted the limitations of traditional CBA and made the shift towards more programmatic and country-focused approach.

Sectoral Application of SCBA: Oil Refineries

The scale and scope of megaprojects like oil refineries and their huge investment schedule necessitates to carefully assess the benefits and costs associated with large-scale projects (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Nash, 1991).

In this regard, it may be worthwhile to mention that extant literature refers CBA as an approach as the 'single most important problem-solving tool in policy work' (Munger, 2000).

A higher BCR signals the competitive advantage of greater benefits as compared to investment costs.

In order to establish Essar Oil Refinery at Vadinar to qualify as a net benefit for the economy and society, the social benefits—such as direct and indirect job creation, increasing economic activities in the local, regional and national economy, multiplier effects and positive externalities—must outweigh the net costs. It may be pertinent to mention here that for ex-post evaluation of Essar Oil's Vadinar Refinery project, SCBA may not be the only tool used for such mega infrastructure projects, but it is one of the most common methodological approach largely recommended in the EU which is classified under the common Cohesion Fund (Bristow & Nellthorp, 2000) as well as in countries outside the Europe such as the United States, Australia or Japan, to name a few. Specific analytical methods differ in each country due to their development of the theory and application, but the commonality is far greater than their dissimilarity (Hayashi & Morisugi, 2000). Vigrena and Ljungberg (2018) puts forward the argument in favour of CBA's formalised and transparent (Beria, Maltese, & Mariotti, 2012) methodological strength: 'which can ensure that projects are indeed judged against the same set of rules and analyses are made comparable'.

SCBA in Global Oil Refineries: Comparable Trends in Benefit–Cost Ratios

Wagner and Shao (2015)—while discussing stringent fuel emission standards in China, at par with Euro-VI norms—focuses on how the country is getting effective at reducing emissions to near-zero levels through establishment of technologically advanced refineries capable of processing more sour crudes. CBA methodological approach has been used to arrive at benefit–cost ratio (BCR) that outweighs the upstream investment costs with the benefits of potential economic, environmental, public health, safety and other advantages. Conservative projections for China at the end of 2040 is a BCR of 7:1. To comply to ultralow sulphur fuel supply and conform to world class emission standards, India has already established a BCR of 8:1 (Bansal & Bandivadekar, 2015), while for the United States it is 5:1 (EPA, 1999) and Mexico 8:1. The projected BCR for SSA is 9:1 (UNEP, 2009). It may be pertinent to mention here that, though applicable for all countries, the overall societal

benefit accruals to countries in emerging economies are far greater than the costs of investment in modernisation of the refineries.

Organisation of the Article

This article is structured as follows. After the introduction, the second section focuses on data and methodology as applied in economic analysis of EOL's Vadinar Refinery and its socio-economic significance. The analysis and results are covered in the third section. The limitations of the study, followed by a brief summary and scope for future work are presented in the concluding section.

II. Data and Methodology

The noted economists Frank, Bernanke, Antonovics, and Heffetz (2018) laid CBA as one of the seven core principles of economic sciences. CBA as a tool can be used either to appraise or to evaluate a given project. Appraisal is done before the commencement of the project and evaluation is done after the completion of the project. This study focuses on Essar Oil's already operational Vadinar Refinery Project. Therefore, technically, this work should be an evaluation of the project. However, the process of analysis is both retrospective as well as prospective. It is retrospective in the sense that the project is already completed and it has become fully operational. It is prospective in the way that by evaluation of the relative merits of the project in terms of the accrued benefits and costs, it serves as a template for deciding a fresh course of equity investment in refinery infrastructure augmentation. It has already been informed by EOL of new investment, and this analysis will aid in appreciation of the strategic direction of the project as well as its overall fit in the broader socio-economic rubric.

Formally, the analysis entails solving the following equation:

$$NSB = \sum. (R_t - C_t)/(1 + r)^{**t} \quad (1)$$

with $t = 1, 2, \dots, n$,

where NSB is net social benefit, R_t is revenues generated from sale of the products in year t , C_t is the cost of refining in the corresponding year t , r is the discount rate, t is the reference year, and n is the number of years in the project; $**$ is the power operator. The CBA analysis is conducted following the generic steps of CBA as described below.

In accordance with European Commission guidelines to CBA (2008), the framework of SCBA for EOL's Vadinar Refinery is construed. The analysis is based on the following stages. First, the financial cost and revenue data are converted from financial prices to accounting or shadow prices by applying explicit conversion factors. Second, all non-market impacts have been monetised by the notion of willingness to pay (WTP) or willingness to accept (WTA), which is grounded on the concept of consumer surplus (CS) or producer surplus (PS). This, in turn, is expressed quantitatively by the Rule of Half. The process of determination of CS and PS involves identifying and quantifying the non-monetised costs and benefit streams associated with the project to generate the specific values of CS and PS. In the next stage, the externalities of the project are duly incorporated in the analysis. This is followed by the determination of the social discounting rate for India using the social time preference rate (STPR) approach. The final stage involves calculation of economic performance indicators such as economic net present value (ENPV), economic rate of return (ERR) and the most critical performance criteria for project evaluation, namely the BCR for the project.

Analysis

The following stages are followed in presenting the analysis.

Financial Analysis

According to the UNIDO guidelines' stage I, financial analysis produces an estimate of the project's financial profit or the net present value (NPV) of the project when all inputs and outputs are measured at market prices. According to the UNIDO guidelines, the methodology used for the determination of the financial returns in CBA is the discounted cash flow (DCF) approach. This implies following assumptions:

1. Only cash inflows and outflows are considered (depreciation, reserves and other accounting items which do not correspond to actual flows are disregarded).
2. The determination of the project cash flows should be based on the incremental approach.
3. To calculate the present value of the future cash flows, the adoption of an appropriate financial discount rate (FDR) is required. The FDR reflects the opportunity cost of capital, defined as 'the expected return forgone by bypassing other potential investment activities for a given capital'. The discount rate is in effect an 'exchange rate' between value today and value in the future (Commonwealth of Australia, 2006).

Financial Discount Rate

The FDR is the opportunity cost of capital. The benchmark for an infrastructure project may be the real return on Government Bonds (the marginal direct cost of public funds), or the long-term real interest rate on commercial loans, or a weighted average of the two rates. In order to arrive at the FDR to be used for financial analysis of EOL, we consulted several sources of information available on the public domain. The initial frame of reference was the 10-year yield on Government Bond that would serve as a benchmark for the standardised interest rate on government securities. Since the discount rate is pegged to the rate of interest, therefore this is a fairly approximate way to arrive at the discount rate at current prices, assuming we are considering the nominal rate of interest (According to EC guide, it is recommended to use nominal prices in financial analysis and a nominal FDR must be used with current prices). The India 10Y Government Bond increased to 7.86 per cent in April 2015 from 7.73 per cent in March of 2015. The India 10Y Government Bond averaged 9.19 from 1994 until 2015, reaching an all-time high of 14.76 in April of 1996 and a record low of 4.96 in October of 2003. To remain relevant and contemporary, we have assumed the 'FDR as 8.4 per cent' taking the historical average from 1968 until 2015.

Total Investment Costs

The total investment costs are worked out under the following categories:

1. Total fixed assets
2. Total start-up costs
3. Variation in working capital

The investment cost figures are obtained from the balance sheet of EOL, as obtained from the annual reports of the company. The costs are shown with a negative sign as they are considered to be outflows on the part of the operator of the refinery project (Chaudhuri & Ray, 2016).

The variations of working capital indicate an investment outlay for the project and are included as a part of the total investment cost. The total investment cost for the project works out to be the sum of the total fixed cost, total start-up cost and variation in working capital.

Total Operating Costs and Revenues

The second step in financial analysis is the calculation of the total operating costs and revenues. The operating costs consist of those items which are purchased as goods and services (Chaudhuri & Ray, 2016).

They are not considered as investment items as they are consumed in the same accounting year of purchase.

The basic assumptions made in calculating the total operating costs and revenues are as follows:

1. A discount rate of 8.4 per cent has been considered for all discounting calculations
2. Depreciation has been excluded in the calculation as it is not an effective cash payment

The NPV of all inflows and all net outflows have been estimated based on discounting until 2014.

Financial Return on Investment

After completion of the tables on total investment costs and operating costs and revenues, the next step in the financial analysis is to arrive at the financial return on investment. In order to evaluate the financial return, there are two major indicators to be determined:

1. Financial net present value (FNPV)
2. Financial rate of return (FRR)

The European Guide to CBA (2008) defines FNPV as the sum that results when the expected investment and operating costs of the project (suitably discounted) are deducted from the discounted value of the expected revenues.

In mathematical notation, FNPV can be expressed as

$$\text{FNPV} = \sum_{t=0}^n a_t S_t = \frac{S_0}{(1+i)^0} + \frac{S_1}{(1+i)^1} + \dots + \frac{S_n}{(1+i)^n}, \quad (2)$$

where S_t is the balance of cash flow in time t , and a_t is the financial discount factor chosen for discounting at time t .

The FNPV is calculated as follows:

$$\text{FNPV} = \sum [S_t / (1 + \text{FRR})^t] = 0 \quad (3)$$

The calculation of the financial return on investment measures the capacity of the net revenues to remunerate the net investment costs.

In our calculation 'FNPV (C) is ₹-1,822.90 crores', by applying a discount factor of 8.4 per cent. It is observed that though the FNPV (C) is negative, however, the project breaks even in 2014. The profit after tax (PAT), standing at ₹-1,180 crores, which was negative in 2013, stood at ₹126 crores, in a whopping positive turnaround. The gross revenue changed by 10.27 per cent between 2013 and 2014,

so did the current price gross refining margin (CP GRM) by 0.4 per cent and earnings before interest, taxes, depreciation and amortization (EBIDTA) by 28.8 per cent between 2013 and 2014. It is interesting to observe that financing cost has decreased by 6.0 per cent, signalling the increased efficiency and economies of scale for the refinery. Operationally, in 2013, EOL launched the 'Optima Plus' programme, designed to enhance refining margins by an additional ~US\$1.0/bbl. over the next three years.

We have modelled the growth of gross revenue, EBIDTA and CP GRM until 2016. Using second order polynomial curve fitting, it is observed that all three performance indicators stands to gain positively in the near short-term movements. The autoregressed variables shows strong interdependencies in their movement and reflects the impact of lagged endogenous variability in the output.

The results conclusively demonstrate the project is financially sustainable and will achieve positive financial internet rate of return (FIRR) and FNPV shortly.

Economic Analysis

In the cost-benefit appraisal of EOL, the financial analysis of the project is followed by economic analysis as shown in Figure 1. The analysis draws its merit from the concepts of consumers' surplus and rents, the distinction between benefits and transfer payments, the concept of shadow pricing, external

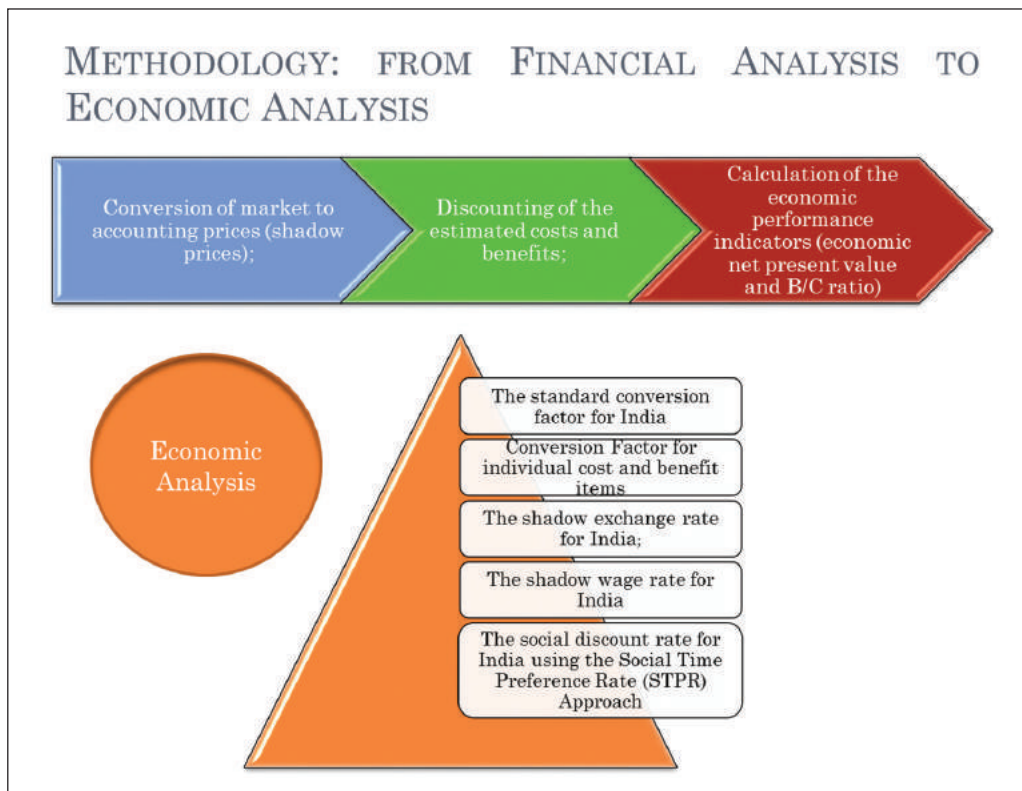


Figure 1. Financial Analysis to Economic Analysis

Source: The authors.

economies and diseconomies, the choice of investment criteria and the problems of uncertainty are adequately covered in the succeeding sections.

The economic analysis is distinctly different from the financial analysis with respect to benefits accrued as a result of the project. Whereas the latter is merely concerned with the owners or promoters of the project, economic analysis attempts to identify the project's impact on the society at large. All datasheets, calculations and analysis are illustrated in the appendices.

Consumer Surplus

According to Alfred Marshall (1925), CS is the maximum sum of money the consumer would be willing to pay for a given amount of the good, less the amount he actually pays. The consumers of a refinery project are the oil marketing companies (OMCs) and other agencies who buy finished products. According to the annual report of EOL for the FY 2013–2014 (page 22), Essar Oil has product off take and infrastructure sharing agreements with all oil public sector units (PSUs; the state-owned PSUs). These include Bharat Petroleum Corporation Ltd (BPCL), Hindustan Petroleum Corporation Ltd (HPCL) and the Indian Oil Corporation Ltd (IOCL). Essar Oil also offers a wide range of products to bulk customers in the industrial (cement, power, chemicals, construction, fertilisers, etc.) and transport sectors. Besides, EOL has also received approvals to supply ATF to the Indian Armed Forces. Essar Oil has an extensive network of about 1,400 operational retail fuel outlets across the country. EOL also stands to gain by lowering the cost of fuel supplied to their retail network by entering into agreements with various public sector OMCs enabling to source products from their refineries and depots. This would also result in operational expenditure (opex) savings for the company.

Producer Surplus

Estimating the PS, the revenue above the long-run average cost, is an important part of social cost–benefit analyses of changes in petroleum use. In case of EOL, PS is obtained by learning curve effect, economies of scale and efficient management practices.

Government Surplus

Government has a direct interest in oil consumption because it generates tax revenues. These revenues can then be used to cut other taxes. However, we first consider these revenues as accruing to the government, even though they are likely to be retroceded to consumers over time. The variation of tax revenues for the government can be calculated with the following formula. T is Tax and Q is Regional Quality Differential (T and Q). In algebraic form:

$$\Delta\Phi = T_2 Q_2 - T_1 Q_1, \quad (4)$$

where $\Delta\Phi$ is the variation in tax revenue. In the case of EOL, we have seen that there is progressive and substantial increase in tax revenue from 2009–2010 onwards.

Externalities for EOL

To make a reasonably good economic analysis, it is equally important to consider the externalities that are not accounted for in the converted financial inputs and outputs. The sum total of the spillover effects as a result of the EOL's Vadinar Refinery megaproject is considered based on the direct, indirect and induced impact generated by construction phase and operational phase (until March 2015) of EOL. The qualitative aspects of these spillage effects have been attempted to capture under the umbrella of quantitative analysis. For calculation of the externalities, we have taken the onsite labour impacts during the construction phase; and the local revenue and supply chain impacts and induced impacts in the operational phase.

Using data obtained from EOL and data available from Petroleum Planning and Analysis Cell (PPAC), Ministry of Petroleum and Natural Gas, the externalities are computed through the Petroleum Refinery Jobs and Economic Development Impact (JEDI) modelling technique of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. Wherever possible, in the absence of actual data, realistic assumptions are made or comparables are used as proxy measures of the reality.

Externalities: Impact on the Local Economy after the Essar's Refinery

The Vadinary refinery has 12 core adjoining villages, which have seen large-scale economic development after the setting up of the refinery. The 12 villages are Mithoi, Jhakar, Singach, Vadinar, Bharana, Timbdi, Kajurda, Mota Mandha, Nana Mandha, Kathi Devariya, Sodha Taraghadi and Parodiya. The Table 1 details the summary of the employment, salaries, businesses & service providers, investment and revenues associated with local economy as a result of establishment of the refinery.

Choice of Social Discount Rate

The Asian Development Bank defines the social discount rate (SDR) 'as a reflection of a society's relative valuation on today's well-being versus well-being in the future'. The choice of the SDR is one of the most critical aspect of CBA (Burgess, & Zerbe, 2011, 2013; Evans & Sezer, 2005; Halicioglu & Karatas, 2011; Harrison, 2010; Hepburn, 2006; Kula, 2004; Moore, Boardman, & Vining, 2013; Park, 2012; Scarborough, 2011; Shelunstsova, 2009; Spackman, 2004; Zhuang, Liang, Lin, & De Guzman, 2007).

The issue reflected in the choice of appropriate SDR is the suitability and applicability of SDR (Arrow et al., 2013, 2014; Drupp, Freeman, Groom, & Nesje, 2018; Emmerling, Groom, & Wettingfeld, 2017; Freeman, 2016a; Freeman & Groom, 2016b; Freeman, Groom, Panipoulou, & Pantelides, 2015; Gollier, 2002a, 2002b, 2008, 2011, 2012a, 2012b; Gollier & Hammit, 2014; Groom & Hepburn, 2017).

There is wide diversity in SDRs, with developed nations typically applying a lower rate (3%–7%) than developing nations (8%–15%). World Bank (2010) too advocates applying 10 per cent–12 per cent SDR for developing economies.

Table 1. Summary of the Employment, Salaries, Businesses & Service Providers, Investment and Revenues Associated with Local Economy As a result of Establishment of the Refinery

Total no. of employees	15,107
Total investment made post-refinery by local businesses and service providers (₹ in lakhs)	13,804.69
Total enterprises and service providers	6,072
Total income of employee associated with local businesses and service providers (₹ in lakhs)	77,347.84
Total revenue earned by local businesses and service providers (₹ in lakhs)	255,247.872

Source: The authors.

Notes: 1. It is assumed that 200 employment days were generated over the period of 20 years and an average daily wage of ₹128 is considered based on the average of annual wages of semi-skilled workers over the years as notified by the Labour and Welfare Department, Government of Gujarat.

2. Regarding revenue, the general assumption of salaries comprising 30% of the total revenues is followed, although there is no blanket standard available. Hence, the total revenue is 70% more than the salaried paid. However, if there is a more accepted standard available, it can be followed in this case.

Table 2. Choice of SDR in Different Countries

Country	Approach	SDR (Percentage)	Source
Non-European Union Countries			
Australia	SOC	8	Zhuang et al. (2007)
USA	STPR	3.5	Moore et al. (2013)
Japan	STPR	5	Evans and Sezer (2004)
Canada	SOC	10	Zhuang et al. (2007)
Mexico	SOC	10.4	–
United Kingdom	STPR	4.5	Groom and Maddison (2018)
(Post-Brexit)			
Brazil	STPR	10.32	Miteva, Kennedy, and Baumgarten (2014)
India	SOC	12	Zhuang et al. (2007)
European Union (Cohesive Fund Countries)			
Austria	STPR	5.3	Evans and Sezer (2005)
Belgium	STPR	4.7	Evans and Sezer (2005)
France	STPR	4	Zhuang et al. (2007)
Germany	STPR	4.3	Evans and Sezer (2005)
Greece	STPR	4.8	Evans and Sezer (2005)
Ireland	STPR	6.8	Evans and Sezer (2005)
Italy	STPR	5	Zhuang et al. (2007)
Luxembourg	STPR	5.4	Evans and Sezer (2005)
Netherlands	STPR	3.8	Evans and Sezer (2005)
Portugal	STPR	5.6	Evans and Sezer (2005)
Spain	STPR	4.7	Evans and Sezer (2005)
Sweden	STPR	2.8	Evans and Sezer (2005)
Czech Republic	STPR	3.1	Evans and Sezer (2005)
Hungary	STPR	3.5	Evans and Sezer (2005)
Poland	STPR	6.1	Evans and Sezer (2005)
Slovak Republic	STPR	6.6	Evans and Sezer (2005)
Turkey	STPR	5.06	Halicioglu and Karatas (2011)
Norway	Government borrowing rate	3.5	Zhuang et al. (2007)
Russia	STPR	11.5	Shelunstsova (2009)

Source: The authors.

It would be appropriate to present a comparative study of the SDR as prevailing in different countries. This would help us to put in perspective the prevailing SDR across economies and establish a rationale for the choice of SDR in Indian context.

In our estimate, we have used the STPR approach to arrive at the SDR for India.

The algebraic expression for the same as expressed by Ramsey (1928) formula is as follows:

$$r = \varepsilon g + p, \quad (5)$$

where r = SDR

ε = Elasticity of marginal utility with respect to consumption

g = Growth rate of public expenditure

p = Rate of pure time preference.

Applying the values for the variables as above, we have

$$r = ((1.64) * (5.3)) + (1.3)$$

$$= 9.99\% \sim 10\%.$$

ADB have also recommended SDR for India in the range of 10 per cent to 12 per cent depending on the project. A high SDR is usually taken for small projects with immediate benefits. For megaprojects like oil refineries, a low SDR is preferred, since the benefits are accrued over a period of time. Thus, our estimate of SDR for India as 10 per cent seems to be reasonably appropriate.

III. Results and Discussion

Results of CBA: Estimation of ENPV and B/C Ratio

To arrive at the economic analysis for EOL, the conversion of elemental costs of investment and operation are required from the financial values to economic values using appropriate conversion factors.

The abridged economic analysis for EOL calculated until 2014 is shown in Chart 1.

ECONOMIC ANALYSIS OF ESSAR OIL								
	2008	2009	2010	2011	2012	2013	2014	
BENEFITS								
Total Consumers Surplus		12680.226	1823.46	14479.3	12943.04	21182.48	18649.14	
Total Producers Surplus		6144.205	4267.4	562.235	10036.33	15924.08	57707.91	
Total Government Surplus	1182.5982	3262.13097	3723.724	4550.07	3836.261	4548.8328	10089.27	
Externalities	130774.62	146264.02	26530.44	26738.3	26946.24	27301.54	63702.28	
Total Benefits	131957.218	168350.582	36345.02	46329.9	53761.87	68956.933	150148.6	
Total Investment Costs		-7121.14	-9635.88	-13581.84	-10743.02	-11320.07	-12053.12	
Total Operating Cost		-22014.46	-22768.7	-28835	-35886.7	-52544.08	-57706.9	
Total Cost		-29135.6	-32404.5	-42417	-46629.7	-63864.15	-69760	
NET BENEFITS	131957.218	139214.982	3940.484	3913.1	7132.149	5092.7829	80388.59	
BCR (TB/TC)		2.31						
BCR (BY NPV METHOD)		2.38						
ENPV		INR 289203.36	CRORES					

Chart I. Economic Analysis of EOL

Source: The authors.

The economic performance indicators of EOL is given below.

- Economic net present value (ENPV): ₹289,203.36 crores (2008–2014)
- B/C ratio (2008–2014): 2.31
- B/C ratio (2008–2014): 2.38 (Using NPV method)

Analysis of Project BCRs

The healthy financial and economic indicators point to the fact that the project has been viable, both in the short term as well as in the future horizon. A comparative analysis of similar projects, as shown in Charts 2 and 3, across the country and overseas, yields quite analogous results.

It may be mentioned that for oil transportation network in the East West Link, prepared by the Victoria State government, Australia, a BCR of 1.4 has been enumerated. The project has over \$1.4 billion of net economic benefit and an internal rate of return of 9 per cent. In case of Alaskan Petroleum Refinery, the project BCR is 2.0 at 10 per cent discount rate (Goldsmith & Schwoerer, 2009). Our estimated BCR of 2.38 for Vadinar Refinery thus seems to be nearly appropriate.

Project	Western Freeway Sea Link	Bandra Worli Sea link	MRTS, Thane	Multimodal International Passenger and Cargo Hub Airport at Nagpur	Mumbai-Pune Expressway; Mumbai Trans Harbour Link
BCR	1.74	1.79	2.53	1.61	1.43

Chart 2. Comparative Analysis of National Projects

Source: Chaudhuri, Vasigh, and Chaudhuri (2015).

Note: It may be noted that for Delhi International Airport Limited the BCR was estimated at 3.78.

The Port of Anchorage (POA), Inter-modal Expansion Program, Alaska, 2011	Roadway Rehabilitation Project, Romania, 2011	City Development Project, Italy, 2011	Portsmouth/Kittery Memorial Bridge Replacement Project, New Hampshire	State Highway Investment in New Zealand, 2010
2.5 (With \$527 M Federal Grant; 1.3 – 1.8 (Without Grant)	1.002	2.748	1.6	2.04

Chart 3. Comparative Analysis of International Projects

Source: The authors.

IV Conclusion

Limitations of the Study

The major limitation of the assignment was the short time frame used in analysing the data. There could be a window of opportunity to refine and improve the results. Investment costs and operating costs and revenue data were made available until December 2014 (unaudited). Taking year-on-year growth of the cost figures, a more realistic FNPV, ENPV and BCR could have been estimated.

Summary and Future Scope

The assignment presents a comprehensive analysis of the benefits and costs associated with the EOL Refinery at Vadinar in Gujarat. The benefits include not only the financial gains of the stakeholders in the system but also the economic gains to the local, regional and national economy as a result of the increase in social welfare created by the EOL Refinery. Using an SDR of 10 per cent as estimated in this article, the economic performance indicators of EOL are obtained. Asian Development Bank (2011) observed that 'countries differ in economic structure, capital scarcity, stage of financial development, efficiency of financial intermediation, impediments faced in accessing the international capital market, and social time preference'. These differences result in varying SDRs and BCRs for refinery projects around the world. It may be worthwhile to examine the choice of SDRs and the corresponding BCR for refinery projects across developed and developing economies. In this article, SCBA of oil refineries has been documented, perhaps distinctively, in the Indian context. Globally, very few studies have been made towards comprehensive evaluation of the socio-economic impact of oil refineries. Thus, the unique and outstanding contribution of this research is to build a template for future researchers interested to explore the economic aspect of oil refineries from welfare perspective. The project has positive ENPVs and BCRs well in excess of one. Evaluation studies done by Canadian Energy Research Institute (Millington et al., 2014) and National Renewable Energy Laboratory (Goldberg, 2013) in the United States for oil pipeline networks and refineries have demonstrated similar results in CBA. The financial and economic benefits have therefore been well justified in the results. The CBA of project EOL proves that the project is economically viable and financially sustainable.

In conclusion, there is abundance of scope to reflect the strategic as well as socio-economic impact of oil refining in India. This would lead to gradual increase in foreign direct investment and public-private partnership in oil refinery projects in India. The article assumes high significance in the context of India's competitive advantage on oil refining in global markets. The adoption of superior technology in oil refining, production of cleaner fuels from most complex crudes and positive gains for the local, regional and national economy, as evident in this work, shall act as a positional guidance system for policy planning in national and international contexts.

Appendix A

Table A1. Financial Analysis of Vadinar Oil Refinery Limited

Evaluation of the Financial Return on Investment	(In ₹ Crores)					
	Years					
	2009	2010	2011	2012	2013	2014
Total operating revenues	37,700.15	37,376.54	47,342.21	58,761.39	89,186.90	171,764.56
Total inflows	37,700.15	37,376.54	47,342.21	58,761.39	89,186.9	171,764.56
Total operating costs	-37,736	-37,892	-48,023	-60,273	-89,309	-97,840
Total investment costs	-14,886	-17,584	-21,619	-24,917	-26,226	-27,354
Total outflows	-52,622.00	-55,476	-69,642	-85,190	-115,535	-125,194
Net cash flow	-14,921.85	-18,099.5	-22,299.8	-26,428.6	-26,348.1	46,570.56
Discount rate						
Note: A discount rate of 8.4% has been applied to calculate the value						
Financial Net Present Value of the Investment—FNPV (C)	(₹1,822.90) Crores					

Source: The authors.

Appendix B

Table B1. Consumer Surplus

	Calculation of CS					
	2009	2010	2011	2012	2013	2014
HSD	10,436	1,501	11,917	10,653	17,434	15,349
Others	14,924	2,146	17,041	15,233	24,931	21,949
Total	25,360	3,647	28,959	25,886	42,365	37,298
CS (ROH)	12,680	1,823	14,479	12,943	21,182	18,649

Source: The authors.

Table B2. Producer Surplus

Refinery	2008	2009	2010	2011	2012	2013	2014
Operating costs (OC)	-612.26	-37,736	-37,892	-48,023	-60,273	-89,309	-97,840
Operating revenues including other incomes (OR)	564	37,700.15	37,376.54	47,342.21	58,761.39	89,186.9	171,764.56
Earnings in foreign currency		12,276	9,002	1,757	21,536	31,922	41,443
Total OR		49,976.15	46,378.54	49,099.21	80,297.39	121,108.9	213,207.56
Net revenue (TOR-OC)	-48.26	12,240.15	8,486.54	1,076.21	20,024.39	31,799.9	115,367.56
Total producer's surplus		6,144.21	4,267.40	562.24	10,036.325	15,924.08	57,707.91

Source: The authors.

Table B3. Tax and Miscellaneous Revenues Towards Calculation of Government Surplus

A	Essar Oil Ltd.	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Total
Direct taxes	Corporate tax	-	-	-	-	-	-	-	-	-	-
Indirect taxes	Income tax (TDS)	16.21	62.23	84.40	76.52	91.47	100.15	133.98	143.35	114.09	822.42
	VAT	23.79	345.90	1,358.34	1,520.90	1,853.08	2,059.21	2,846.38	3,875.42	3,531.42	17,414.45
	Customs duty	87.37	396.09	412.11	173.54	1,309.89	523.68	113.90	124.94	123.51	3,265.03
	Excise duty payment	28.05	791.62	4,097.68	5,089.11	5,225.83	3,736.75	4,984.69	5,048.85	6,191.36	35,193.95
Local taxes	Rates and taxes (Municipal taxes, electricity duty, RTO, entry tax, wealth tax, etc.)			126	72	63	170	148	156		735.39
Total A		155.43	1,595.85	6,078.16	6,932.15	8,543.57	6,589.60	8,227.39	9,348.71	9,960.38	57,431.23
Vadinar Oil											
B	Terminal Ltd.	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Total
Direct taxes	Income tax		0.25	0.37	0.40	0.00	125.49	14.48	0.00	0.00	141.00
Indirect taxes	VAT		0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.04	0.13
	Service tax		1.83	47.80	42.49	47.83	53.19	70.02	70.18	61.82	395.17
Total B			2.09	48.17	42.90	47.83	178.68	84.50	70.28	61.86	536.30
Vadinar Power											
C	Company Ltd.	2006-07	2007-08	2008-09	2009-2010	2010-11	2011-12	2012-13	2013-14	2014-15	Total
Direct taxes	Income tax						18.54	14.34	5.02	35.00	72.90
Indirect taxes	VAT						0.00	0.00	0.00	0.00	0.00
	Service tax						21.36	29.24	35.98	33.73	120.30
	Custom duty					12.47	2.02	0.75	2.80	0.22	18.25
	Professional tax					0.04	0.05	0.05	0.05	0.05	0.32
Mega risk insurance payments						1.40	2.91	3.64	6.72	7.56	22.47
Total C				0.0450417	0.2581452	13.90975435	44.87655075	48.02146723	50.5727279	76.56147367	234.25
Total A + B + C		155.43	1,597.94	6,126.37	6,975.30	8,605.32	6,813.15	8,359.91	9,469.56	10,098.80	58,201.78

Source: The authors.

Appendix C

Table C1. Externalities Associated with Vadinar Refinery of Essar Oil Limited

Local Economic Impacts: Summary Results		Jobs	Earnings	Output	Value Added			
During construction period								
Project development and onsite labour impacts		22,409	\$2,546.5	\$2,848.1	\$2,717.2			
Construction and interconnection labour		22,409	\$2,546.5					
Construction-related services		0	\$0.0					
Local revenue and supply chain impacts		15,662	\$1,048.3	\$4,036.2	\$1,641.0			
Induced impacts		12,205	\$609.6	\$1,741.8	\$1,131.4			
Total impacts		50,276	\$4,204.4	\$8,626.2	\$5,489.5			
During operating years (annual)								
Onsite labour impacts		1,314	\$136.1	\$136.1	\$136.1			
Local revenue and supply chain impacts		1,587	\$95.2	\$423.9	\$269.4			
Induced impacts		904	\$47.1	\$134.7	\$87.5			
Total impacts		3,805	\$278.4	\$694.7	\$493.1			
Local Economic Impacts								
		2008	2009	2010	2011	2012	2013	2014
Onsite labour, local revenue, supply chain, induced impacts		129,372.92	129,372.92	9,090.44	9,090.44	9,090.44	9,090.44	9,090.44
Revenue accruals to the state exchequer		1,401.7	5,891.1	5,891.1	5,891.1	5,891.1	5,891.1	5,891.1
Forex savings		0	11,000	11,548.9	11,756.8	11,964.7	12,320	12,496
Externalities		130,774.62	146,264.02	26,530.44	26,738	26,946	27,302	63,702

Source: The authors.

Appendix D

Table D I. Economic Analysis with Rule of Half and Externalities Incorporated

Benefits	2008	2009	2010	2011	2012	2013	2014
Total consumers surplus		12,680.226	1,823.4599	14,479.3	12,943.043	21,182.4801	18,649.144
Total producers surplus		6,144.205	4,267.4	562.235	10,036.325	15,924.08	57,707.91
Total government surplus	7,879.740839	6,975.304629	8,605.3179	6,813.153	8,359.9113	9,469.55794	11,016.874
Externalities	130,774.62	146,264.02	26,530.44	26,738.34	26,946.24	27,301.54	63,702.28
Total benefits	138,654.3608	172,063.7556	41,226.618	48,593.03	58,285.519	73,877.658	151,076.21

Source: The authors.

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