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Message from Editor-in-Chief

It gives me immense pleasure in sharing that University School of Management Studies is coming out with its next issue of Indraprastha Journal of Management an Academic bi-annual Journal. There are lot of areas where attention is needed and academic journals help to focus on those areas. Education without research and development becomes meaningless to the society and community at large. This is further true when we are growing globally. In case of India, there are lot of areas which needs attention like increasing food prices, employee retention, problems of illiteracy, control of inflation, improvement in technology, concern for consumer etc. which can be dealt with when somebody researchers on it and suggest plausible solutions. Indraprastha Journal of Management becomes a valid platform for academicians and researchers to contribute their research papers based on high quality research they have done in the field of Management. The Journal endeavors to provide forum for the same. The key focus would however be on the emergent sectors and researches which discusse application and usability in societal or consumer context. This issue is covering articles which have been put to double blind review and other regress academic standards so that the articles are of high quality.

I would like to thank the contributors and all editorial team members, reviewers and the team who have helped in making this issue of journal of possibility. I look forward to make this endeavor very meaningful and hope that authors will keep on contributing their articles in this bi-annual Indraprastha Journal of Management.

(Prof. Sanjiv Mittal)
Editor-in-Chief

Service Quality, Customer Satisfaction and Mediating Role of Perceived Value in Banks

An Investigation Based On Structural Equation Modeling Approach

Sanjay K. Jain* and Sonali Jain**

Abstract

Service quality has come to be recognized as a key factor affecting customer satisfaction, unanimity continues to elude as to the manner in which it affects the latter. While a majority of past studies report service quality to be directly affecting customer satisfaction, a few researches point to its indirect influence on customer satisfaction through mediation of customer value perceptions. Present study is an attempt to look into this issue in the context of retail banking in India. Unlike preponderance of past studies focusing primarily on analysis of functional aspect of service quality, the present study employs a broader perspective encompassing both the functional and outcome quality dimensions. Analysis of the data collected through a survey of customers of Indian banks reveal that both functional quality and outcome quality affect customer satisfaction, and that too only directly. Relatively speaking, it is rather outcome quality which exerts greater impact. Perceived value, however, is not found as a variable mediating influence of service quality on customer satisfaction. The paper concludes with implications for the bank management and directions for researches in future.

Keywords: Service quality, functional and outcome quality, customer satisfaction, perceived value, direct and mediating effects

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1. INTRODUCTION

Service quality has come to be recognized as a strategic tool to gain and retain customers in the present day hypercompetitive services market. As a research disciple too, it has gained considerable attention during the last three decades. A substantial body of literature has got built up conceptualizing and operationalizing service quality construct (e.g., Garvin, 1983, 1987; Gronroos, 1982; Parasuraman, Zeithaml, & Berry, 1985, 1994; Parasuraman, Berry, & Zeithaml,1985, 1991; Dabholkar, Thorpe, & Rentz, 1996; Zeithaml, 2000) and empirically examining its linkages with various consumer behavior constructs such as customer perceived value, satisfaction and behavioral intentions which hold potentials to add to the service firms' financial performance (e.g., Lewis & Booms, 1983; Brown & Swartz, 1989; Carman, 1990, 2000; Cronin & Taylor, 1992, 1994; Boulding, Kalra, Staelin, & Zeithaml, 1993; Bitner & Hubbert, 1994; Taylor & Baker, 1994; Dabholkar et al., 1996; Spreng & Mackoy, 1996; Zeithaml, 1996; Kellogg, Youngdahl, & Bowen, 1997; Ruyter, Bloemer, & Peeters,1997; Shemwell, Yavas, & Bilgiu, 1998; Jain, 2005; Zeithaml, 2000; Brady & Cronin, 2001; Olsen, 2002; Zhou, 2004; Bei & Chiao, 2006; Kassim & Souiden, 2007; Clemes, Ozanne, & Laurensen, 2010; Zhou, Lu, Zhang, & Chau, 2012).

No doubt several empirical studies have been undertaken across different service sectors in the past, consensus continues to elude about the mechanism through which service quality affects customer satisfaction. While a great majority of the studies posit service quality to be *directly* affecting customer satisfaction (e.g. Oliver, 1980; Zeithaml, 1988; Dodds, Monroe, & Grewal, 1991; Cronin & Taylor, 1992; Anderson & Sullivan, 1993; Anderson & Fornell, 1994; Holbrook, 1994; Rust & Oliver, 1994; Taylor & Baker, 1994; Leung, Li, & Au, 1998; Athanassopoulos, 2000; Cronin, Brady, & Hult, 2000; Lassar, Manolis, & Winor, 2000; Oh, 2000; Kim, Park, & Jeong, 2004; Lin, 2006; Park & Kim, 2006; Clemes et al., 2010), a few other studies point to its *indirect* influence on customer satisfaction via the mediating role of customer perceived value (e.g., Cronin *et al.,*2000; Kuo, Wu, & Deng, 2009; Lai, Griffin, & Babin, 2009). In the absence of

clarity on the issue, it seems inconceivable for the service management firms to evolve strategies capable of enhancing customer satisfaction, and thereby augmenting customer intentions to continue to patronize a given service provider and recommend it to others.

Dearth of such studies is especially conspicuous in the banking sector which has over time become fiercely competitive and the banks are vying with each other to attract and retain customers. In addition to being limited in number, past studies suffer from the limitation that only functional aspect of service quality has been investigated. Impact of outcome quality on customer satisfaction has remained ignored (Jain & Jain, 2014a; Jain & Jain, 2014b). Methodologically too, these studies suffer and their findings as such cannot be considered totally reliable and valid. Relationship of service quality with customer satisfaction has largely been examined through correlation and regression analyses (e.g., Debasish, 2001; Gupta, 2005; Jain & Gupta, 2008) which are not methods robust enough to take care of measurement errors. Moreover, these methods suffer from the limitation that these are not capable of assessing the direct and indirect effects of one variable on the other in single set of analysis.

The present paper is an attempt to fill this void in services marketing literature. Employing a broader operationalization of service quality construct encompassing both functional and outcome quality dimensions, the study strives to empirically investigate direct as well as indirect linkages of service quality with satisfaction. Relationships among these three constructs have, moreover, been examined with the help of structural equation modeling (SEM) approach which is a preferred technique for validating the operationalization of latent constructs and it examines direct and indirect linkages among the exogenous and endogenous constructs in a single set of analysis along with taking care of measurement errors (e.g., Hair, Black, Babin, Anderson, & Tatham, 2006; Kline, 2011).

The paper is organized as follows. The first section provides a conceptual overview of three core constructs under investigation in the study, viz., service quality, perceived value and customer satisfaction. The

next section discusses linkages of service quality with perceived value and satisfaction, and proposes hypotheses to be investigated in the study. Research design used in the study is discussed thereafter. Survey results are presented and analyzed in the fourth section. Final section summarizes findings of the study and spells out managerial and research implications.

2. CONCEPTUAL FRAMEWORK

2.1 Service Quality

Despite considerable work done in the area, it is ironical that there exists no unanimity among the service experts and researchers as to what service quality means. Majority view, however, favors the definition provided by Parasuraman et al. (1985, 1988, 1991, 1994) who have explicated it as "a global judgment, or attitude, relating to the superiority of the service" and have operationalized it as a difference between customer perceptions of *'what they get'* and their expectations of *'what they want'*.

Based on their extensive review of literature and discussions with several executives of service firms and customers, Parasuraman et al. (1985, 1988, 1991, 1994) identified a pool of items that represent various attributes or features of service quality. Several rounds of factor analyses and validity tests were performed on the data collected from different service sectors and this led them to propose SERVQUAL scale as an instrument to measure service quality. The scale is comprised of twenty-two items spread over five dimensions, namely reliability, assurance, tangibles, empathy, and responsiveness. Using the scale items, customers' expectations and perceptions of service quality are separately ascertained. Difference between the two scores serves as a measure of customer service quality.

Since the time of its inception, SERVQUAL has been a popular scale among the researchers and has been employed in a number of studies across several service sectors (e.g., Parasuraman et al.,1991; Avkiran, 1994; Bahia & Nantel, 2000; Jain & Gupta, 2004; Jain, 2008; Awan, Bukahri, & Iqbal, 2011). In view of its certain psychometric problems with the expectation part of the scale (see, for instance, Babakus & Boller, 1992; Cronin & Taylor, 1992; Jain & Gupta, 2004; Jain, 2008; Ladhari, 2009; Jain & Jain, 2012), an alternate version of the scale has been proposed by Cronin and Taylor (1992). Since the modified scale is based on performance scores alone, it is referred to as SERVPERF scale. Because of being a parsimonious as well as convergent instrument, this scale too has gained considerable popularity among the researchers.

A major problem with SERVQUAL as well as its counterpart, viz., SERVPERF, is that both these scales focus primarily upon *'functional'* or *'process'* aspect of service quality (i.e., *'how'* part of the service delivery). *'Outcome'* or *'technical'* quality that deals with *'what'* part of service delivery (i.e., what customer eventually gets after completion of a transaction with the service provider) is largely missing from the scale (for further discussion, see Jain and Jain, 2014a; Jain and Jain, 2014b). Since the time its importance was highlighted by Gronroos in the early eighties (Gronroos, 1982, 1984, 1990), outcome quality has come to be recognized as an important aspect of service quality. Though empirical studies examining outcome quality are limited in number, yet these unequivocally point to its significance in influencing customer service quality perceptions, satisfaction and behavioral intentions (e.g., Brady & Cronin, 2001; Kang & James, 2004; Yoshida & James, 2010; Emari, Iranzadeh, & Bakhshayesh, 2011; Powpaka, 2011; Choi & Kim, 2013; Theodorakis, Alexandris, Tsigilis, & Karvounis, 2013). However, studies assessing role of outcome quality with customer satisfaction in the banking context are conspicuously absent. Hence, knowledge base is lacking in the banking sector as to what extent outcome quality acts as an antecedent of customer satisfaction and in what way it influences the latter.

It is against this backdrop that the present study has been undertaken. Employing a broader operationalization of service quality encompassing both functional and outcome aspects, the study endeavors to investigate relative strength as well as nature of its influence on customer value perceptions and satisfaction.

2.2 Customer Satisfaction

Customer satisfaction too has emerged as a thrust area of researches. Services marketing literature posits it as an important variable influencing customers' future patronization and recommendation intentions, and thereby helping service firms improve their financial performance (Oliver, 1980; Fornell, 1992; Zeithaml, 2000; Lovelock, Patterson, & Walker, 2001; Yavas, Benkenstein, & Stuhldreier, 2004; Olorunniwo, Hsu, & Udo, 2006).

Notwithstanding a large number of researches undertaken in the field during the last three decades or so, no consensus exits among the researchers as to what customer satisfaction means and how it needs to be operationalized (Oliver, 1980; Yi, 1990). As many as eleven major different conceptualizations have been offered and nine different models of customer satisfaction (including the ones relating to expectancy-disconfirmation paradigm, attribution model and equity model) have been proposed in the services marketing literature during the period between 1981 and 1996 (Meng, Summey, Herndon, & Kwong, 2008).

The expectancy-disconfirmation paradigm, however, appears as the most popular model that has been employed in several past researches. The model proposed by Oliver (1980) postulates that customer satisfaction is a post-purchase response that occurs as a consequence of comparing pre-purchase expectations and perceived performance. In other words, customer satisfaction is the difference between a customer's expectations and perceived performance of a product or service that he or she has consumed. When perceived performance exceeds pre-purchase expectations, it is referred to as *positive disconfirmation*. Positive disconfirmation means customer satisfaction, and it positively influences consumer attitudes towards the product or service. But when expectations are higher than perceived service performance, it represents the case of *negative disconfirmation*. A customer is considered dissatisfied when a negative disconfirmation arises and this tends to adversely affect customer's relationship with the service provider. And a *confirmation* arises when expectations match with perceived performance (Oliver & DeSarbo, 1988; Patterson & Spreng, 1997).

Though service quality too has been operationalized in a similar manner by Parasuraman et al. (1985, 1988, 1991 and 1994), the two constructs differ from each other. A noteworthy aspect about satisfaction is that customer satisfaction judgment is a function of affective (emotional) post-purchase responses. In other words, it is an affective construct rather than a cognitive one which is the case with the service quality construct, and it as such represents, and is also a result of, an emotional process (Oliver, 1993, 1997). Spreng and Mackoy (1996) in this connection have rightly opined that satisfaction is a post consumption affective state that is characterized by a consumer's "emotional reaction to a product or service experience". It is worth referring to observations put forward by Oliver (2009) in the recently released book titled '*Satisfaction: A Behavioral Perspective on the Consumer*' that customer satisfaction is:"*…consumer's fulfillment response. It is a judgment that a product/service features, or the product or service itself, provided (or is providing) a pleasurable level of consumption-related fulfillment, including levels of under or over-fulfillment*". Olorunniwo et al. (2006), however, are of the view that customer satisfaction is a customer's fulfillment response that can be both evaluative and emotional-based, following the consumption experience.

2.3 Perceived Value

In the wake of fast changing marketing environment due to rapidly changing technology, emergence of newer consumer demand patterns and rise of both the price and non-price based competition, it has become considerably difficult for the business firms to attain, retain and grow their customer base. Customers these days have started increasingly searching for and demanding value in the products and services, and the term perceived value has as such gained currency in the marketing literature (Cronin, Brady, Brand, Jr, & Shemwell, 1997). Provision of superior customer perceived value has fast emerged as a strategic tool to compete in the market (Heskett, Sasser, Christopher, & Hart, 1994).

Perceived value for a given product or service can be viewed from two angles: '*what is received*' and '*what is given*' by the customers in the marketplace (Jen & Hu, 2003). Perceived value, therefore, can be

operationalized as a tradeoff between *perceived benefits* and *perceived costs* (Zeithaml, 1988; Lovelock, 2000). Zeithaml (1988) in this connection holds the view that perceived value is "*consumer's overall assessment of the utility of a product based on perceptions of what is received for what is given. Though what is received varies across consumers (i.e., some may want volume, others high quality, still others convenience) and what is given varies (i.e., some are concerned only with money expended, others with time and effort), value represents a tradeoff of the salient give and get component*".

Perceived benefits are the 'receiving' or 'getting' part of the transaction and mostly incorporate product or services attributes such as quality, features, functions and brand name. *Perceived cost,* on the other hand, is monetary as well as non-monetary price customers have to give up or they agree to sacrifice (Zeithaml, 1988). Monetary price is the amount of money customers spend or pay to buy services. Non-monetary price is the non-financial aspect which includes cost of time spent for getting the service, amount of efforts put by the customer while searching a particular service provider and psychological costs that are associated with purchase of services (Kuo et al., 2009).

3. DIRECT EFFECTS

3.1 Service Quality and Customer Satisfaction

Investigation of relationship between service quality and customer satisfaction has been a pivotal area of researchers in the services marketing literature (e.g., Gotlieb, Grewal, & Brown, 1994; Spreng & Mackoy, 1996; Zeithaml, 1996; Cronin et al., 2000; Brady, Cronin, & Brand, 2002; Jain & Gupta, 2004, Yavas et al., 2004; Bei & Chiao, 2006; Kassim & Souiden, 2007; Ladhari, Pons, Bressolles, & Michel, 2011). Both theoretically and empirically, there has been a great deal of discussion about the causal ordering of the two constructs, i.e., whether service quality affects satisfaction or it is satisfaction which affects service quality (e.g., Parasuraman et al., 1988; Bitner, 1990; Cronin & Taylor, 1992; Anderson & Sullivan, 1993; Taylor & Baker, 1994; Yavas et al., 1997; Bahia & Nanetel, 2000; Cronin et al., 2000;

Lassar et al., 2000; Eggert & Ulaga, 2002; Tung, 2004; Wang, Lo, & Yang, 2004; Yang & Peterson, 2004; Naeem & Saif, 2009). Majority view, however, is that service quality affects customer satisfaction and it as such needs to be viewed as an antecedent of the latter (e.g. Oliver, 1980; Zeithaml, 1988; Dodds et al., 1991; Cronin & Taylor, 1992; Anderson & Sullivan 1993; Anderson & Fornell, 1994; Holbrook, 1994; Rust & Oliver, 1994; Taylor & Baker, 1994; Leung, Li, & Au, 1998; Athanassopoulos, 2000; Cronin et al., 2000; Lassar et al., 2000; Oh, 2000, Clemes et al., 2010).

In the banking sector too, several studies point to the fact that service quality affects customer satisfaction (Johnston, 1995; Aldlaigan & Buttle, 2002; Zhou, 2004; Arasli, Mehtap-Smadi, & Katircioglu, 2005; Brady et al., 2005; Bei & Chiao, 2006; Kassim & Souiden, 2007). Johnston (1995), for instance, report that attributes related to four dimensions (assurance, empathy, responsiveness, and reliability) of SERVQUAL scale act as determinant of customer satisfaction. In a study measuring bank service quality in the United States and South America, Lassar et al. (2000) concluded that service quality affects level of bank customer satisfaction. In a similar vein, Jamal and Nasser (2002) found service quality dimensions positively affecting customer satisfaction, and hence concluded that service quality is an antecedent of customer satisfaction. In a study across five countries (namely USA, Australia, Netherlands, Hong Kong, and Morocco), Brady et al. (2002) reported service quality to be having a direct impact on customer satisfaction. A study of retail banking in the United Arab Emirates by Kassim and Souiden (2007) too has proved a positive influence of service quality on customer satisfaction. Another study by Arasli et al. (2005) also points to the same conclusion in the context of Greek Cypriot banking industry. Since majority of the past studies have been based upon SERVQUAL scale (or its variant SERVPERF scale) that focuses upon measurement of functional quality, their findings too imply that functional quality is positively and significantly related to customer satisfaction. Hence, it can be hypothesized that:

H_1: Functional quality directly affects customer satisfaction.

In view of the growing recognition of outcome quality in service quality literature, researchers have started exploring relationship between outcome quality and customer satisfaction too. Though the number of studies examining influence of outcome quality is quite limited (e.g., Yoshida & James, 2010; Choi & Kim, 2013; Theodorakis et al., 2013), these too point to a positive and significant relationship between outcome quality and customer satisfaction. In view of these findings, it can therefore be hypothesized that:

H_2: Outcome quality directly affects customer satisfaction.

3.2 Service Quality and Perceived Value

As explicated above, perceived value is construed as being comprised of two components, namely '*what a customer receives*' and '*what the customer pays or has to forego*'. What a customer thinks he or she is getting from a service provider is to a great extent shaped by customer quality perceptions. Service quality, therefore, can be construed as an antecedent of perceived value. In many past studies too, service quality has been found to be positively associated with perceived value. (e.g., Cronin et al., 1997, 2000; Brady et al., 2002; Lewis & Soureli, 2006; Eggert & Ulaga, 2002; Wang et al., 2004; Kuo et al., 2009; Lai et al., 2009). Keeping in view this *raison d'etre*, and also the two dimensional service quality perspective adopted in this study; it can be hypothesized that:

H_3: Functional quality affects perceived value.

H_4: Outcome quality affects perceived value.

3.3 Perceived Value and Customer Satisfaction

Service marketing literature postulates perceived value as a determinant of customer satisfaction, implying thereby that more favorable the perceptions customers hold about perceived value, more they are likely to feel satisfied with the services provided to them. Even a few past studies undertaken in this connection point towards a positive and significant relationship between perceived value and customer satisfaction (Cronin et al., 2000; Tung, 2004; Wang and Yang, 2004;

Wang et al., 2004; Turel & Serenko, 2006; Ismail, Abdullah, & Francis, 2009). Though Clemes et al. (2010) have employed perceived value as a moderating variable, they too found it to be exerting significant influence on the relationship between service quality and customer satisfaction. It, therefore, can be hypothesized that:

H_3: Customer perceived value affects customer satisfaction.

3.4 Service Quality Customer Satisfaction: Indirect Linkage via Mediating Role of Perceived Value

No doubt service quality literature posits service quality as a determinant of customer satisfaction, implying thereby that higher service quality perceptions lead to higher customer satisfaction. But this relationship cannot be expected to be always holding true for the simple reason that satisfaction depends upon not only what a customer gets, but also what he or she pays or sacrifices in exchange of getting that service. Quite conceivably, there can arise situations when customers despite holding favorable perceptions about service quality might not be feeling satisfied with the services in case they feel that they are being charged inordinately high prices and/or required to undergo considerable amount of physical and emotional labor. In such situations, therefore, poor or adverse customer value perceptions can emerge as a factor causing customer dissatisfaction. Findings of a few past studies undertaken in this connection do provide support to this assertion (e.g., Cronin et al., 2000; Kuo et al., 2009; Lai et al. 2009). It, therefore, can be hypothesized that:

H_4: Functional quality indirectly affects customer satisfaction via mediating role of perceived value.

H_5: Outcome quality indirectly affects customer satisfaction via mediating role of perceived value.

4. RESEARCH DESIGN

4.1 The Sample

A survey of customers of Indian banks was carried out to obtain the necessary data for empirically testing the model proposed above. In view of the non-availability of list of Indian bank customers,

it was decided to select respondents on the basis of quota sampling. A total of 500 persons located in Delhi and NCR region and having account with Indian banks were personally approached and administered a structured non-disguised questionnaire. After repeated call backs, only 325 duly filled in questionnaires were received back, thus constituting a 70 per cent response rate. Majority of the respondents in the finally selected sample were males, graduates and service class people. Marital statuswise, married and unmarried respondents were in almost equal proportion. In terms of age as well as income, respondents were found belonging to different clusters, thus ensuring fair representation of the population of the bank customers.

4.2 The Instrument

A structured non-disguised questionnaire was used for obtaining the necessary information. Customer perceptions of *functional quality* were gauzed through use of 22-item 'performance only' version of the SERVQUAL scale (Parasuraman et al., 1994). SERVPERF version of the scale was preferred because it does not contain expectation component which is not only conceptually problematic, but also increases the number of scale items to 44 which the respondents find difficult to answer. Necessary modifications in the scale items were made so as to adapt it to the context of retail banking sector.

An 8-item scale was used for measuring outcome quality. While six items were adapted from studies (Brady & Cronin, 2001; Kang & James, 2004; Al-Hawari, Ward, & Newby, 2009; Wu, 2009), the remaining two items were developed by the authors themselves on the basis of discussions held with the select bank customers during the qualitative phase of the research.

Customer value in the present study has been ascertained through a 3-items scale. While one item 'Considering the time, effort, and money you spent in transacting with this bank, the value you got is high' was adapted from the study of Hartline and Jones (1996), respondents' opinion regarding the costs associated with banking services was elicited through two scale items drawn from the study by

Wei (2001) which were suitably modified before use in this study.

A 7-item scale has been used to measure customer satisfaction. While the four items were adapted from the study by Kang and James (2006), the remaining three were developed by the authors themselves based on suggestions received from the customers and experts during the in-depth interviews with them.

Customer responses to all the scales were obtained on a 7-point Likert scale, ranging from '1' (Strongly disagree) to '7' (Strongly agree), with '4' indicating respondents' indifference with the scale item. The questionnaire so developed was pre-tested with select customers and suitable modifications were made based on the comments and observations received from them.

5. DATA ANALYSIS AND RESULTS

The collected data have primarily been analyzed with the help of structural equation modeling (SEM) technique which is considered as a method robust enough to take care of the measurement errors present in the data set. It, moreover, performs reliability and validity analysis and investigates direct and indirect linkages between the exogenous and endogenous constructs in a single round of analysis. As suggested by Anderson and Gerbing (1988), a two stage SEM model building process was employed. First the measurement model was specified and tested, and then the structural model entailing both the direct and indirect paths among the latent constructs was analyzed using AMOS 17 software. Various parameters were estimated using maximum likelihood (ML) method. For examining presence of mediation effects among the constructs, a framework suggested by Baron and Kenny (1988) was employed. SEM analysis approach, however, was used as it is regarded a method far superior to performing a series of regression analysis.

5.1 Measurement Model

Each of the scales used in the study was subjected to various rounds of reliability and validity analyses. Based on Cronbach alpha values, item-to-total correlations, factor loadings and other parameters estimated through exploratory factor analysis (EFA)

and confirmatory factor analysis (CFA), items found redundant were successively dropped.

In respect of 22-item functional quality scale, only eleven items could be retained. These items were found loading on three dimensions: reliability, personal interactions and tangibles (for further details, see Jain & Jain, 2014a). Even in respect of 8-item outcome quality scale, only four-items could be retained. As a part of further validation process, purified versions of these two scales were subjected to a composite CFA analysis which once again suggested dropping of three items from the functional quality scale and two items from the outcome quality scale. Convergent and discriminant validity analyses were performed on the finally retained versions of the 9-item functional quality scale and 2-item outcome quality scales, and the purified versions of the two scales were found convergent and discriminant valid (for details, see Jain & Jain, 2015).

A similar purification and validation process was adopted in respect of 3-item perceived value and 7-item customer satisfaction scales. Items found redundant were dropped successively in various rounds of CFA analysis. In the final round, only two items each could be retained. Because of being comprised of only two items, these scales became underidentified and hence no statistics relating to their goodness-of-fit indices, factor loadings, composite reliability could be obtained. Cronbach alpha values of 0.64 and 0.77 respectively for these two scales are above the minimum prescribed level for the exploratory studies (Hair et al., 2006), thus implying reliability of these too scales.

Structural Model

Having validated the linkages of manifest variables with the latent constructs, the analysis proceeded with testing the structural model proposed earlier in the conceptual framework section of this paper. Mean scores for each of the sub-dimensions of functional quality (FQ) were computed and inputted as indicators of functional quality construct. Two items each retained after the purification process for rest of the three constructs, viz., outcome quality (OQ), perceived value (PV) and customer satisfaction (CS), were employed as manifest variable for these

constructs. The model linking each of the latent constructs with their manifest variables and showing linkages among the latent constructs is presented in Figure 1.
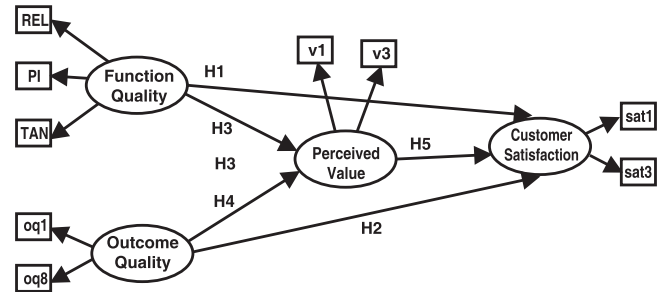
Figure 1: Proposed Model and Hypotheses

The model proposed in Figure 1 represents a '*partial mediation*' model as all the path coefficients in this model have been allowed to be freely estimated, thereby positing service quality dimensions to be affecting customer satisfaction *partly* in a direct manner and *partly* in an indirect manner through mediation of perceived value construct. In order to judge the model's goodness-of-fit in a comparative and more robust manner, an alternate '*no mediation*' model too was specified by restraining all the paths going to and emanating from perceived value construct to zero, thus nesting this model within its parent model. A *chi-square difference test* revealed significant deterioration in the model fit ($\triangle X^2$ = 162.811, df = 1, p $\leq$ 0.000), suggesting retention of partial mediation model for further analysis.

Goodness-of-fit statistics for the partial mediation model are reported in Table 1.While CFI and RMR values conform to the prescribed thresholds of 0.95 and 0.05, GFI and TLI indices are slightly lower than 0.95 cut-off point (Hair et al., 2007; Bryne, 2010). Though RMSEA value is higher than generally prescribed level of 0.08, it yet seems in line with MaCallum *et al.*'s (1996) recommendation and as such can be construed as representing an adequate model fit. Of course, the chi-square value is significant (p $\leq$ 0.000) and implies poor model fit. But not much reliance can be placed upon this statistic as it is quite sensitive to sample size and hence is not considered as a reliable measure of model fit (Bryne, 2010). Taken as a whole, the obtained goodness-of-fit indices indicate specified model is fitting the data.

Table 1: Model Fit Indices for Finally Retained Structural Model

	χ^2 value	Sig. level	df	χ^2/df	GFI	CFI	TLI	RMR	RMSEA
Default model	70.655	0.000	21	3.365	0.939	0.958	0.928	0.048	0.099

Estimates of path coefficients and R^2 values corresponding to two endogenous variables, viz., perceived value and customer satisfaction, are reported in Table 2 and Figure 2. Functional quality is having a significant and positive relationships with customer satisfaction (β = 0.32, p ≤ 0.05), thus lending support to hypotheses H_1. Outcome quality, however, does not emerge as a significant antecedent of customer satisfaction, and thus H_2 is found rejected. Both functional quality and outcome quality are having significant and positive relationship with perceived value (β = 0.35, p ≤ 0.015 and β = 0.56, p ≤ 0.01). Findings of the study thus fail to reject hypotheses H_3 and H_4. Taken together, the two exogenous variables, viz., functional quality and outcome quality, are able to explain 77.7 per cent of variations in customer value perceptions. The variable perceived value, however, is not found bearing any significant relationship with customer satisfaction. The hypothesis H_5, therefore, stands rejected.

Table 2: Structural Model-Partial Mediation Structural Model-Path Coefficients and R^2 Values

Regression paths	β coefficient
FQ→ PV	0.346*
OQ→ PV	0.568**
FQ→ CS	0.316*
OQ→ CS	0.369
PV→ CS	0.277
R^2 values:	
- PV	0.777
- CS	0.833

Note: 1. Significance level   **   p ≤ 0.01, *   p ≤ 0.05
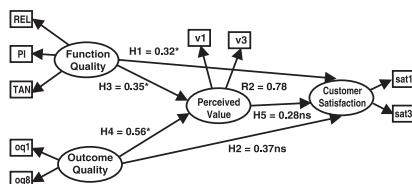
Figure 2: Structural Model: Path Coefficients and R^2 values
Notes: 1. NS= Non significant path
2. Significance levels: ** p ≤ 0.01,   * p ≤ 0.05

An insignificant beta coefficient in respect of path between perceived value and customer satisfaction in Figure 2 signifies absence of mediation effects. For mediation effect to occur, path from the mediating variable to dependent variable needs to be significant. Absence of a significant path in the present study implies that functional as well as outcome quality variables do not exert any indirect influence on customer satisfaction, thus leading to rejection of hypotheses H_6 and H_7. The study findings, therefore, suggest that functional quality and outcome quality do not indirectly affect customer satisfaction via the mediating role of perceived value.

It may be pointed out here that the two initially proposed models, viz., 'partial mediation' model and 'no mediation' model, were developed for purposes of testing on a comparative basis the presence of mediating effects. The later model (i.e., 'no mediation' model) was created by constraining paths going to and emanating from the perceived value construct to be zero. Since chi-square difference test revealed this model to be causing significant deterioration in the model fit, this model was dropped and its counterpart, viz., partial mediation model was retained. This decision was arrived at purely on statistical grounds based on the results of chi-square difference test. But an in-depth analysis of this model attempted in the preceding paragraph reveals that even this model is not tenable on substantive grounds. Since the mediation effects are altogether lacking significance, there appears no logic in retaining perceived value as a mediating variable in the model.

Another model without perceived value was, therefore, specified and tested. Results relating to the goodness-of-fit statistics of this model are presented in Table 3 and reveal this model to be fitting well to the data in terms of majority of the goodness-of-fit indices. A little higher value of RMSEA than the prescribed threshold level does appear as a matter of concern. And if an adjustment is made in the

model by allowing error variances relating to two manifest variables (TAN and PI) to be correlated as hinted by modification indices in the CFA output, RMSEA value is expected to fall to a value of 0.069, thus representing a superior model fit. In the absence of any theoretical justification for the same, the authors however decided not to carry out this adjustment in the model and treat the unmodified model itself as adequately fitting the data in view model's other goodness-of fit indices Though chi-square value is still significant, this need not be taken seriously because of its inherent limitation of being too sensitive to sample size.

Table 3: Finally Retained Structural Model - Model Fit Indices

	Default model
χ^2 value	44.804
Sig. level	0.000
df	11
χ^2/df	4.073
GFI	0.951
CFI	0.963
TLI	0.930
RMR	0.045
RMSEA	0.112

Note: 1. Significance levels: *** p =   0.00   * p ≤ 0.05

The truncated model (i.e., the model without perceived value construct) is presented in Figure 3. Path coefficients relating to this model are reported in Table 4 and these show both functional and outcome quality to be directly and significantly affecting customer satisfaction, with outcome quality exerting relatively greater impact. Taken together, these two antecedents are able to account for as high as 81.40 percent of variations in customer satisfaction perceptions.

Table 4: Linkages between Service Quality and Customer Satisfaction - Direct Effects

Linkage	β coefficient	R²
FQ→ CS	0.374*	0.814
OQ→ CS	0.562***	

Notes: 1. Legend: FQ= Functional quality, OQ = Outcome quality, CS = Customer satisfaction

2. Significance levels: *** p = 0.00   * p ≤ 0.05
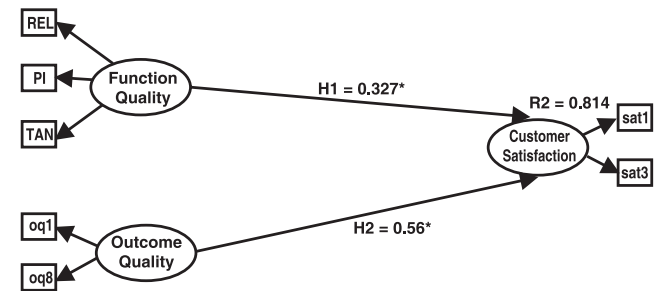
Figure 3: Finally Retained Structural Model: Path Coefficients and R² values

6.   DISCUSSION AND IMPLICATIONS

The present study makes an important contribution to service quality literature by having adopted a broader conceptualization of service quality construct and making use of structural modeling approach for analyzing linkages among service quality, perceived value and customer satisfaction constructs. Though several past studies have examined impact of service quality on customer satisfaction, these suffer from the limitation that only functional quality aspect has been investigated. Inclusion of outcome quality which has come to be conceptually recognized as a major component of service quality construct in service quality literature is a noteworthy feature of the present study.

Another salient feature of the study is the use of structural equation modeling for assessing impact of service quality and perceived value on customer satisfaction. Most of the past studies, especially in the context of Indian banking sector, have attempted to examine relationship between service quality and customer satisfaction with the help of only regression analysis. Due to its inability to control for measurement errors and the requirement for testing mediation effect through a series of regression

analyses, it is not considered as robust a method as structural equation modeling. Application of structural equation modeling in respect of testing of both the measurement and structural models do constitute a positive aspect of the present study.

Findings of the present study entail two managerially useful implications. Firstly, the study finds both functional and outcome quality to be *directly* affecting consumer satisfaction. Secondly, the study finds outcome quality to be acting as a relatively more important factor affecting customer satisfaction. Both these findings imply that bank management needs to reorient their operational and marketing strategies in favor of focusing more on outcome quality so as to start providing higher level of outcome quality to their customers. No doubt provision of an adequate level of functional quality in terms of aspects such as reliability of banking services (e.g., timely delivery of services, honoring what the banks promise to customers), maintaining effective personal interactions with customers (e.g., courteous and friendly behavior of the bank staff) and tangibles (i.e., convenient and good looking physical environment in the banks) is necessary, but it alone would not be able to help banks to expand and retain their customer base. With increased competition in the market and customers becoming more demanding and discerning, delivery of higher level of outcome quality becomes utmost important for the bankers. Unless the customers feel that they are getting outcome quality, i.e., they feel that they are able to accomplish the core objective of undertaking transactions with their banks, they are unlikely to feel satisfied with the banking services provided to them and might even think of switching over to competing banks.

Before we come to the end of the paper, it will not be out of place to mention a few of its limitations. And it is these very limitations that can serve as direction for future researches.

A small sample size comprising of customers based in Delhi and its NCR region is one major limitation of the study. Due to its small size and restricted coverage, it is not possible to generalize the study findings to the population of banking customers in the country as a whole. Future studies using larger samples and selecting customers from various geographical areas, including both the rural and urban areas, are called for. Furthermore, the present study is confined to the context of retail banking. It will be a worthwhile attempt to investigate perceptions of corporate customers also in future studies.

The present study has been undertaken in the context of traditional brick and mortar system of banking. Since the e-banking too has started gaining momentum in the country, it seems equally imperative to suggest replication of this study in the context of e-banking too.

The study has not been able to come up with empirical support in favor of the mediating role of perceived value. This probably could have happened due to adoption of relatively narrow operationalization of perceived value construct. As has been done in a few past studies, it will be worthwhile attempt on the part of the future researchers to employ a broader operationalization of the construct and examine separately the influence of each of its two constituent elements, viz., receipt part (i.e., perceptions as to what customers feel they are getting) and sacrifice part (i.e., perceptions as to what they feel they are giving up monetarily and otherwise). It is suggested that emotional aspect of value also be included in future studies.

As per European perspective, image has also been posited as a factor affecting service quality, perceived value and satisfaction. Role of image has not been examined in the present study due to space considerations. Researchers can incorporate this variable too in future studies.

During the scale validation process, many scale items got deleted. Only 9-item functional quality scale, 2-item outcome quality scale, 2-item value scale and 2–item customer satisfaction scale could be retained. Due to considerably a reduced number of scale items eventually employed in the investigation, especially in respect of outcome quality, perceived value and customer satisfaction constructs; generalizability of the study findings are at stake. Efforts are, therefore, needed to identify pool of additional scale items so that more reliable and valid scales can be developed for use in future studies.

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Scale Items Finally Retained and Used in Study

	Dimension/ item code/ item		Source
Functional Quality			
Reliability			
	sq1	Providing services as promised.	
	sq3	Performing services right the first time.	
	sq4	Providing service at the promised time.	
Personal Interactions			
	sq15	Employees who deal with customers in a caring manner.	
	sq17	Employees who understand the needs of their customers.	
Tangibles			
	sq18	Modern looking equipment, fixtures and facilities.	
	sq19	Visually appealing facilities.	
Outcome Quality			
	oq1	In general, I am able to successfully complete transactions with this bank.	Kang and James (2004)
	oq8	Bank services and items such as cheque books, pass books, forms, etc. are available as and when demanded by customers.	Self
Customer Value			
	v1	Considering the time, effort and money you spent in transacting with this bank, the value you get is high	Hartline and Jones (1996)
	v3	Your level of satisfaction with charges you pay for the bank services is high:	Wei (2010)
Customer Satisfaction			
	sat1	My bank provides services as per my expectation.	Self
	sat3	I consider it a right decision to stay with this bank	Self

Implementation of Supply Chain Management Information System and Organizational Success Factors

An Empirical Analysis of the Indian Automotive Industry

Manisha Seth*, D P Goyal** and Ravi Kiran***

Abstract

Companies are using information and communication systems in the supply chain due to the advent of globalization and fast changing environment. Supply chain management information system (SCMIS) offers several benefits like reduction in inventory costs, lead time for customers, increase coordination with suppliers and better material control. Huge cost and time is involved in implementation of these systems. Review of literature has revealed that the success in implementation of SCMIS is not very encouraging therefore research on critical success factors for the implementation has gained significant interest. This study aims to examine the influence of organizational factors in the successful implementation of SCMIS in Indian automotive industry. A questionnaire was designed and administered to executives of automobile companies, their suppliers and distributors. The conceptual model was developed and structural equation modeling was used to assess the measurement model and evaluation of convergent and discriminant validity of each of the measurement scales was done. The second stage of SEM process involves testing the structural model and the proposed model was examined using a software AMOS. The maximum likelihood method was employed to estimate all parameters and fit indices. The results identified four major organizational success factors namely top Management Support, change management, External support and Clear Business Plan and Vision. Based on the finding of the study various recommendations have been made so as to ensure successful implementation of SCMIS.

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1. INTRODUCTION

In the contemporary world competitive advantage of an organization depends on the information sharing and flow of information across the supply chain with the help of information technology. Through the use of information based upon the use of information technologies, the efficiency and effectiveness of supply chains can be significantly enhanced. Thus IT plays an important role in integrating supply chain. Besides information flow it also helps in various decision making processes. At present focus is on integration of upstream and downstream partners through Supply Chain Management Information System (SCMIS).

SCMIS is an extension of Enterprise resource planning (ERP) which integrates companies beyond the boundaries of an organization and with the advent of globalization it has further gained more importance (Marwah, et al., 2012 and Gunasekaran, 2004). It has been recognized by many organizations as a strategy to attain business goals (Altekar, 2005; Chan and Lee, 2005). SCMIS involves managing and coordinating all activities associated with goods and information flows from raw material sourcing to product delivery and finally to the end customers (Wei and Chen, 2008). It provides high quality, relevant and timely information flow that effectively supports decision-making for inventory replenishment, capacity activation and for synchronizing material flows at all tiers within the supply chain. Thereby it plays an increasingly critical role in the ability of firms to reduce costs, increase responsiveness (Chopra and Miendl, 2005), gain competitive advantage (Dezdar, 2011) and achieve better coordination.

Manufacturing companies including automobile companies have already realised the importance of these systems as it needs to keep control over costs at every stage to remain competitive. The emergence of e-business has thus led to different way in which enterprise communicate, transmit and receive information with the suppliers upstream and customers downstream. Major OEMs have realized the benefits arising out of these systems; however, the achievement of these above mentioned benefits depend upon the effective implementation of the SCMIS. Implementing these systems is a complex, lengthy and expensive process. These systems require huge commitment of funds, time and expertise (Motwani et al., 2008). There is a strong evidence in the literature that implementation of SCMIS projects were either not completed on time or did not bring about the planned effects (Holland, 1999) and even exceeded their estimated costs (Davenport, 1998).

This was substantiated by studies of Zhang et al., (2005) which revealed that ERP projects implemented exceeded their budget as well as the time duration and delivered only 30 per cent of promised benefits and in the study by Wang and Chen (2006) proves that more than 90 per cent of ERP implementations have been delayed, and required additional budget amounts. Further the research done by Panorama consulting solutions which summarizes the experiences of 192 ERP customers with regards to enterprise software, vendors, consultants and overall implementation shows the average cost of implementation for last five years to be $6.4 million dollars and average duration for implementation to be 16.6months. Further for 2013, 54% of the projects have exceeded their planned budgets, 72% have exceeded their planned durations and about 66% of respondent organizations have received less than 50% of the benefits that was expected from the system. The overall failures and implementation difficulties in implementing these systems have attracted lot of research (Liu and Seddon, 2009; Singh, 2010; Syed Iftikhar, 2008). Therefore the question that arises is "What are the critical success factors (CSFs) that would lead to the successful implementation of these systems?" and since these projects are expensive and time consuming therefore it becomes imperative for the management to evaluate whether the system implemented is successful. The review of literature illustrates that studies have been undertaken which focus on analyzing the CSFs that would lead to the successful implementation of the system. Various researchers have divided CSFs broadly into four categories namely technical, Organizational, Human and Inter Organizational. With this background in mind the present study was conducted to identify and analyze critical dimensions under organizational factor that needs to be considered to ensure successful implementation of the information system for the automobile industry. The organizational factor has

been considered to be very vital for the successful implementation of the system by various studies (Zhang et al., 2005; Dezdar and Sulaiman, 2009). The paper develops a model to analyze the relationships between factors and success indicators. Finally, the paper provides recommendations for the success of these systems based on the analysis of critical factors. The contributions of the paper would be useful for industry practitioners, researchers and policy makers. The process model and critical success factors would provide a useful guide for industry practitioners who are planning to implement SCMIS in their organizations. Further the study would help them to improve decision making for successful implementation of SCMIS right from inception and subsequent realization of the enormous benefits that will accrue with the right implementation.

2. REVIEW OF LITERATURE

The review of literature is divided into two parts namely identifying factors influencing successful implementation of the system and implementation success. The CSFs are categorized into Organizational, human and technological groups based on the study by Garcia and Perez (2007). Since the study focuses only on the organizational factors therefore these are discussed below.

2.1 Organizational factors:

According to the study by Garcia and Perez (2007) variables like top management support, Clear Business Plan and Vision, external support, change management and Business process reengineering (BPR) are included in the organizational dimension. These variables are explained below:

2.1.1 Top Management Support

Top management support describes the extent to which executive managers of the adopting firm provide the attention, resources, and authority required for ERP implementation (Wang and Chen, 2006). Top management has the responsibility to align the new ERP system with the current business practices and prepare the employees for the change brought by the new technology (Madininos, 2011). With top management support, user resistance can be partially mitigated by having top executives encourage, or even mandate, user engagement in the implementation. (Wang and Chen, 2006). The involvement of top management is also vital for the effective re-engineering of the supply chain and logistics processes (Gunasekaran et al., 2004) leading to successful Inter organizational systems and relationship. It is the top management commitment and willingness to take up risk involved in the adoption of IOS to gain competitive advantage that will lead to successful implementation of the systems. Thus intervention of the top management is necessary for the allocation of financial and human resources, to take fast and effective decisions, resolve conflict, to promote company wide acceptance of the project and to build cooperation among the diverse groups within the organization. The study by Ahmad (2013) which had reviewed over 50 papers relevant to the identification of CSFs for the implementation of ERP systems had observed that management support had an occurrence percentage of 100.

2.1.2 Clear Business Plan and Vision

The system implementation requires that the key personnel within the organization should have a clear goals and vision about how to satisfy customers, facilitate suppliers and empower the employees (Umble, 2003) thus leading to the successful implementation of the system. The organization also needs to define the purpose of implementing the system so as to justify the investment. The vision should provide a clear link between business goals and IS strategy (Finney, 2007). Wee (2000) stated that the business plan should outline proposed strategic and tangible benefits, resources, costs, risks, and the timeline.

2.1.3 Change Management

The implementation of SCMIS requires changes in the way an individual employee performs his job. Employees are often comfortable the way they are performing their work and do not feel the need for a new system. Therefore change management is very important which enables the employees to adapt to the change. If people are not properly prepared for the imminent changes, then denial, resistance, and chaos will be predictable consequences of the changes created by the implementation (Umble, 2003).

However if the change management initiatives are properly undertaken people would be well prepared to embrace the opportunities that would be provided by the system. Due to its collaborative nature, managing people, organizational inertia and change management are even more critical to ERPII implementation (Koh et al., 2008; Møller, 2005; Weston, 2003).

2.1.4 External Support

The implementation process requires external support in the form of vendors' and consultants'. Vendor support represents an important factor with any packaged software including extended technical assistance, emergency maintenance, updates, and special user training (Sawah, 2008). Consultants support is required to facilitate the implementation process by providing suitable solutions to the problems being faced. Further internal implementation team depends on the consultant for their technical expertise.

2.1.5 BPR and Minimal Customisation

BPR plays an important role in implementing SCMIS. It is very imperative that the organization should be willing to change the way businesses are conducted as to have minimum customization of the software. It is the enterprise that should fit into the system so lead to a successful implementation

2.2 Implementation success measures

The review of literature focuses on different measures that act as a surrogate to the IS implementation success. Measuring information system (IS) implementation success is a complicated issue and has been a major topic of research in the area of information systems. One of the most important measure of IS success is user satisfaction. Ives et al., (1983) defines user satisfaction as "a perceptual or subjective measure of IS success" and considered information product, EDP staff and services, and user knowledge and involvement as three construct to user information satisfaction which was confirmed in the study by Baroudi and Orlikowski (1988). Further research in this area was done by Doll et al., 1995; Doll and Torkzadeh, 1988; Doll, et al., 1994; Doll and Weidong, 1997; Torkzadeh and Doll, 1991. Doll and Torkzadeh (1988) in their study proposed a second-order factor model of end-user computing

satisfaction. The first-order factors measured by 12 items include content, format, accuracy, ease of use, and timeliness. The second-order factor is interpreted as end-user computing satisfaction. Doll, et al., (1994) conducted a confirmatory factor analysis on the Doll and Torkzadeh model (1988) to confirm the five factor second order model.

Further DeLone and Mclean (D&M) model (1992) is one of the most cited model for information system success (Gable, Sedera & Chan, 2003; Myers, Kappelman & Prybutok,1997; Heo & Han, 2003), D&M conducted an extensive review of literature and classified dimensions of IS success measures into six categories:

(1) System quality: The desired characteristics of an IS itself.

(2) Information quality: The desired characteristics of the product of an IS.

(3) Use: The receipt consumption of the product of an IS.

(4) User satisfaction: The interaction between the user and the system.

(5) Individual impact: The effect of information on the behavior of a receipt.

(6) Organizational impact: The effect of information on organizational performance

According to them these six dimensions of success are not independent but they are interrelated. Figure1 shows D&M IS success model. System quality and information quality both would affect use and user satisfaction which are themselves related. Use and user satisfaction in turn will have an impact on the individual performance and this impact finally affects the organizational performance. Thus the first two variables of system quality and information quality are quality measures; next two variables of use and satisfaction are attitudinal outcomes and last two variables of individual and organizational impacts are basically performance related outcomes.
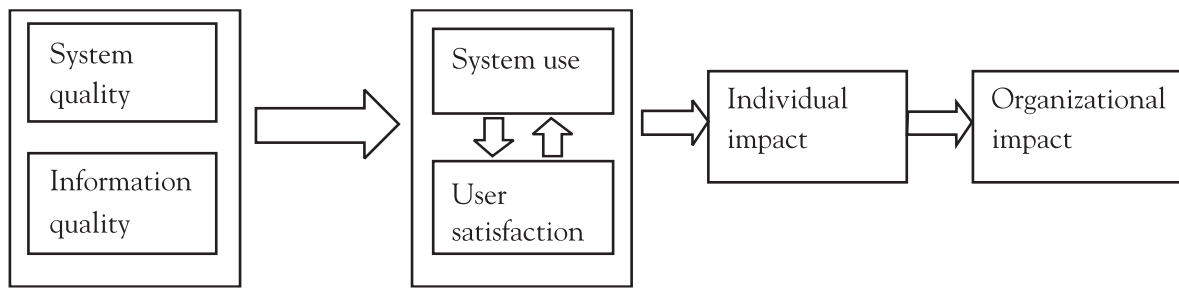
Figure 1: D&M IS success model

Thus D&M developed a model of "temporal and causal" interdependencies between six categories of IS success.

Thus review of literature defines five surrogates of IS implementation success:

1. Oliver White's ABCD Classification Scheme which was considered by various researchers (Burns and Turnipseed, 1991; Wilson et al., 1994). They created an ABCD checklist and proposed successful implementation measures along two dimensions namely improved performance and user satisfaction.

2. Completion of system implementation on time

3. Completion of system implementation within budget

4. Intended business performance improvements has been used as by various researchers (Al-Mashari et al., 2003; Hong and Kim, 2002; Mandal and Gunasekaran, 2002; Markus et al., 2000; White et al., 1982; Yusuf et al., 2004)

5. System acceptance and usage

Based on the review of literature, the following hypotheses were defined:

H1: Top management support has a positive impact on SCMIS implementation success.

H2: Change Management initiatives have a positive impact on SCMIS implementation success.

H3: BPR has a positive impact on SCMIS implementation success.

H4: External support has a positive impact on SCMIS implementation success.

H5: Clear Business Plan and vision has a positive impact on SCMIS implementation success.

3. RESEARCH METHODOLOGY

3.1 Questionnaire Development

The dimensions are based on the previous studies reported in the literature and discussions with the researchers, experts and practitioners in this field. The questionnaire was developed using review of literature with some measures being adapted from the previous research while others were formed specifically for this study. Items for the Top Management Support variable were adapted from the study by Ngai et al., (2004), change management items from Ahmed et al., (2006), items for variable BPR from Zhang (2003) , External support variable items were adapted from Jafari et al., (2006)   and items for Clear Business Plan And Vision variable from Dezdar et al., (2009).

Thus the final questionnaire was divided into three sections. In section I the respondents were required to fill their demographic profile such as gender, total work experience and to specify the department they were working in. In section II the respondents were asked to give their perception on the factors that influence SCMIS implementation success in their Organization. In section III the respondents were asked to indicate the success of the system implemented in their organization based on user satisfaction and organizational impact.

The questionnaire covering these variables were framed on five-point Likert scale ranging from 1 (highly disagree) to 5 (highly agree) to measure the attitude of respondents for every question. A pilot test was conducted for measuring the validity and reliability of the questionnaire. Thirty practitioners and scholars were administered the questionnaire and were asked to comment on its readability and comprehensiveness. Thus the validity was established

using a panel of experts from the area of SCM and discussions with academicians and practitioners. The discussion with the experts led to certain changes in the wording of some survey items which was incorporated into the draft of the questionnaire. The reliability of the data was tested using the SPSS software. The value of Cronbach alpha, for all items, were 0.88 which is above 0.7, hence, the questionnaire was considered to be reliable as suggested by Hair et al., (2006).

3.2 Sample of the study

A sample of 145 executives from two main companies namely – Maruti Suzuki India Ltd. and Honda Cars India Ltd including their suppliers and dealers located in National capital region (NCR) of India was selected. The pretested questionnaires were administered through e-mail and personal meetings with the respondents. Total of 113 questionnaires were returned and after reviewing 13 questionnaires were omitted, as they were incomplete. Therefore only 100 questionnaires were used for analysis.

3.3 Proposed conceptual model

Based on the variables under the organizational factor a conceptual model has been proposed for the successful implementation of the SCMIS. The model shows that if variables like top Management Support, change management, BPR, External support and Clear Business Plan and Vision are considered, it would lead to successful implementation of the information system. The framework of the proposed conceptual model is given below (Figure 2)
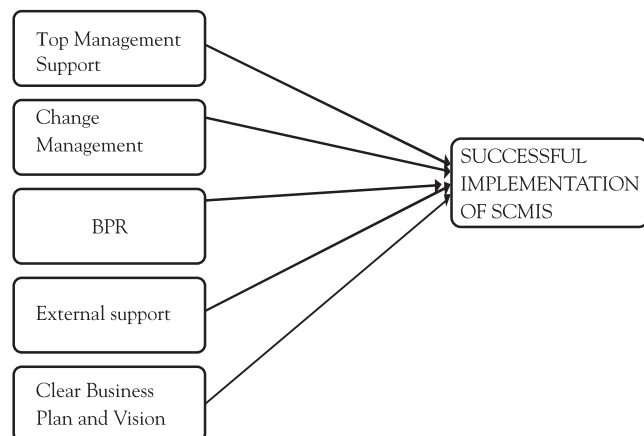
FIGURE 2: CONCEPTUAL MODEL

4. DATA ANALYSIS AND FINDINGS

4.1 Profile of the respondents

Table 1 shows the demographic profile of the respondents. The study was conducted among 100 respondents of whom 79% were Males, 44% of total respondents had working experience of 5 -10 years while 31% respondents had working experience of more than 10 years. The table further reveals that 47% of the total respondents were from SCM department while 13% of them were from the IT Department and production department.

Table 1: Demographics Profile of Respondents

	Number of respondents	Percent	Cumulative percent
Gender			
Male	79	79.00	79
Female	21	21.00	100
Total work experience			
Less than 5 years	25	25.00	25
5-10 years	44	44.00	69
More than 10 years	31	31.00	100
Department			
Production	13	13.00	13
Purchasing	10	10.00	23
Supply chain Management	47	47.00	70
IT	13	13.00	83
Finance	02	02.00	85
Marketing	11	11.00	96
Others	04	04.00	100

4.2 Measurement model

To assess the measurement model evaluation of convergent and discriminant validity of each of the measurement scales is done. For assessing convergent validity three measures are used namely factor loading, composite construct reliability (CR), and average variance extracted (AVE). For discriminant validity

measures used are Maximum Shared Variance (MSV) and Average Shared Variance (ASV).

According to Hair et al., (2006) the recommended threshold values for these measures are:

For R**eliability**

CR > 0.7

For Convergent Validity

CR > AVE

AVE > 0.5

Discriminant Validity

MSV < AVE

ASV < AVE

These measures are shown in table 2.

Table 2: Convergent and Discriminant validity

Construct	Items	Factor loading	Composite reliability (CR)	Average variance extracted (AVE)	Maximum Shared Variance (MSV)	Average Shared Variance (ASV)
Top Management support (TM)	TM1	0.72	0.823	0.537	0.264	0.144
	TM2	0.78				
	TM3	0.70				
	TM4	0.73				
Business Process Re-engineering (BPR)	BPR1	0.75	0.815	0.595	0.112	0.064
	BPR2	0.79				
	BPR3	0.78				
External Support (ES)	ES1	0.75	0.769	0.526	0.185	0.081
	ES2	0.71				
	ES3	0.72				
Change Management (CM)	CM1	0.73	0.793	0.562	0.187	0.106
	CM2	0.77				
	CM3	0.76				
Clear Business Plan and Vision	BPV1	0.80	0.886	0.609	0.260	0.115
	BPV2	0.80				
	BPV3	0.80				
	BPV4	0.72				
	BPV5	0.71				
User satisfaction and organizational impact	SM1	0.65	0.896	0.588	0.264	0.191
	SM2	0.70				
	SM3	0.68				
	SM4	0.75				
	SM5	0.77				
	SM6	0.59				

Therefore, analyzing table 2 all constructs had adequate convergent and discriminant validity as recommended by Hair et al., (2006).

4.3 Structural Model

The second stage of SEM process involves testing the structural model. The proposed structural model was examined using a software AMOS. The maximum likelihood method was employed to estimate all parameters and fit indices .To evaluate the fit of CFA various goodness of fit (GOF) indices are employed. Various GOF indicators included in the study to assess the model's goodness of fit are the ratio of $x2$ to degrees-of-freedom (DF), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), incremental fit index (IFI), root mean square error of approximation (RMSEA) and root mean square residual (RMR) .

Table 3: Goodness of fit measurement of the SEM framework

EVALUATION INDEX	GOF	THRESHOLD	VALUES
Absolute fit index	Pearson chi-square ($x2$)	The least	260.568
	Degrees of freedom		236
	CMIN/DF	<3 good <5 sometimes permissible	1.104
	P value	> 0.05	.130
	RMR value	>0.05	.027
	RMSEA value	>0.05	.032
	GFI value	>0.9	.836
	AGFI	>0.8	.800
Relative fit index	IFI value	>0.9	.977
	CFI value	>0.9	.976

Thus based on the results of the SEM fit indices, the proposed model provided an acceptable fit for the data.

5. DISCUSSIONS

SEM path results, standardized path coefficients and significance values of all relationships hypothesized in the model are shown in figure 3

* p<0.05
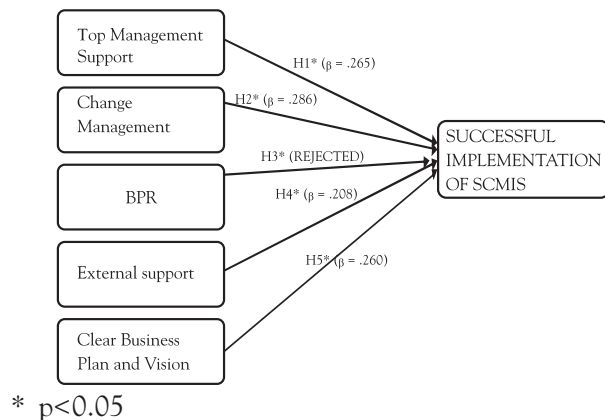
FIGURE 3: Path analysis results for SCMIS implementation success model

Hypothesis H1 proposed that top management support has a positive impact on SCMIS implementation success. The results of SEM analysis support this hypothesis (β =.265; p<0.05)

Next H2 proposed that change Management initiatives have a positive impact on SCMIS implementation success. The results of SEM analysis support this hypothesis (β =.286; p<0.05) Further Hypothesis H3 which proposed that BPR has a positive impact on SCMIS implementation success was not found to be significant (p>0.1) therefore it was rejected. Furthermore, hypothesis H4 recommended that external support has a positive impact on SCMIS implementation success. The coefficient for this path is also significant (β =.208; p<0.05) which support H4. Finally H5 recommended that the clear business plan and vision has a positive impact on SCMIS implementation success. The coefficient for this path is also significant (β=.260; p<0.05) which support H5.

The highest beta value is for change management initiatives which have a significant impact on the successful implementation of the system. The finding is consistent with the results of the research done by Aladwani (2002); Motwani et al., (2005); Finney (2007). Therefore the organizations should implement the strategies for minimizing this risk and should be competent enough to facilitate a smooth implementation of the system. The most frequently used strategies to overcome resistance to change are communication, user participation, user involvement and training.

Communication

As the organizations move towards integration with the outside world proper communication is imperative between the users, top management, project management team and leader. Communication is required in every phase before, during and after the implementation. Proper communication should ensure that the users understand the need and the benefits associated with the adoption of the inter-organizational system. Communication should be two way as well as open where employees are free to express themselves and give their feedback .Communication will reduce the uncertainty with the adoption of the information system and would diminish the concern about the threat of job, power or status.

User participation and involvement

According to Briolat and Pogman (2000), "user participation is advocated in order to discover

Users' needs and point of view validate specifications, and hence build better IS for the Organization". The users who participate in the planning and implementing stage of the system are less likely to resist the change. Users' participation can improve system quality by knowing exactly the information requirements, not adding any superfluous feature that adds cost of implementation but does not add any value to the user. The users should be asked to give their suggestions and feedback in the process of implementation which will improve user understanding of the system. Thus it is very important to keep

the users and other stakeholders motivated and actively involved.

Education and training

Education and training should be provided to the user so that he becomes comfortable with the system. Due to lack of training users are uncomfortable to input or retrieve data from the system (Peng & Nunes, 2007) .The user will be reluctant to use the system or will not posses sufficient skill unless and until sufficient training is imparted to him. Low-skilled and ill-trained staff represents a crucial barrier to the use of ERP systems (Sherer & Alter, 2004; Wright & Donaldson, 2002). It is very important to give hands on training to the user so that he gets a feel of it. There must be development of a formal training program to meet the requirements of the system users. Proper allocation of resources for the training should also be done. The training could be organized in-house or at the training centre where consultants could transfer knowledge to the technical personnel and end users. Training is one of the most costly components of an ERP implementation project (Estevez et al., 2002) so the proper monitoring and evaluation should be done to ensure that the employees have received the appropriate training.

It is very necessary to reduce human impediments because user satisfaction has received widespread acceptance as a measure of information system success (Wu et al., 2002). As also noted by Holsapple et al., (2005) user satisfaction is one of the key factors affecting the management information systems' success.

The results of the study also showed that there is positive relationship between top management support and successful implementation. This result supports the findings of previous research

(Al-Mashari et al., 2006, Somers and Nelson, 2004; Ifinedo, 2008; Sedera and Dey, 2006; Sawah et al., 2008). For the successful implementation top management plays an important role. Formal and honest communication from the top management leads to reduction in the resistance to change. Employees and the Management acting in tandem as a team can alleviate the resistance. The Management can

facilitate team spirit by empowering the employees and also create an environment for the employees to accept change. They can also develop informal leaders who can become effective agents of change and also can practice soft coercion tactics to reduce resistance. Top management should assign sufficient resources to the change management and should act as a leader and not boss. Top management should establish reward system which would further reduce the resistance.

Further the study showed that external support by the vendors and consultants have a positive impact on the successful implementation of the system. This result is supported by the findings of the study by Ifinedo (2008); Wang and Chen (2006). The external expertise is a necessity for the successful implementation of the system. The vendors and consultants should provide the necessary training, knowledge, maintenance and other technical support to the organization implementing the system since at times the organizations do not have the expertise in implementing the system. Organizations want the vendors and consultants to be cooperative and trustworthy.

Lastly the study showed that clear business plan and vision have an impact in the successful implementation of the system and this result is supported by the findings of Ifinedo (2008); Stefanou (2001). It is imperative to have clarity about the adoption of the system vis-a-vis corporate mission and operational goals for the successful implementation. An organization that understands how SCMIS implementation can help it realize their objectives will gain from it and all those that do not understand such issues will face the failure of implementation. Thus it is very important for the organization to align the reasons for adopting these systems with their business intent for the successful implementation.

6. CONCLUSIONS

The study aimed to stress upon the organizational factors that are critical for the successful implementation of SCMIS. The study concluded that the most important organizational factor is the change management initiatives that will drive towards the successful implementation of the system.

Further top management support is an imperative organizational factor that will lead to the successful implementation of SCMIS. Study also concluded that having clear business plan and vision will further lead to the successful implementation. Lastly the effect of the external support, cooperation from the vendors and consultants will further steer towards the successful implementation of SCMIS.

The contributions of the paper are important for industry practitioners, researchers and policy makers. The process model and critical success factors will provide a useful guide for industry practitioners who are planning to implement SCMIS in their Organizations. The study can help them to improve decision making for successful implementation of SCMIS right from inception and subsequent realization of the enormous benefits that will accrue with right implementation.

For the academic researchers the study forms the basis of a more detailed examination of the subject related to the implementation of SCMIS. The proposed model can form the basis of deriving 'performance metrics' to give organizations a clearer picture of the benefits accruing from SCMIS. This study can encourage and enlighten policy makers to establish new training institutes and formulate policies in favour of SCMIS in the wider interest of the industries and improve the overall economy.

7. LIMITATIONS OF THE STUDY

The major limitation of this study is that the findings were limited to only two major players of the automotive sector of National capital region of India. Thus it is recommended that similar research studies should be conducted by taking a larger sample of organizations in automotive industry from other parts of India so as to include any other dimension whatsoever, that might have been left out while covering these two organizations only of the automotive industry. Secondly the study does not include the views, opinions and perceptions of software experts that are involved in the development of SCMIS from organizations like IBM, Oracle and SAP. Thirdly the present study focused only on organizational factors for the successful implementation of the system. Future researchers could examine other

factors like human dimension, technical and inter organizational.

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Creating Patient Experience

An Exploratory Study

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Abstract

The Healthcare sectoris poised for rapid growth. Factors like Growing population, increasing affordability, increased patient awareness and lower treatment costs as opposed to the developed countries are the key factors to look out for which would drive the future growth of healthcare in India. On the other hand, medical tourism, telemedicine, health IT etc. are encouraging out-of-the-box thinking by the healthcare players for better operation.Patients are becoming more aware of their health needs, demanding quick response, expecting less waiting time and better quality care. They do notjust want a plain health careservice; they desire a betterhealthcare experience.

The purpose of this paper is to discuss key drivers of patient experience (delight) andevaluate patient perceived service quality in Indian hospitals. For patients, perceived service quality has become the prominent aspect to choose between hospitals. The key focus of this paper is to studythe relationshipbetween patient satisfaction and patient delight.This research used two staged research design. First stage incorporates exploratory researchand the second stage consists of a descriptive research through an online survey to collect information on recent hospital encountersof respondents and their expectations for similar future visits. By understanding the relationships among different metrics and the impact of these dimensions on patient experience, we were able to build predictive models.Structured Equation Modelling (SEM) technique was used totest and validate models. The study also indicated that obvious components, like service quality remain the top priority while choosing a health care provider followed by service performance, service design, personal satisfaction, innovations and customization in a rank order. The results of this study have certain limitations, as these are based on Indian hospitals. The contribution of this research paper will be the creation of an experiential model based on the importance of certain unexplored factors important for patient satisfaction and patient delight in health care. This work provides practitioners and policy makers a new approach to address issues related to the patient care.

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1. INTRODUCTION

In today's world when the competition is very intense, "delighting" customer has become the most essential driver for long-term success of any business. Merely "satisfying" customers is just not enough. Service practitioners realize that in order to retain customers they must go beyond the usual satisfaction level to make customers feel delighted. Excellent design, marketing, and delivery are as crucial for good experience as they are for goods and services. Experience is an emerging concept in product and service and it takes place when quality concepts are put forth through customization and relationship management. It is essentially reducing the gap between customers' expectations and their subsequent service encounter. According to Pine and Gilmore (1998); for creating experiences companies intentionally use services as the stage, and goods as props, to engage individual customers in a way that creates a memorable event. Today, experience design has become as much important as the product and process design.

Kotler and Armstrong (2004) defined service as "any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything." Factors like intangibility, inseparability, variability, heterogeneity, being labor intensive, participation of the customer in the service delivery process are peculiar to services as compared to a product. Healthcare service is not an exception. The healthcare service industry is dynamic and requires a holistic approach to address health concerns. It has gone through a transition in health care service delivery process and recently higher service expectations of patients, ever-advancing technology, and greater access to health information through the internet and the digital media have become great influences. In such competitive healthcare market with growing patient consumerism, in order to satisfy and exceed patients' expectations, it is important for healthcare providers to understand how patients and their patient's families perceive healthcare service quality. It is also important to explore the factors that impact perceptions. Before a hospital can charge admission, it must design an experience that patients judge to be worth the price. Therefore, it is critical for providers to understand what builds an experience for the patients and families.

Hospital data are mostly used to provide information on health outcomes and the level of satisfaction of patients during the service encounter. The missing link is in - "what do patients desire"? What would they want from the hospitals, in order to have a delightful healthcare experience?

Research related to patient experience has not been paid enough attention whilst there have been numerous studies on patient satisfaction. There is an extant literature on patient satisfaction while very less has been done in the field of patient experience. There is no commonly accepted model for patient experience. It needs to be understood that what may satisfy a patient may not necessarily provide a true delightful experience.Therefore, there is a greater need of a" Patient experience creation model" in Indian hospitals. A new framework has to be developed which encompasses all relevant dimensions of the customer experience, suitably modified in healthcare contexts. In this paper an attempt has been made to address issues related to identification of patient experience creating dimensions and the extent of their influence of patient delight and build an experiential model.

In the next section, past research related to experience economy and its relation to health care has been analyzed. Objectives of research have been presented in the third section. Fourth section establishes a rationale for the study. Methodology including data source, sampling frame and empirical model is presented in the fifth section. The sixth section concludes the paper and presents the further research scope.

2. LITERATURE REVIEW

The construct of experiential designing of services appeared in literature for the first time in early 1990s. In the last few years there has been increasing interest from both academia and practitioners in the field of customer experience. Pine II and Gilmore's article "Welcome to the experience economy" is regarded as the forerunner in this area of research. The article was published in 1998 in the Harvard Business Review. The study explored the small

world of experience creation introduced by Pine and Gilmore. An in-depth analysis of the scientific influence of this article was performed, based on the citations article received from 1998 to 2012. The results confirmed the influence of the "customer experience" concept on the healthcare industry. Pine and Gilmore's articles have been used in different number of areas ranging from business to non-business fields such as sports, leisure and hospitality.

Customer experience as a research idea has already been covered by many practitioner-oriented journals or management books (Berry, Carbone and Haeckel 2002; Meyer and Schwager 2007; Shaw and Ivens 2002). However, these publications focused more on the managerial actions and out comes than the theories underlying the antecedents and consequences of customer experience. Historically, the literature in marketing, retailing and service management doesn't exclude customer experience as a separate construct. Researchers have indeed focused on measuring the customer satisfaction and service quality (e.g., Parasuraman, Zeithaml, and Berry 1988; Verhoef, Langerak, and Donkers 2007). However, some work focused on the customer experience has also been put forth. In 1982, Holbrook and Hirschmann theorized that consumption has experiential aspects (see also Babin et al. 1994). Schmitt (1999) presents how companies created experiential marketing by making customers feel, think, act and relate to a company and its brands.

Pine and Gilmore suggested two dimensions to assist thinking about the customer experience. The level of customer participation (from passive to active) is the first dimension. The degree of connection (or depth of the relationship) between the customer and the performance is the second dimension. It ranges from absorption to immersion. The memorability of the "staged" events, as in the Pine and Gilmore's works, is no longer of primary importance: what contributes to the value creation is not so much selling memorable experiences, but enabling customers to live all the moments of the relationship with a company in a way which is even beyond customer's expectations. More recently, a comprehensive contribution has been made in the direction of "Co Creating experience" It passes through experiences that are co-created by consumers and companies (Prahalad and Ramaswamy, 2003). According to Prahlad and Ramaswamy (2004), customers create their own unique experience together with the company. In this perspective, companies do not sell (or stage, according to Pine and Gilmore's perspective) experiences, but rather they provide contexts, that are conducive of experiences and which can be properly employed by consumers to co-create their own unique experiences. Schmitt (1999) stated that right environmental settings need to be provided by the marketer for any desired experience to emerge.

Based on recent understating and modern views, customer experience could be defined as a process which involves various stages of interactions between two these sides, customer and the company. Such experience involves customer's involvement at different levels, such as rational, sensorial, emotional, physical and spiritual (Gentile, Spiller, and Noci 2007). A second and related definition presents this experience as a subjective response by customers to any type of contact, direct or indirect, with the company. Direct contact takes place during the purchase process of product or service. This is generally initiated by the customer. In contrast, indirect contact most often takes place through unplanned encounters with the company representatives (Meyer and Schwager 2007). Pullman and Gross (2004) defined experience design as an approach to create an emotional connection with customers through various planned events. Such events could be tangible and intangible in nature.

On the basis of the literature reviewed, identified metrics, for customer experience and patient experience, are being prepared and presented in the following Table-1 and Table-2. Since these indicators were suggested by multiple researchers, the following tables group authors according to their work in service experience and patient experience respectively.

Table 1: Reviewed literature on customer experience

Theme and the year of publication	Source
Understanding Customer experience (1998)	B. Joseph Pine and James H. Gilmore et al
Consumer perceived value (2001)	Jillian C. Sweeneya et al
Experience Innovation (2003)	C. K. Prahalad, Ramaswamy et al

Managing customer experience (2002)	Leonard L. Berry et al
Measuring customer experience (2010)	Ruchi Garg, ZillurRahman et al
Sustaining customer Experience (2007)	Chiara gentile et al
Customer experience & profitability (2009)	Jamie Lywood et al
Effect of value, quality and satisfaction on behavioral intentions (2000)	J. Joseph cronin et al
Application of experiential marketing strategy on customer behavior (2009)	Kuo-Ming Lin et al
Customer Experience Creation (2009)	Peter C. Verhoef ,A. Parasuramanetal
Brand Experience(2009)	J. Joˇ skoBrakus, et al

Source: Compiled by authors

Table 2: Reviewed literature on patient experience

Theme & Year of publication	Source
Managing customer experience (2002)	NHS model- H. J. Hartwell, et al
Experience Innovation (2003)	EFQM approach-Johannes Moeller,
Physician - patient relationship (2003)	Eric B Larson et al
Measuring experience (2004)	Maxwell Drain et al
Co-Creation in Health Care(2009)	Michael Bartl et al
Customer experience & profitability (2009)	Holly Lorenz et al
Measuring customer experience (2010)	SERVQUAL – Emin Babakus et al
Patient-centered care (2011)	Karen Luxford et al ,
Healthcare Services capes(2011)	Seunghae Lee et al

Source: Compiled by authors

It is evident from the above tables that most of the research works in the area of experience creation focuses on activities of service industries. Customer satisfaction has been extensively presented in literature with a relatively less attention on customer experience and delight. Though, the importance of such experience has been highlighted by individuals who practice, the academic marketing literature investigating this topic has been limited, especially on health care service experience.

3. RATIONALE FOR THE STUDY

While performance measurement metrics are well adopted in patient satisfaction, constructs /models for patient experience creation are still at a nascent stage. Reasons for lesser attention to patient experience creation are not well documented. Further, most of the hospitals and healthcare research consider patient satisfaction as the central point.

Empirical research in the Indian context has to be carried out to come up with a model or framework which if followed will lead to an exceptional and delightful patient experience. Structural Equation Model (SEM) would be used to validate the PEC model proposed in this paper. Working on a "Patient experience creation" model based on the above factors may give valuable insights to hospital managers and administrators. It may also help in optimization of healthcare service delivery thus creating a customer delight or experience.

4. HYPOTHESES

Opportunities to enhance patient experience exist everywhere in hospitals. Hospital focus needs to be on creating the 'value for the patient' rather than the 'volume'. The key is to identify and consider patients as their customers, and to design the patient's end-to-end experience accordingly. Changes are being introduced slowly, particularly in urban areas. Few corporate hospitals have started thinking in terms of creating a delightful experience for their customers. Change is imperative, but with a huge gap between demand and supply for quality health care, implementing patient-centric care and achieving customer delight will be easy. Healthcare in India is still stuck between two ends, a physician/hospital centric model in the best case and profit-centric in worst case in such scenario, delivery models involving participatory medicine and consumer experience need to be given required momentum. Though service practitioners believe that in order to retain customers they must go beyond satisfaction to delight, unfortunately there is no commonly accepted scale to measure customer delight in the area of the health care service sector.

Scales such as Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), Service Quality scale (SERVQUAL), Service performance scale (SERVPERF) and Patient personal experience (PPE- 15) exist but are incomplete in one way or the other. Therefore, this study is an effort to identify the building blocks of patient experience creation and arrange them in order of importance, to design a patient experience creation (PEC) model which can be applied to any hospital and improve/design the Healthcare Experience". This may also help us to move up the ladder of economic offerings (Pine & Gilmore).

Commodity → Product → Service → Experience

Based on literature review and in-depth interview following research hypotheses were formulated:

Hypothesis 1: Customization of Healthcare services leads to creation of healthcare experience
Hypothesis 2: Service quality leads to creation of a healthcare experience
Hypothesis 3: Service Performance leads to creation of a healthcare experience
Hypothesis 4: Service Design leads to creation of a healthcare experience
Hypothesis 5: Personal Satisfaction leads to creation of a healthcare experience
Hypothesis 6: Cost effectiveness leads to creation of a healthcare experience
Hypothesis 7: Innovative services leads to creation of a healthcare experience
Hypothesis 8: Experiential designing of health care service improves the quality of care and acceptance of hospitalization as a primary method of healthcare.

Seven distinct dimensions of a perceived healthcare service creation leading to an optimum healthcare experience were identified and hypotheses were built. Our model assumed that patient experience consists of these seven constructs. The 7 major dimensions (constructs) were Customized Service (co creation), Service Quality, Service performance, Service Design (service scope), Personal Satisfaction, Cost Effectiveness and Innovations in service and their impact on satisfaction, buying behaviour, repeat purchase and future recommendation about the service they availed was also measured.

5. OBJECTIVES

The primary objective of this research is to explore the factors which create a healthcare service experience and assess the extent of its influence on patient's future expectations. The specific objectives of the study are as follows:

a. To assess patient's preferences in health care services
b. To find out the factors which create a desirable patient healthcare experience
c. To know the impact of these factors on future intentions outcomes
d. To assess the above factors in order of their importance so that healthcare service can be designed as an experiential event
e. To develop a model for experiential marketing in healthcare

6. METHODOLOGY

In this section research design and data collection technique has been described. The hypothesized model is also discussed in this section.

6.1 Research Design and data collection

A two stage research design was used. In the first stage, an exploratory study was conducted through in-depth interviews and focus group discussions with members across all stakeholders. It helped in defining the problem and formulation of hypotheses. After working upon the responses and inputs of experts in interviews and focused group discussion, a set of constructs was identified which create patient experience and a model linking them was hypothesized. A structured questionnaire was designed which was pilot tested in Delhi. After testing the content, sequence, difficulty level of the questionnaire, changes were made. An online survey data collection was carried out.Sampling Unit consisted of any individual who has an opinion regarding his/her choice of healthcare service provider and is willing to respond to the online. Thus the sampling technique was convenience samplingfor a mix of online respondents.

6.2 Model for creating patient experiences

The proposed model presented in Figure-1 is derived

from in-depth interviews with experts and study of literature. The model proposed in this paper was validated through Structural Equation Model. The purpose of this model was to assess the role and importance of these constructs increasing patient experience.
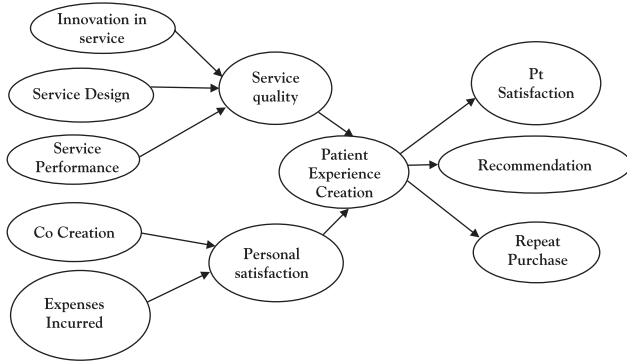

Figure 1: Hypothesized model of patient experience

7. ANALYSIS

7.1 Definition of Constructs

Our model assumed that patient experience comprises of these seven constructs: Customized Service (co creation), Service Quality, Service performance, Service Design (service scope), Personal Satisfaction, Cost Effectiveness and Innovations in service and their impact on satisfaction, buying behaviour, repeat purchase and future recommendation about the service they availed.

Table 3: Definition of Constructs

	Constructs
CC	*Co Creation* :Firms and active customers share, combine and renew each other's resources and capabilities to create value through new forms of interaction, service and learning mechanisms
SQ	*Service Quality*: The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."
SP	*Service performance*: The degree to which health care provider uses resources to get the best value.

SD	*Service Design*: Creating platforms that support value creation processes, helping users and organizations to make sense of how to use the system and build their own value.
PS	*Personal Satisfaction*: is the consistent meeting of patient expectations and has four key elements: delivering the promise of quality healthcare, providing a personal touch, doing a more than adequate job and resolving problems well.
EI	*Expenses Incurred:* Expenditure incurred in getting the healthcare service.
IS	*Innovations in service*: Innovation can be viewed as the application of better solutions for meeting new requirements accomplished through more effective products, processes, services, technologies, or ideas.
PEC	*Patient experience Creation*: Experience happens when quality concepts are put forth through customization and relationship management. It is essentially reducing the gap between customers' expectations and their subsequent service encounter

Indicator / observed variables for these constructs were identified on the basis of exploratory research and past results. Maximum likelihood estimation method of structural equation modeling (SEM) using AMOS 18.0 was used to test the model.

Data were entered into SPSS (Statistical Package for Social Sciences) 18.0 and proposed relationships among identified constructs of patient experience creation have been validated using parameter estimation statistics and goodness-of-fit statistics of Structural Equation Modeling (using IBM SPSS AMOS 18.0). Structural Equation Modeling (SEM) technique is used to make a structural model of the constructs of "Patient Experience". CFA has been carried out to confirm the components Patient Experience and conduct the reliability and validity of the PEC instrument. On the basis of results obtained, a model to link underlying factors of creating a delightful patient experience has been proposed.

7.2 Measurement Model

We propose the model which tests the validity

and reliability of the constructs. Constructs enable us to understand the process going on behind any phenomena, therefore to understand these better and to test the measurement model, constructs were put under few conditions. First, factor loading of one observed variable per construct was fixed to a value of unity. Second, constructs were freely allowed to correlate with each other. Additionally, measured variables had freedom to load on only one construct (unidimensionality) however, correlation among the error terms with each other was not allowed. Minimum 3 indicator variables under each construct were used in the measurement model and covariance between each construct was drawn. The measurement model is described in Figure 2 below.

The CMIN/DF value of 1.849 reported by our measurement model indicates that the model fits the sample data fairly well. The RMR value of our model has been found to be .053, which is just slightly above 0.05. GFI value of 0.925 and CFI value of 0.959 obtained for our model indicate good fit. RMSEA value of less than 0.05 indicate good fit and value as high as 0.08 represent reasonable error of approximation in the population (Browne and Cudeck, 1993). Closeness of fit (PCLOSE) tests the hypothesis that RMSEA is "good" in the population (specifically, that it is < 0.05). Jöreskog and Sörbom (1996) have suggested that the p-value for this test should be > 0.50. RMSEA value equals
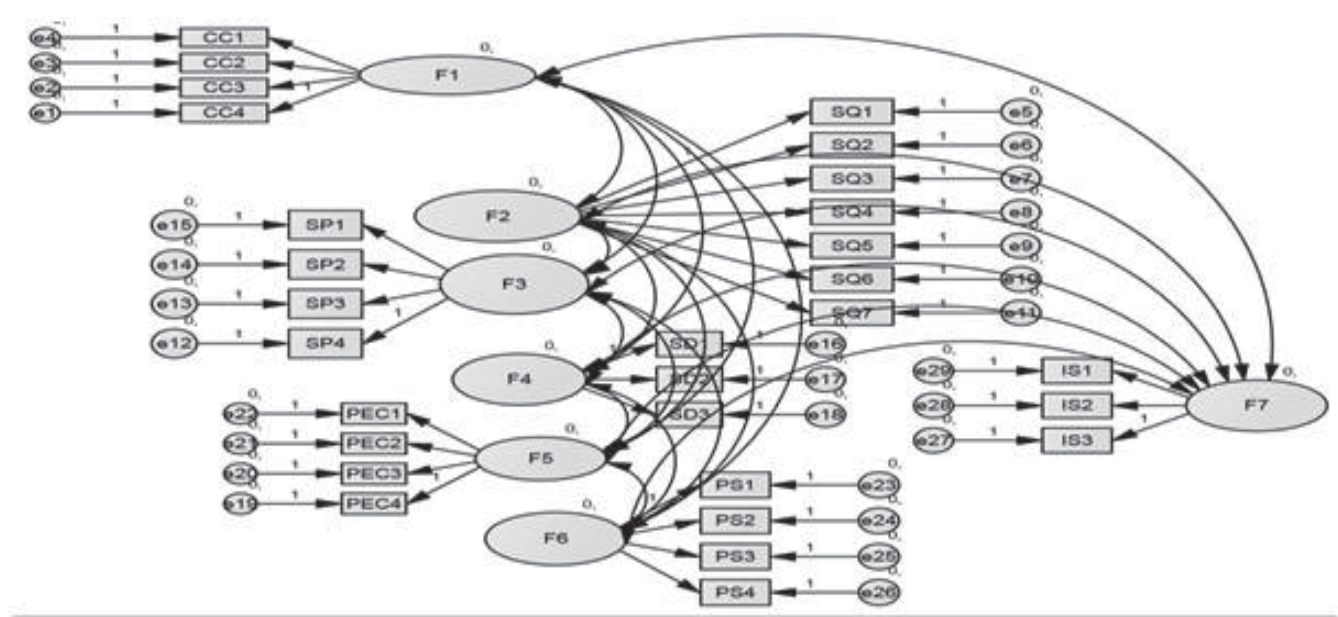
Figure2: Measurement model

F1= CC (Co creation); F2=SQ (Service Quality); F3= SP (Service Performance); F4= SD (Service Design); F5=PEC (Patient Experience Creation); F6= PS (Personal Satisfaction) and F7 = IS (Innovation in services).The relevant model statistics are shown in Table 4

Table 4: Goodness-of-fit statistics for patient experience- CFA model

0. 073 with PCLOSE value of 0.59 (> 0.5) for our model indicate the good fit.

7.3 Structural Model

Responses received from the questionnaire survey were used to test the hypothesized model. Results of the model such as standard errors,

Model	CMIN/DF	RMR	GFI	CFI	RMSEA	PCLOSE
Default model	1.849	.053	.925	.959	.073	.59
Recommended	3:1	<.05	>.901	>0.90	<.07	>0.50
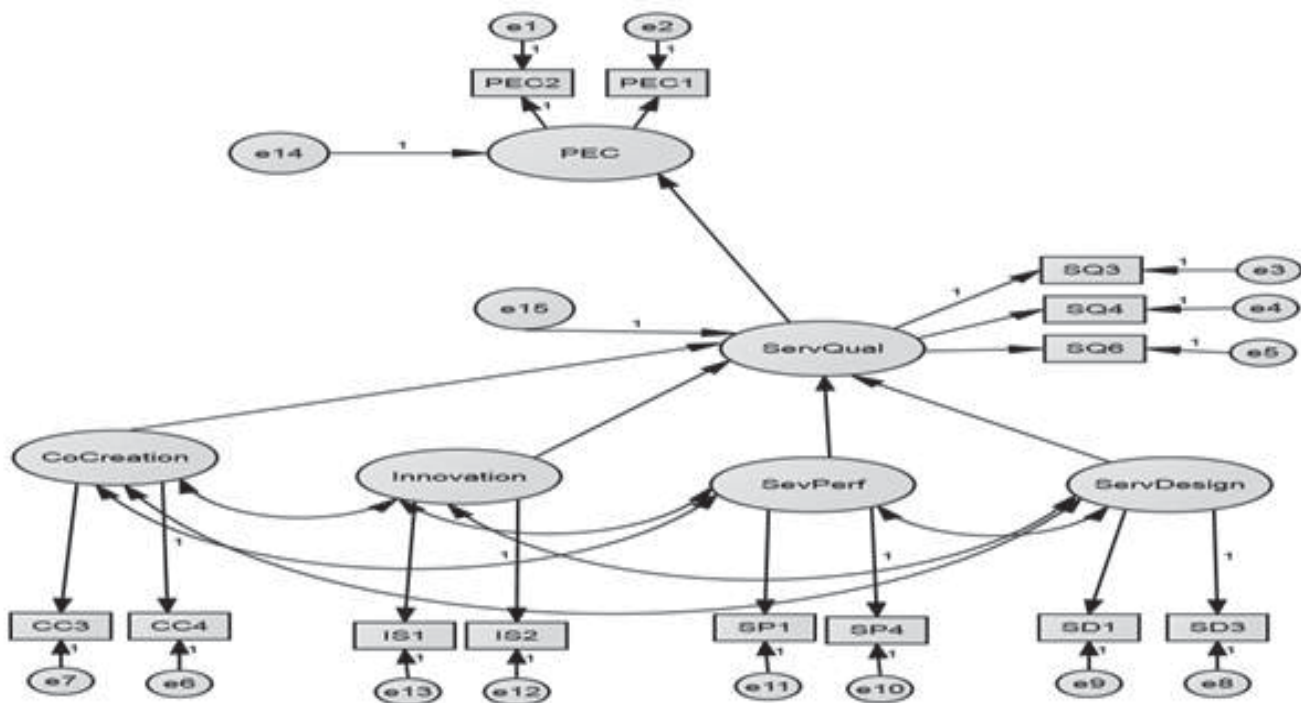
Figure 3: Structural Model

critical ratios, and regression weights have been estimated and have been presented in figure 3.

The values of Standard errors are in good order since they are in the range 0.101 to 0.327. Critical ratio values are significant at 0.001 levels. Next, using Goodness-of- fit statistics, we aim to find the extent to which our hypothesized model adequately describes the sample data. Results for the same are as follows:

7.4 Reliability and validity

Reliability of the model is measured through composite reliability. The scale exceeded the recommended cut off value 0.7. Therefore, the scales have been concluded to be reliable. In terms of Average variance extracted (AVE), all values are greater than 0.50 which empirically supports the convergent validity

Table 5: Goodness-of- fit of statistical model

Model	CMIN/DF	RMR	GFI	CFI	RMSEA	PCLOSE
Default model	2.792	.031	0.931	.903	0.106	0.774
Recommended	3:1	<.05	>.901	>0.90	<.07	>0.50

CMIN/DF for the structural model is 2.792, which is between 2-5, indicates a satisfactory fit. RMR for the model is. 031, which is less than .05 again indicate a good fit. CFI equals 0.903 and GFI equals 0.931 both are greater than 0.9, represent that sample data fit the model well. RMSE A value for the model is 0.106 which is slight higher than 0.07PCLOSE of 0.774 (>0.50) represents the excellent model fit. These results affirm the data fit.

of the scales. AVE values are greater than the corresponding SIC values (Squared Inter-construct Correlation estimates). Therefore, it can be concluded that the indicators share more attributes with the construct they are associated with than they do with other constructs. Therefore, CFA model shows discriminant validity. Furthermore, all correlations were significant and positive, ensuring the nomological validity of scale.

7.5   Hypothesis testing

Various parameters have been estimated for the model. This allows us to test different hypothesis. Results for the same have been presented in the following table:

Table 6: Parameter estimates for the model

			Regression weights (Standardized)	Estimate	S.E.	C.R.	P
SevQual	<---	SevPerf	.901	.877	.327	2.681	.007
SevQual	<---	ServDesign	.102	-.098	.221	-.444	.657
SevQual	<---	CoCreation	.185	-.148	.200	-.737	.461
SevQual	<---	Innovation	.437	.376	.160	2.353	.019
PtExperienCo-Creation	<---	SevQual	.762	.443	.101	4.364	***

S.E. stands for Standard Error; C.R. stands for Critical Ratio.

- H1 stated that Customization/co creation of Healthcare services leads to the creation of a healthcare experience. With std_β value as 0.185 and P ≤ 0.001, the effect of Customization has been found to be statistically significant which supports this hypothesis. Therefore H1 is accepted.

- H2 stated that Service quality leads to the creation of a healthcare experience. With std_β value as 0.762 and P ≤ 0.001, the effect of coordination level has been found to be statistically significant which supports this hypothesis. Therefore H2is accepted.

- H3 stated that Service Performance leads to the creation of a healthcare experience. With std_β value as 0.901and P ≤ 0.001, the effect of Service performance has been found to be statistically significant which supports this hypothesis. Therefore H3is accepted.

- H4 stated that Service Design leads to the creation of a healthcare experience. With std_β value as 0.102 and P ≤ 0.001, the effect of Service design has been found to be statistically significant which supports this hypothesis. Therefore H4is accepted.

- H5and H6stated that Personal Satisfaction and Cost effectiveness leads to the creation of a healthcare experience. These effects were not found statistically significant in the measurement model, thus H5 and H6 were rejected.

- H7 stated that Innovative services lead to the creation of a healthcare experience. With std_β value as 0.437 and P ≤ 0.001, the effect of Service design has been found to be statistically significant which supports this hypothesis. Therefore H7is accepted.

8. CONCLUSION

"Experience Creation" is not a new phenomenon. Researchers have shown that this aspect of service encounter is extremely important and should be one of the prime areas of concern for administrators and service providers while designing a service. The proposed model validated the hypothetical model formulated on the basis of existing theory. The model established an empirical relationship between Patient experience creation and various indicator variables such as Service Quality, Innovations, Cost effectiveness patient centeredness etc. These predictive models may help hospitals understand how to deliver a better patient experience through customer experience management practices. The findings will assist hospitals who might be focusing on the wrong areas to improve patient loyalty or are failing to design an apt patient experience.

The study explored factors which create a healthcare service experience and assess the extent of its influence on future patient intentions and design a conceptual model of "Patient Experience Creation". Results, obtained from structural equation modelling approach support all causal relationships to be statistically significant except the one relationship between

perceived experiential value and guest loyalty. This study provides a good insight of the patient's repurchase decision-making intention. In general, the level satisfaction (characterized by Service Quality, Co Creation, Service Design etc.) among the sample of online respondents was found to be low. Majority of the respondents in the study had a wide range of expectations for their future Healthcare Service encounter when asked how it can be converted to a desirable experience.

9. IMPLICATIONS FOR THE FUTURE RESEARCH

The patients, in the present study, however had not had an optimum healthcare experience suggesting the need for organizational interventions for service reforms to initiate the process of a "delightful patient experience". It is further suggested that, future studies need to have both inclusion and exclusion criteria in terms of age, years of experience and mental and emotional health profile of the sample. It is important to mention here that the future researchers would need to be careful in selecting the sample with respect to age, i.e., respondents in higher age bracket or higher income range may be having more expectations from their healthcare services and in the circumstances of not getting what they had expected may create an undesired experience. In order to further generalize the findings and results of the present study, it would have been more desirable to have a larger sample with age wise and income wise distribution. The future studies need to have both inclusion and exclusion criteria in terms of age, Income Profile, type of healthcare service provider and mental and emotional health profile of the sample. The PEC instrument designed during this study needs to be refined with the factors of less importance excluded so that the complexity of this instrument can be reduced and the variables can be measured in a better way. A scoring system for each indicator variable could be another area for future research.

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Establishing an Efficient team by Improvising Employees

Selection Process applying Integrated AHP and LP for a Soft Drink Manufacturing Company

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Abstract

To improve efficiency, insure the production of quality products and enhance product development a company must invest in resources. Human resource is of vital importance, especially in the selection and hiring of potential candidates to fill various vacant posts. The major challenge is in the selection of suitable candidates who will provide the company with optimal value for their human resource allocation investments. We seek to illustrate the application of Analytic Hierarchy Process (AHP) and linear programming (LP) in the selection and hiring of candidates to fill vacant posts in carbonated soft drinks manufacturing company located in Dar Es Salaam, Tanzania. AHP is a prominent multi-criteria decision making tool that assists decision makers in the selection and hiring process by disintegrating the candidate selection goal into a hierarchical structure with levels of criteria, sub-criteria and alternatives, and further constructing pair-wise comparison matrices for elements in each hierarchical level. The Additive Normalization (AN) method is employed in the development of priority weights and Linear Programming (LP) is used to ensure optimal solutions for the human resource allocation problem seeking to maximize returns of the company's investment.

1. INTRODUCTION

The science of decision making has evolved over time. For ages it was believed that decision making was a very complex process, and was thus limited in its application and use. It was considered an artistic task due to the absence of proper guidelines and procedures to assist the decision maker. As a result, decision was as good as the process used to obtain it and not its ability to take into consideration the stakeholders' views and interests.

Today, decision making is considered a more systematic task. In a world with increasing complexities, making an appropriate decision is not only complex but also of paramount importance. Although technological discoveries and recent development have helped human beings to reduce uncertainty, randomness, manual effort and time, complexities too have increased at the same time.

The presence of multiple criteria in a decision problem further heightens the level of complexities together with the incorporation of multi-actors and stake holders with conflicting interests and opinions. A good decision must cater to all the objectives, interests and opinions of all its stakeholders and must also have the ability to predict both controlled and uncontrolled criteria and outcomes for a sustainable period of time. Every decision maker avoids making unstructured, ad-hoc decisions based on incomplete information, risks, and non optimal consequences of decisions. Therefore a systematic mathematical tool for problem solving is required. This is because mathematical tools aside from being simple to utilize, provide decision makers with the reliability needed to support or reject their decisions.

2. A COMPANY CASE ILLUSTRATION OF CORPORATE MULTI-CRITERIA DILEMMA.

In this paper we seek to demonstrate a particular case of the application of such a mathematical tool which will assist decision makers in multi-criteria decision making. The application of this mathematical tool will enhance the decision choice's reliability and eradicate potential controversies.

This is a case of a family owned business company that was established in 1970s. Having its main locations in Dar as Salaam, Tanzania the business company deals with the manufacture of carbonated soft drinks among other things and is one of the largest business organizations in the Sub-Saharan part of Africa. Owners of this multi-national establishment boast of about 3 million dollars annual revenue and cannot therefore afford to make wrong decision choices. Within the corporate world, decision making is a process of enormous risk and challenge The Company's day to day activities requires a strategic decision making technique since the stakes are high and have long term consequences. To avoid making bad decisions, top managers must access the weights, ranks and priorities of every activity in relations to the respective outcome.

As the case with many related companies in Africa, decision makers aim to provide their companies with sustainable growth, acquisition of competitive advantage and to ensure longevity of their business practices. They adopt and apply various strategic business practices, methods, models and tools to enhance decision making in problems related to human resource, quality assurance and market and profit expansion.

Of the many human resource related decision making problems, hiring and selection of candidates to fill various vacant posts at production plants is a sensitive one. Decision makers at the company understand the advantage of employing qualified, goal oriented, efficient and effective personnel. More so, they take extra precaution because selecting and hiring of employees is a risky and challenging task. They must ensure the integration the business objectives with the right personnel who possess the required skills and ability to achieve the goals and objectives of the company. Having a budget and position constrictions, they have to select a viable candidate while taking into consideration the company's laid out mission and vision. They must ensure ultimately the employment of qualified candidates who possess qualifications that can be incorporated with the values, culture and goals of the company in one hand and at the same time assist and contribute to the growth and profit attainment of the company in the other.

For these reasons, a reliable tool that is able to measure both tangible and intangible criteria is

required. The key task is to find the right scale that can measure all criteria, minimize error and biasness, a tool to assist in the selection of the right kind of personnel to handle the right kind of job-related tasks within the organization and achieve value for their investment simultaneously. AHP (Saaty, Peniwati & Shang, 2007) proves to being one of the best tools to ensure the attainment of their goals for the selection of employees and linear programming (LP) for optimization. Rouyendega & Erkan (2012) has discussed the selection of academic staff using fuzzy analytic hierarchy process. AHP (Dolores & Jose, 2014) has been applied in decomposing the value creation when assessing investments. In the model they consider four criteria as financial capital, human capital, structural capital and relational capital. The development of analytic hierarchy process can be found out in (Ishizaka & Ashraf, 2011) and (Vaidya & kumar, 2006). Our purpose here is to illustrate AHP, and to formulate an LP model which is then solved using EXCEL's solver.

3. AHP AND LP APPROACH

3.1 AHP

Thomas L. Saaty, one of the creators of Operations Research, observed communication difficulties and the absence of a systematic practical tool in setting of key priorities in judgment formulation. He bore witness to the difficulty experienced by decision makers; a perfect motivation for the development of a well structured, systematic approach for the organization and analysis of complex, multi-criteria, multi-person decision making problems to handle complex decisions.

(Saaty, 2003) recognized the value of structuring a complex problem into a hierarchy of unvarying, similar cluster of factors, a common method that has long been used by human beings to handle complexities for generations. He developed a mathematical model that fragments complex decision making problems into a hierarchy. The Analytic Hierarchy Process (AHP) has gained massive popularity over the past three decades emerging as one of the best approaches to solving multi-criteria decision making problems. It is a very popular method of multi-criteria decision making and has been successfully applied in banks (Tien-Chin & Ying-Ling, 2009), government organizations (Vaidya & Kumar, 2006). It is used also in organization performance strategy adoption (Cheng & Heng, 2001), project selection, and ranking (Sinuany-Stern, Mehres & Hadad, 2006).

AHP uses a fundamental scale (Table 1) in the measurement of both tangible and intangible criteria (Saaty, 2003) in terms of their relative importance by taking characteristics that are similar, comparing them and obtaining their ultimate proportions and weights. As a result, the decision maker is able to calculate the total weight of the criteria for candidate selection according to the order of increasing priority to obtain the relative importance.

Table 1: Saaty's fundamental Scale of Relative Comparison

Intensity of Importance	Definition	Explanation
1	Equally Important	Two activities contribute equally to the objective
3	Moderate Importance	Experience and judgments slightly favor one activity over another.
5	Strong Importance	Experiences and judgment strongly favor one activity over another.
7	Very Strong	An activity is favored very strongly over another.
9	Extreme Importance	The evidence favoring one activity over another is of the highest possible order affirmation.
2,4,6,8	For compromise between the above values	Sometimes one needs to interpolate a compromise judgment numerically because there are no good words to describe a unit.

The application of AHP involves the following procedural steps namely

- Decomposition of the goal,
- Pair wise comparison matrix,
- Priority weights determination and consistency check and
- Global weight synthesis.

After clearly identifying and defining the multi criteria decision making problem, a decision maker is required to disintegrate the problem into a hierarchical model that frames the factors to be considered towards solving the problem. The structure of this hierarchy is composed of different levels; the goal, criteria, sub-criteria (if any) and finally the alternatives.

The hierarchy presents a clear detailed elaboration of the goal with different criteria to be employed and options available for the realization of the said goal. It breaks the desired goal down into a structure consisting of aggregates of criteria into alternatives. It arranges judgments and feelings in a very controlled and very specific manner. At each level of alternative and criteria the decision maker is required to avoid under specification (omission of relevant criteria) and over specification (inclusion of irrelevant criteria) of the judgments or perceptions and feelings necessary for decision making. This helps to minimize error. The criteria and alternative have to be precise and relevant. Figure 1 demonstrates the disintegration of the goal relevant with our case herein.
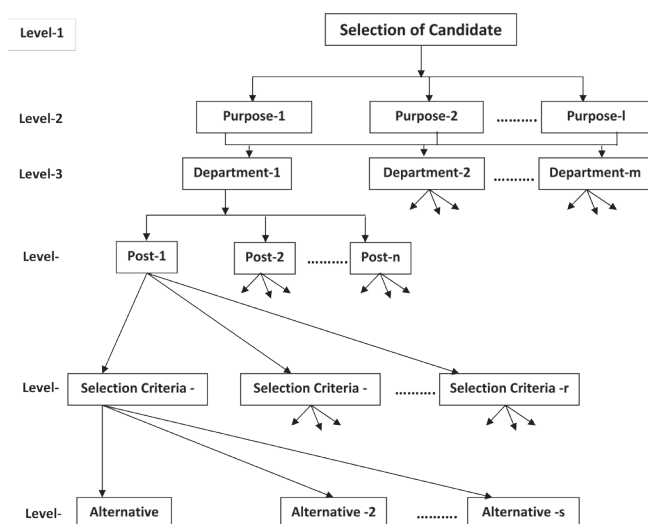

Figure 1: Selection hierarchy for Carbonated Soft drink Manufacturing Company, Dar ES Salam

At the core of AHP lie two fundamental processes; the creation of a pair-wise matrix and the development of priority vectors. At every level of hierarchy, a pair-wise matrix comparison is done to give the relative importance of each alternative or criterion over the other. The number of pair-wise comparison under each level of the hierarchy is   where 'n' is the number of criteria or alternatives under each cluster or level.

Many scholars have developed and introduced new methods of priority development while others have proposed modified versions of earlier established methods.. The most commonly applied methods are additive normalization (AN), eigenvector method (EM), logarithmic goal programming (LGP), logarithmic least-square (LLS) and linear programming (LP) to mention a few (Srdjevic, 2005). The EM was introduced by Saaty in the late 1970s and (Cogger & Yu, 1985) provided an interesting adjustment to it. The LP employs a two staged approach for the development of priority vector. In the first stage, a linear program model that consists of a consistency bound for a specific formulated comparison matrix is constructed. It further continues to utilize this consistency bound that has a priority vector as its solution. (Chandran, Golden & Wasil, 2005). The variables of the linear program are then defined and error in the judgments of the pairwise matrix is estimated. The basic decision involved at this stage is the minimization of errors. The natural logarithm is used to define and construct constraints accordingly (Chandran et al. 2005, p 2235). Finally a near consistent matrix is obtained. The LLS method optimizes the values of the priority vector by minimizing the logarithmic objective function subject to a series of given constraints. (Crawford & William, 1985).

3.2 Additive Normalization

The additive normalization uses a nXn pairwise comparison matrix in the following way.

Let A=(a_{ij})f oralli, j=1,2,….,n denote a pairwise square comparison matrix, where   (a_{ij}>0) give the importance of element over the element i and each entry in matrix A is reciprocal (a_{ij}=1/a_{ji}) foralli, j=1,2,…,n.

The decision maker wants to compute a vector $w=(w_1, w_2, \ldots, w_n)$ associated with A. If the matrix A is consistent, that is $a_{ij}=a_{ik}*a_{kj}$ *foralli, j,k=1,2,…,n*, then A contains no error and denoted as

$$A=\begin{pmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} \\ \vdots & \vdots & \cdots & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} \end{pmatrix}$$

In AN, the priority vector is obtained by the process as demonstrated below:

$$a'_{ij} = a_{ij} / \sum_{i=1}^{n} a_{ij} \quad i,j = 1,2,\ldots n \qquad (1)$$

$$w_i = \left(\frac{1}{n}\right) \sum_{j=1}^{n} a'_{ij}, \quad i = 1,2,\ldots, n \qquad (2)$$

The next procedural step is the consistency check. Practically, it is rare to find the criteria having the same unit of measure. AHP is designed to include inconsistency in weighing the relative preferences of choices or alternatives. The reason is some decision problems are of qualitative in nature making it difficult to assign specific weights of preferences between their comparisons and that decision makers are not always capable of logically consistent. While eliciting weights a decision maker is likely to form a reduplication of comparisons due to poor judgments or uncertainty. These reduplications are what cause numerical error. AHP tolerates an inconsistency ratio of less than 10% taking into account the different units of criteria and goals to be compared. To check the inconsistency the consistency index (CI), Consistency Ratio (CR) and largest eigen value are calculated as:

$$\lambda_{max} = \sum_{i=1}^{n}\sum_{j=1}^{n} a_{ij}w_j \qquad (3)$$

$CI = (\lambda_{max} - n)/(n-1)$, $\quad CR = \frac{CI}{RI}$ being the random consistency index is used.

We tolerate the decision as long as. If CR greater than 0.1, the decision maker is to re-evaluate his decision. Having established and obtained all the priority weights, the final process is the global weights synthesis. A global combination of weight is calculated in relations to the goal as per the hierarchical composition. It may be noted that the sum of all global weights in an AHP structure is equal to 1 after the synthesis of all local weights provided under each level of the decision hierarchy.

3.3. Linear Programming

A Linear programming problem is defined as maximization or minimization of a linear objective function subject to a set of linear constraints. The objective is to find a vector

$x=(x_1, x_2,\ldots,x_n)$ such that it maximizes

Maximize$c^T x$

> Subject to
>
> $Ax = b$
>
> $x \geq 0$

The objective function coefficients are the priorities of the individual candidates. The decision variables are binary subject to salary constraints, lower and upper bounds, non-negativity constraints.

4. HUMAN RESOURCE REQUIREMENT PROBLEM

4.1 Recruiting of Human Resources

The following is the illustration of the case discussed in section 2. This is a problem of hierarchical disintegration of the hiring and selecting of suitable candidates, development of the pair-wise comparison matrix, priority weights development and the global weights development. Consider the fact that the company is looking to employ a Technical Manager, a Driver and one to three Assistant to fill the vacancy at one of their plants located in the district of Dar as Salaam.

The company has many departments including Human Resource, Production, the General Management, Finance and Sales. For the illustration, we will only focus on the General Management department. The department is headed by a general manager who is assisted by the Deputy General Manager. The General Manager has two subordinates reporting directly to him, the operations manager and the technical manager. Each general management department posts are entitled to a company maintained car, a personal driver and at least one assistant among

other job-related entitlements. The company is not considering spending more than 10 million TSH for all the posts as monthly salary. The details and qualifications of the posts and the salary package are given in Table 2.

Table 2: Details of the posts

S/N	Post	Department	Number of Positions	Criteria of selection	Take-Home monthly salary TSH(000,000)*
1	Tech. Manager	General Management	1	Experience; Education; Comm. Skills (CS); Tech. Skills (TS)	6
2	Driver	General Management	1	Experience; Education; Mechanical Skills (MS);	0.8
3	Assistant	General Management	(1-3)	Experience; Education; Office Management. Skills (OMS); Communication Skills (CS)	1.2

TSH= Tanzanian Shillings, 1USD= 1,700 TSH. The problem is disintegrated into a hierarchy with the following levels. The first level (goal) is the selection of candidates. The second level is the requirement purpose. The company is to hire a technical manager to ensure quality of the products, to increase efficiency, to enhance capacity and to facilitate a room for product development. The department level is the third where in this case, the only department with vacancy is the general management. The fourth level is where the organization to fill the post technical manager, driver and assistants.

The hierarchy is further decomposed into a level of criteria for each of the post under the general management department. Under each criterion of every post, a further decomposition is done such that every selection criterion is assigned different values of intensity. The final level is that of the candidates who have applied for each post, these are the alternatives. Due to space constrictions here, we have reduced the hierarchy to include only the first five levels (see Fig 2). In each hierarchical level a pair wise matrix comparison is made using the fundamental scale (Table 1). For example, comparison matrix

for the requirement purpose (Level 2) is developed in (Table 3) with the help of partial questionnaire given in Appendix 1.
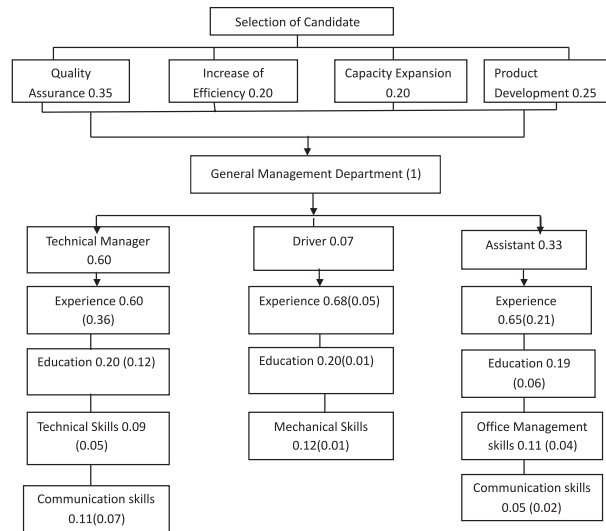
Table 3: Pairwise Comparison Matrix -Level 2 Requirement Purpose

$$
\begin{array}{c}
\begin{array}{cccc} QA & IE & CE & PD \end{array}\\
\begin{array}{l}
\textit{Quality Assurance }(QA)\\
\text{Increase of Efficiency (IE)}\\
\text{Capacity Expansion (CE)}\\
\text{Product Development (PD}
\end{array}
\begin{pmatrix}
1 & 2 & 2 & 1\\
1/2 & 1 & 1 & 1\\
1/2 & 1 & 1 & 1\\
1 & 1 & 1 & 1
\end{pmatrix}
\end{array}
$$

After additive normalization process the priority weights are obtained accordingly (See Table 4-6). These weights are mentioned in Fig-2. Since we have only one department (general management), its priority weight is given as 1.(see Fig 2)

Each post has its specific selection criteria. The technical manager's post has 4 criteria of selection namely; experience, education, technical skills and communication skills. To obtain the weight of each of the criterion a pair-wise matrix comparison is developed and the additive normalization method is further applied (see Table 6). The weights of the criteria are added together and the ratio of the weight corresponding to the weight of the technical position (0.6) is synthesized accordingly. We then obtain (0.36, 0.12, 0.05 and 0.07) (see Table 3).

The entire process is repeated for the remaining two posts. Pair wise comparison matrices for the driver and personal assistant are composed accordingly, given the selection criteria including experience, education level, and technical skills for the driver post and experience, education level, office management skills and communication skills for assistant posts respectively (See Table 7 & 8).

4.2 Intensities and composite scores

To implement absolute measurement mode in AHP, each selection criterion for every post is further sub-divided into different levels of intensity. These intensities should be located at level 6 of Table 3 and the list is found in Table 9. For example, for evaluation of Technical Manager have the following intensities: (i) experience is divided in to three intensities of high (corresponds to 3+ years of experience), medium (1-3 years), and low (less than one year); (ii) education is divided in to master, degree and diploma; (iii) technical skills in to excellent, fair and poor; (iv) communication skills in to high, medium and low. The priorities of the intensities are derived from pair wise comparisons and idealized by dividing each by the largest so that the largest becomes 1 and rest follows proportionally.

After conducting a series of interview on job performance skills, personality traits, communication skills, each candidate was evaluated by a group of experts (minimum 3)according to the posts they applied for and the selection criteria under each post. The comparison matrix is developed after taking the geometric men of the judgments and weights shown in Table 10. The candidate's synthesized score for each level with its corresponding priority weights is shown in Table 11.

Table 4: Additive Normalization- Level 2

Requirement Purpose	QA	IE	CE	PD	Weights
Quality Assurance (QA)	0.333333	0.4	0.4	0.25	0.3458333
Increase of Efficiency(IE)	0.166667	0.2	0.2	0.25	0.2041667
Capacity Expansion (CE)	0.166667	0.2	0.2	0.25	0.2041667
Product Development(PD)	0.333333	0.2	0.2	0.25	0.2458333
				CI=	0.0208333
				CR=	0.0210438

Table 5: Additive Normalization- Level 4

Posts	TM	DRV	Asst	Weights
Technical Manager (TM)	0.615385	0.571429	0.625	0.603938
Driver (DRV)	0.076923	0.071429	0.0625	0.070284
Assistants (Asst)	0.307692	0.357143	0.3125	0.325778
			CI	0.003932
			CR	0.005958

Table 6: Additive Normalization for criteria of- Technical Manager (Level-5)

	Experience.	Education	TS	CS	Weights
Experience	0.627802691	0.68571429	0.5	0.608695652	0.605553157
Education	0.156950673	0.17142857	0.2	0.260869565	0.197312202
Tech. Skills	0.125560538	0.08571429	0.1	0.043478261	0.088688271
Comm. skill	0.089686099	0.05714286	0.2	0.086956522	0.108446369
				CI	0.0326
				CR	0.0049

Table 7: Additive Normalization for criteria of Driver post (Level 5)

	Experience	Education	MS	Weights
Experience	0.689655172	0.727273	0.625	0.680643
Education	0.172413793	0.181818	0.25	0.201411
Mech. kills	0.137931034	0.090909	0.125	0.117947
			CI	0.044
			CR	0.066

Table 8: Additive Normalization for criteria- Assistants (Level 5)

	Experience	Education	Offc.M. skills	Comm. skills	Weights
Experience	0.6728972	0.6956522	0.705882353	0.529411765	0.650961
Education	0.1682243	0.173913	0.176470588	0.235294118	0.188476
Off.M. skills	0.08411215	0.0869565	0.088235294	0.176470588	0.108944
Comm.skills	0.07476636	0.0434783	0.029411765	0.058823529	0.05162
			CI		0.054
			CR		0.055

Table 9: Ideal priorities of the intensities for each post. (Level 6)

Post	Sel. Criteria	Level of intensities and Idealized priorities		
Tech. Mangr	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1yr) (0.27)
	Education	MSc(1)	Degree (0.44)	Diploma(0.11)
	Technical skills	Excellent(1)	Fair(0.32)	Poor(0.10)
	Communication skillls	High(1)	Medium (0.64)	low (0.20)
Driver	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1) (0.27)
	Education	Diploma(1)	Certificate(0.44)	Secondary Level(0.11)
	Mechanical Skills	High(1)	Medium (0.22)	low (0.10)
Assistant	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1) (0.27)
	Education	Degree(0.11)	Diploma(1)	Certificate(0.44)
	Office Mgmt. skills	Best(1)	Good(0.30)	Poor(0.18)
	communication skills	High(1)	Medium (0.64)	low (0.20)

Table 10: A list of candidates, their application posts and awarded scores after interviews.

Candidate	post	Technical Manager			
	Sel. Cri.	Experience	Education	Technical Skills	Communication Skillls
	weight	0.36	0.12	0.05	0.07
1		High	Masters	Fair	High
2		High	Degree	Excellent	Medium
3		Medium	Degree	Excellent	Medium
4		High	Diploma	Excellent	Low
	Post	Driver			
	Sel. Cri.	Experience	Education	Mechanical Skills	
	weight	0.05	0.01	0.01	
5		High	Secondary Level	Medium	
6		Medium	Diploma	Low	
7		Low	Certificate	High	
8		Medium	Certificate	High	
	Post	Assistant			
	Sel. Cri.	Experience	Education	Office Mgmt. Skills	Communication Skills
	weight	0.21	0.06	0.04	0.04
9		High	Certificate	Best	Low
10		Low	Degree	Poor	High
11		Medium	Certificate	Good	Medium
12		Low	Diploma	Poor	Low
13		Medium	Degree	Best	Medium

Table 11: Score synthesis - Candidate's qualifications with selection criteria for each post.

	Technical Manager Post				
	Experience	Education	Technical skills	Communi. skills	Score
	0.36	0.12	0.05	0.07	
1	1	1	0.32	1	0.566
2	1	0.44	1	0.64	0.5076
3	0.64	0.44	1	0.64	0.378
4	1	0.11	1	0.2	0.4372
	Driver				
	Experience	Education	Mechanical Skills		Score
	0.05	0.01	0.01		
5	1	0.11	0.22		0.0533
6	0.64	1	0.1		0.043
7	0.27	0.44	1		0.0279
8	0.64	0.44	1		0.0464
	Assistant				
	Experience	Education	Office Mgmt. skills	communication skills	Score
	0.21	0.06	0.04	0.04	

9	1	0.44	1	0.2	0.2844
10	0.27	0.11	0.18	1	0.1105
11	0.64	0.44	0.3	0.64	0.1984
12	0.27	1	0.18	0.2	0.1319
13	0.64	0.11	1	0.64	0.2066

Table 12: Optimal solution for the selection of the candidate problem

Candidate		Number	Post	Monthly Salary (000,000)*Tsh	Total Salary
1		1 Post	Technical Manager	6	6,000,000
9		1 Post	Assistant	1.2	1,200,000
11		1 Post	Assistant	1.2	1,200,000
13		1 Post	Assistant	1.2	1,200,000
Total		4 posts			9,600,000

4.3 Optimizing Manpower Allocation

We present a linear programming model to allocate best human resources.

The objective function coefficients are the priorities of the individual applicants given in Table 11. The decision variables are binary, subject to salary constraints, lower and upper bound constraints and non negativity constraints.

For better demonstration, we begin by redefining the candidates (Candidate 1, 2, . . . 13) to be represented as and the salary entitled for each post (6, 0.8 and 1.2 Tsh for the technical manager, driver and assistant respectively).

The model identifies the candidates that can provide the company with optimal solution of their organization purposes given their applied posts.

$Max 0.566x_1 + 0.5072x_2 + 0.378x_3 + 0.4372x_4 + 0.0533x_5 + 0.0439x_6 + 0.0279x_7 + 0.0464x_8 + 0.2844x_9 + 0.1105x_{10} + 0.1984x_{11} + 0.1319x_{12} + 0.2066x_{13}$

Subject to salary constraint under each post

$6x_1 + 6x_2 + 6x_3 + 6x4 + 0.8x_5 + 0.8x_6 + 0.8x_7 + 0.8x_8 + 1.2x_9 + 1.2x_{10} + 1.2x_{-11} + 1.2x_{-12} + 1.2x_{-13} \leq 10$

The constraint relating to the number of vacancy to be filled in each position:

$x_1 + x_2 + x_3 + x_4 = 1$ (*TechnicalManager*)

$0 \leq x_5 + x_6 + x_7 + x_8 \leq 1$ (*Driver*)

$1 \leq x_9 + x_{10} + x_{11} + x_{12} + x_{13} \leq 3$ (*Assistant*)

x_j for j=1.2….,13 *are binary*

The problem is to find the number of posts to be filled, best candidate to be hired under each post so as maximize the organization purpose of the company and the total budget the decision makers must spend.

The above model was solved using EXCEL solver. The employees that are to be hired to maximize the goal of the carbonated soft drink manufactured company are as follows (Table 12):

x_1 *Technical Manager*

x_9 *Assistant*

x_{11} *Assistant*

x_{13} *Assistant*

5. CONCLUSION

Linear programming is a useful optimization technique for solving allocation problem when tangible measures are considered. Many real world problems like employee selection cannot be readily solved by linear programming because they often contain intangible variables that cannot be quantified. AHP can measure intangible. Combining AHP and LP makes it possible to deal with all optimization problems whether the problems are tangible or intangible.

The selection of new candidates to fill vacant posts in any company is of paramount importance. Decision makers must ensure the selection of qualified candidates who will provide their companies with maximal returns of the human resource investment. In Section 3, the AHP is employed to decompose the company's candidate selection problem into different levels of tangible and intangible factors. Using the additive normalization process, we demonstrated the development of priority weights for the tangible and intangible factors at every level in the hierarchy. In Section 4, we showed through examples, the application of AHP-derived priority weights in the formulation of a linear programming model whose objective function is the optimization of the company's human resource investment. Using EXCEL's Solver the selection of the candidates that can provide the most contribution to the company's laid out mission and vision is illustrated.

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Partial Questionnaire

Example: For which do you give more Importance?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

	Increasing Importance	Increasing Importance
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Increase of Efficiency
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Explanation :

i) If you choose 1, when comparing Quality Assurance and Increase of Efficiency that means you give equal importance to both the criteria.

ii) If you choose 9 towards right side, when comparing Right Side Criteria with Left one that means you give 9 times more importance to the Right Side Criteria (Capacity Expansion) over the Left side criteria (Quality Assurance).

iii) If you choose 6 towards left side, when comparing Left Side Criteria with Right one, that means you give 6 times more importance to the Left Side Criteria (Quality Assurance) over the Right Side Criteria (Product Development).

Name:………..

Designation:……………………………………………………………………………………………………….

Question 1: What is the relative Importance of '**Quality Assurance**' with respect to others?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

	Increasing Importance	Increasing Importance
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Increase of Efficiency
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Question 2: What is the relative Importance of '**Increase of Efficiency**' with respect to others?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

	Increasing Importance	Increasing Importance
Increase of Efficiency	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Increase of Efficiency	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Question 3:   What is the relative Importance of '**Capacity Expansion**' with respect to other?
Please compare the decision criteria and circle your Answer using the scale below:
1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

	Increasing Importance	Increasing Importance	
Capacity Expansion	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9		Product Development

Leverage Effect in Indian Banking Sector Returns

Vandana Dangi*

Abstract

Indian banking industry has emerged as a reliable investment alternative among investors. Rational investors rely on fundamental analysis while taking decision regarding investing their moneyin banking sector. They estimate and predictreturn alongside risk in fundamental analysis of an investment avenue in banking sector. The prediction of impact of negative or positive news on volatility in banking stocks is also vital for investors to measure the risk exposure in their investment. The present treatise is an attempt to investigate the leverage effect in Indian banking sector indices ofBSE Bankex, CNX bank and CNX PSU. The daily banking sector indices for the period of January 2004 to October 2014 are taken from the online database maintained by the Bombay Stock Exchange Ltd. and the National Stock Exchange Ltd. The banking sector return series are initially studied for stationarity with the help of Augmented Dickey–Fuller test. The return series are further tested for autoregressive conditional heteroskedasticity (ARCH)with the help of Engle's ARCH test (i.e Lagrange multiplier test) and Breush-Godfrey-Pagan test. The test results confirmed that the return series are stationary and ARCH effect is present in return series. Vanilla GARCH model do not allow for asymmetries. So, EGARCH model was employed to study the leverage effectinBSE Bankex,CNX bank and CNX PSU return series. The results confirm the presence of highly persistent volatility and asymmetric leverage effect in banking sector return series. The conditional variance reacts differently to a given positive shock than to a negative shock with equal magnitude. The news impact curvesdrawn from EGARCH fitted series indicate that investors would face higher uncertainty in negative shocks as compared to positive shocks. These results will help investors in framing their strategy for risk management.

Keywords: Asymmetries, autoregressive conditional hetroskedasticity, news impact curve, stationarity and volatility clustering

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1. INTRODUCTION

Indian banking sector have significantly developed in terms of transparency and efficiency. The credit of its improvement goes to the timely introduced reforms that include the enactment of the Securitization Act, establishment of asset reconstruction companies, change in the basis of income recognition, initiatives for improving recoveries from non-performing assets and regulatory uniformity in Indian banking sector. These developments on one hand spurted the treasury income and on other hand improved the loan recoveries of Indian banks. The outstanding track record of innovation, growth and value creation is reflected in their market valuation. Indian banking sector has emerged as one of the most attractive investment avenues for investors not only for depositing their money but also to invest their money in their securities. Masses sacrifice their present benefits in order to earn future benefits after analysing the market by employing technical analysis or/and fundamental analysis. The prediction of volatility in financial market is vital for investors as it indicates a measure of risk exposure in their investment. Investors need to study the behaviour of volatility in response to the news. They need to find either the return series have symmetrical response or asymmetrical response to different kind of news. So, investors study the impact of news on volatility in banking stocks. News about government policies, political unrest, financial results, global cues, mergers and acquisitions, Foreign Institutional Investors activities, insider trading, bonus dividends, stock splits, inclusion/exclusion from indexes, rights issue, change in board, changes in demand or/and supply, joint ventures, rumors, new technology, new interventions and many more affects stock markets as these factors have a direct impact on the bank indices. Investors analyse the relationship between the news and the market because news can change a good day into bad one or bad day into a good. That is why; the accurate modeling and forecasting of the volatility and the impact of news have received a lot of attention in the investment community. The introduction of ARCH models by Engle (1982) and their generalization by Bollerslev (1986) had

refined the approach to model the conditional volatility that captures the stylized characteristics of the financial data in better way. Crouhy Michel and Rockinger Michael (1997) applied AT-GARCH (1,1) model to capture the residual structure by extending ATGARCH (1,1) to an hysteresis model (HGARCH) for structured memory effects. They found that bad news was discounted very speedily in volatility. However, good news had a very small impact on the volatility. Robert A. Connolly and Christopher T. Stivers (1999) studied variations in the volatility relation between the conditional variance of individual firm returns and yesterday's market return shock by using daily equity returns. They found number of regularities in this market-to-firm volatility relation. They concluded that volatility decreases following macroeconomic news announcements. Volatility did not change systematically during the high-news months when firms announce quarterly earnings. Kaur, Harvinder (2004) employed various volatility estimators and diagnostic tests to investigate the nature and characteristics of volatility in the Indian stock market. She found that volatility clustering, asymmetry, intra-week and intra-year seasonality, spillover between the US and Indian markets were present in Sensex and Nifty. Connolly, Robert A. and Stivers, Christopher Todd (2005) studied volatility behaviour in the daily stock returns at index and firm level from 1985 to 2000. They noticed decline in the relation between a day's index return shock to its next period's volatility when important macroeconomic news was released. They finally concluded that volatility clustering was strong when there were disperse beliefs about the market's information signal. Bhaskar Sinha (2006) modelled the presence of volatility in the inter day returns in the Sensex of the Bombay Stock Exchange and the Nifty of the National Stock Exchang e. He employed asymmetric GARCH family of models to unearth the phenomena of volatility clustering and persistence of shock in these two indices. They concluded that EGARCH and GJR-GARCH model successfully explain the conditional variance in the returns from Sensex (BSE) and Nifty (NSE) respectively. Pati, Pratap

Chandra (2006) examined the volatility dynamics and investigated the Samuelson Maturity Hypothesis in the context of Indian Futures Market by using ARMA-GARCH, ARMA-EGARCH models. He took Nifty Index Futures daily closing price, volume and open interest traded on NSE from the period January 1, 2002 to December 29, 2005 for near month contract. He found time-varying volatility, volatility clustering and leverage effect in Indian futures market. Sarangi, Sibani Prasad and Patnaik, K. Uma Shankar (2006) used family of GARCH techniques to capture time varying nature of volatility and volatility clustering in the returns of S&P CNX Nifty, Nifty Junior and S&P 500 index from January 1, 1997 to March 31, 2005. They found that there were no significant changes in the volatility of the spot market of the S&P CNX Nifty Index but there was change in the structure of the volatility to some extent. They also found that the new information was assimilated into prices more rapidly than before indicating decline in the persistence of volatility in the indexes since the inception of futures trading. Daal Elton, Naka Atsuyuki and Yu Jung-Suk (2007) proposed a mixed GARCH-Jump model for the specific circumstances in emerging equity markets. They accommodated lagged currency returns as a local information variable in the model. The lagged currency returns in the autoregressive jump intensity function incorporated jumps in the returns and volatility. Their proposed model encompasses asymmetrical volatility response to both normal innovations and jump shocks. Model captured the distinguishing characteristics of the Asian index returns and significantly improved the fit for markets that were affected by Asian crisis in 1997. Hourvouliades, L.Nikolaos (2007) examined the existence and nature of volatility clustering in the Athens FTSE20 index futures contract to unearth the characteristics of clustering in derivatives market. He applied GARCH model and exponential smoothing model to compare forecasting power on volatility. He found volatility clustering in the time series of the Greek futures market with negative shocks being more persistent as compared to positive shocks. Ninga Cathy, Xub Dinghai and Wirjantoc Tony S (2009) investigated the asymmetric pattern of volatility clustering on both the foreign exchange rate and

stock markets. They employed copula-based univariate time-series models that accommodate the clusters of both small and large volatilities. They concluded that the volatility clustering was strongly asymmetric in the sense that clusters of large volatilities tend to be much stronger than clusters of small volatilities. They further concluded that the volatility clusters remain persistent even after forty days. Ramlall Indranarain (2010) studied the impact of the credit crunch on the volatility clustering and leverage effects in major international stock markets. He studied the impact with GARCH (1, 1), GJR and news impact curves techniques. He found that GARCH fits all the stock markets except for SEMDEX. He noticed leverage effects in the post crisis period only in case of emerging markets such as JSE and SSEC. He concluded that the credit crunch accentuated the level of volatility clustering and also increased leverage effects in major international stock markets. Mahmud, Mahreen and Mirza, Nawazish (2011) modelled and forecasted the volatility before and during the financial crisis in the stocks traded at the KSE (Karachi Stock Exchange). They found volatility clustering and asymmetries in the return series. They applied GARCH family of models capability of the EGARCH(1,1) model at forecasting for both periods lending support to the use of GARCH family of models for emerging markets during crisis. Sinha, Bhaskar (2012) modelled the volatility by using GARCH family models in the historical returns of Sensex and Nifty to find volatility clustering and persistence of shock. He found that EGARCH and GJR-GARCH model successfully modelled the Sensex data Nifty data respectively. Xue Yi and Gencay Ramazan (2012) studied multiple trading frequencies using Bayesian information updates in an incomplete market and introduced a market microstructure model to generate volatility clustering with hyperbolically decaying autocorrelations. They concluded that signal extraction induced by multiple trading frequencies can increase the persistence of the volatility. They found that the volatility of the underlying returns series varies greatly with the number of traders in the market. Lin, Pin-te and Fuerst, Franz (2013) applied a Lagrange multiplier test for the autoregressive conditional heteroskedasticity effects and an

exponential generalized autoregressive conditional heteroskedasticity-in-mean model to assess the similarity financial characteristics of regional house prices and stock indices in Canada. They found that volatility clustering, positive risk-return relationships and leverage effects exist in the majority of provincial housing markets of Canada. They further concluded that volatility behaviours differ across provinces. More densely populated provinces as compared to less populated provinces exhibited stronger volatility clustering of house prices.

Academicians and researchers have given lot of attention to the volatility dynamics and impact of news in the developed and emerging financial markets. But there is lack of investigation of leverage effect in the sectoral indices of banking sector in India. The present treatise is an attempt to fill this lacuna by exploring the leverage effect in Indian banking sector indices of two largest stock exchanges of India.

2. OBJECTIVE OF THE STUDY

The present treatise attempts to study the leverage effect in Indian banking sector indices of BSE Bankex, CNX bank and CNX PSU by estimation of market volatility in terms of asymmetrical response to news.

3. RESEARCH METHODOLOGY

The daily stock price data for the period of January 2004 to October 2014 on BSE Bankex, CNX bank and CNX PSU have been taken from the online database maintained by the Bombay Stock Exchange Ltd. (BSE) and the National Stock Exchange Ltd. (NSE). The present treatise attempts to investigate the leverage effects in three Indian banking indices. It covers the two leading banking indices of BSE and NSE viz. BSE Bankex and CNX bank. There have been various changing dynamics of Indian banking industry. Public sector banks play dominant role in Indian banking sector. Public sector banks hold more than sixty seven per cent of total assets of all scheduled commercial banks. So, the present treatise also covers one public sector indices of NSE viz. CNX PSU.

Bankex indices track the performance of banking sector stocks listed on the Bombay Stock Exchange Ltd. It includes the stocks of UTI Bank Ltd, Kotak Mahindra Bank, UCO Bank, Indian Overseas Bank, Jammu & Kashmir Bank, Vijaya Bank, Allahabad Bank Ltd, Centurion Bank Ltd, Indusind Bank Ltd, Karnataka Bank Limited, Federal Bank Ltd, Yes Bank Ltd, IDBI Bank Ltd. These stocks represent ninety percent of the total market capitalization of all banking sector stocks. This index is based on the free float methodology of index construction. The other index is CNX Bank Index. This index is comprised of the large capitalised and most liquid Indian banking stocks. It includes twelve stocks from the banking sector that trade on the National Stock Exchange Ltd. It is computed using free float market capitalization method. This index represents fourteen percent of the free float market capitalization of the stocks listed on NSE. The top ten constituents as per their weightage in the index are HDFC Bank Ltd. (30.52), ICICI Bank Ltd. (28.42), State Bank of India (11.60), Axis Bank Ltd. (8.71), Kotak Mahindra Bank Ltd. (7.16), IndusInd Bank Ltd. (4.36), Bank of Baroda (2.58), Yes Bank Ltd. (2.15), Punjab National Bank (1.91) and Bank of India (0.94). CNX PSU index consists of major public sector banks that are listed on National Stock Exchange Ltd. CNX PSU index again comprises of twelve companies listed on National Stock Exchange Ltd. It is computed using free float market capitalization weighted method. The top ten constituents as per their weightage in the index are State Bank of India (54.48), Bank of Baroda (12.13), Punjab National Bank (8.99), Bank of India (4.42), Canara Bank (4.14), Union Bank of India (3.61), IDBI Bank Ltd. (2.88), Oriental Bank of Commerce (2.32), Allahabad Bank (2.23) and Syndicate Bank (1.80).

4. ECONOMETRIC METHODOLOGY

The present treatise uses the log difference of closing prices of two successive periods in order to calculate the rate of return as the volatility in BSE Bankex, CNX bank and CNX PSU indices has been estimated on return. The log difference is expressed

in percentage terms that ease comparability. The series of banking sector indices have been converted into return series by applying the following formula:

$$R_t = (\text{In } P_t - \text{In } P_{t-1})*100 \qquad (1)$$

where R_t is the return for day t, p_{t-1} is closing prices for day t, is the closing prices of previous trading day and *In* is natural log.

The data was initially studied for stationarity with the help of **Augmented Dickey–Fuller test**. It is a test for a unit root in a time series sample. It examines whether a time series variable is non-stationary using an autoregressive model. It tests the existence of a unit root as the null hypothesis. The testing procedure for the ADF test consists of estimating the following regression:

$$\Delta y_t = \square + \beta t + \gamma y_{t-1} + \delta\_1 \, \Delta y_{t-1} + ... + \delta_{p-1} \, \Delta y_{t-p+1} + \varepsilon_t \qquad (2)$$

The unit root test is carried out under the null hypothesis against the alternative hypothesis of Once a value for the test statistic is computed, it is compared to the relevant critical value for the Dickey–Fuller Test. If the test statistic is less than the critical value, then the null hypothesis is rejected implying no unit root is present.

The data is further tested for autoregressive conditional heteroskedasticity with the help of **Engle's ARCH test (i.e Lagrange multiplier test) and Breush-Godfrey-Pagan test**. The ordinary least square equation may mislead in case of time varying variance. The residuals from the ordinary least square regression equation is tested for Autoregressive Conditional Heteroskedasticity effect (ARCH effect) to verify either the assumption of constant variance holds good or it is time varying. Engle's ARCH test is a Lagrange multiplier test to assess the significance of ARCH effects. The null hypothesis is:

$$a_0 = a_1 = ... = a_m = 0 \qquad (3)$$

The alternative hypothesis is:

$$e_t^2 = a_0 + a_1 e_{t-1}^2 + ... + a_m e_{t-m}^2 + u_t \qquad (4)$$

where u_t is a white noise error process.

Breush-Godfrey-Pagan test is based on the Lagrange multiplier test principle (John H.H. Lee, 1991) that is used to test heteroskedasticity in the regression model.

It is a chisquared test with k degrees of freedom. It examines whether the estimated variance of the residuals are dependent on the independent variable. The heteroskedasticity is examined by regressing the squared residuals on the independent variables:

$$\hat{u}^2 = Y_0 + Y_1 \, x + \upsilon \qquad (5)$$

5. MODEL SPECIFICATION

Models can be linear in mean and variance (like ARMA model); linear in mean and non-linear in variance (like Generalised Autoregressive Conditional Heteroskedasticity Model); non-linear in mean and linear in variance (like Bicorrelation Model); and non-linear in mean and non-linear in variance (like Threshold GARCH Model). Linear models are incapable to explain leptokurtosis, volatility clustering and leverage effect. The appropriateness of a non-linear model for the data may be judged on the statistical ground. Generalised Autoregressive Conditional Heteroskedasticity (GARCH) type process best characterised the dependence (Brooks 1996). Engle (1982) had proposed ARCH process to model time varying conditional variance by using past disturbances. He used past disturbances to model the variances of the series and allow the variance of the error term to vary over time. Bollerslev (1986) further generalized the ARCH process. GARCH model avoid over fitting and it is more parsimonious. This model allows infinite number of past errors to effect current conditional variance. As already discussed, GARCH model cannot account for the leverage effects as it is unable to allow for direct feedback between the conditional mean and conditional variance. The conditional variance in the model is not the function of signs of lagged residuals rather it is the function of magnitude of lagged residuals. That is why, GARCH model enforce a systematic response to positive and negative shocks. The Nelson's (1991) Exponential Generalised Autoregressive Conditional Heteroskedasticity (EGARCH) model allows asymmetries as log(is modelled and there is no need for artificially imposing the non-negativity constraints for the model parameters. The conditional variance is modelled to capture the leverage effect

of volatility. The EGARCH(1,1) model is defined as follows:

$$In\ (h^2_t)=0+\gamma\ (e_{t-1}/h_{t-1})+\lambda\ [(|e_{t-1}|/h_{t-1})-(\square2/\pi)^{0.5}]+\beta In\ (h^2_{t-1})\ (6)$$

Where () is conditional variance

γ ,   and β are parameters

 represents the symmetric effect i.e. GARCH effect

β measures the persistence level in conditional volatility

γ measures the leverage effect

If the value of γ = 0, then it indicates that the model is symmetric. In case $\gamma < 0$, then good news generate less volatility than bad news. When $\gamma > 0$, it indicates that good news are more destabilizing than bad news.

Properties of BSE Bankex, CNX bank and CNX PSU Market Returns

Daily closing prices have been taken for BSE Bankex, CNX bank and CNX PSU. These price series are converted to return series. The basic statistics of BSE Bankex, CNX bank and CNX PSU return series are portrayed in the table 1.

Table 1: Basic statistics of BSE Bankex, CNX bank and CNX PSU returns

Descriptive Statistics	BSE Bankex	CNX bank	CNX PSU
Mean	0.071413	0.069110	0.049050
Median	0.119154	0.091396	0.114867
Maximum	17.54832	17.23940	16.35230
Minimum	-14.48036	-15.13805	-17.19390
Std. Dev.	2.081732	2.114401	2.267583
Skewness	-0.058808	-0.122066	-0.207368
Kurtosis	8.640934	8.443158	7.459534
Jarque-Bera	3561.426	3321.297	2244.151
Probability	0.000000	0.000000	0.000000
Observations	2685	2685	2685

The average statistics of BSE Bankex, CNX bank and CNX PSU returns are positive implying the fact that all indices have increased over the period. The returns are negatively skewed that indicates the high probability of earning negative returns. The value of kurtosis statistics is more than three. It means that the data is leptokurtic. BSE Bankex, CNX bank and CNX PSU returns series have a heavier tail as compared to the standard normal distribution. Jarque-Bera test confirms the non-normality of all return series of Indian banking sector as the value of probability is zero i.e. the null hypothesis of normal distribution cannot be accepted by the Jarque-Bera test.The return series of BSE Bankex, CNX bank and CNX PSU are tested for stationarity by applying Augmented Dickey–Fuller test.

Table 2: Results of augmented Dickey–Fuller test

Panel	Null Hypothesis	t-Statistic	Prob.*
1	BANKEX has a unit root	-45.17067	0.0000
2	CNXBANK has a unit root	-45.16801	0.0000
3	CNXPSU has a unit root	-45.09170	0.0000

*MacKinnon (1996) one-sided p-values.

The results of Augmented Dickey–Fuller test in table 2 indicate that all return series are stationary. The null hypothesis that the returns series have unit root is rejected as the probability value is 0 i.e. less than 0.05. Exhibit 1 portrays the daily returns on BSE Bankex, CNX bank and CNX PSU returns series. It is clear from the visual inspection that volatility in banking sector indices has changed over time. There are clear and distinct periods of high volatility and relative calm that suggests volatility clustering in the BSE Bankex, CNX bank and CNX PSU indices. Returns on BSE Bankex, CNX bank and CNX PSU indices continuously fluctuate around a mean value that is close to zero.
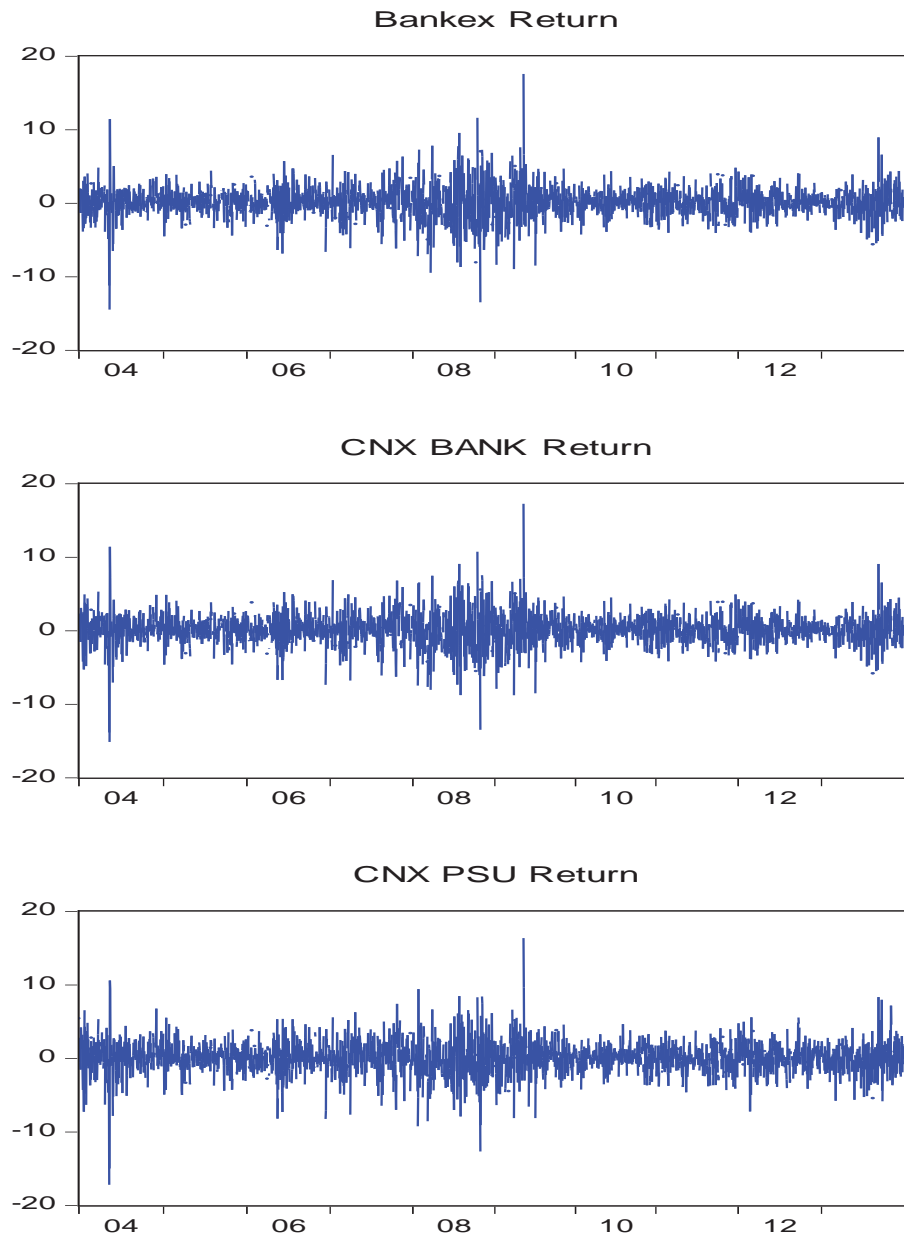
Exhibit 1: Plot of daily returns

Bankex Return

CNX BANK Return

CNX PSU Return

Table 3: Correlogram of return series of BSE Bankex, CNX bank and CNX PSU

Box-Jenkins methodology is applied to detect whether BSE Bankex, CNX bank and CNX PSU return series follow a pure AR process or pure MA process or ARMA process. The results shown in table 3 and 4 specifies ARMA (1,1) structure of the mean equation for BSE Bankex, CNX bank and CNX PSU return series.

Lags	Bankex AC	Bankex PAC	CNX bank AC	CNX bank PAC	CNX PSU AC	CNX PSU PAC
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Table 4: Results of ACF, PACF and Q statistics

Lags	Bankex AC	PAC	Q-stat	Prob	CNX bank AC	PAC	Q-stat	Prob.	CNX PSU AC	PAC	Q-stat	Prob
1	0.136	0.136	49.53	0	0.136	0.136	49.571	0	0.138	0.138	51.449	0
2	-0.031	-0.05	52.115	0	-0.035	-0.055	52.913	0	-0.027	-0.047	53.369	0
3	-0.005	0.006	52.192	0	-0.01	0.003	53.16	0	-0.003	0.007	53.397	0
4	-0.024	-0.026	53.698	0	-0.02	-0.021	54.232	0	0	-0.002	53.397	0
5	-0.051	-0.045	60.768	0	-0.055	-0.05	62.268	0	-0.049	-0.05	59.987	0
6	-0.059	-0.048	70.008	0	-0.056	-0.044	70.574	0	-0.04	-0.026	64.284	0
7	-0.003	0.008	70.026	0	0.002	0.011	70.583	0	0	0.006	64.285	0
8	0.037	0.032	73.662	0	0.028	0.022	72.701	0	0.015	0.012	64.9	0
9	0.031	0.02	76.189	0	0.032	0.025	75.516	0	0.045	0.043	70.428	0
10	0.028	0.02	78.275	0	0.029	0.02	77.736	0	0.031	0.018	73.025	0
11	0.023	0.014	79.704	0	0.022	0.013	79.004	0	0.007	0	73.168	0
12	-0.007	-0.011	79.825	0	-0.006	-0.01	79.106	0	-0.013	-0.013	73.615	0
13	-0.007	0.001	79.966	0	-0.008	0	79.281	0	-0.014	-0.009	74.108	0
14	0.033	0.04	82.832	0	0.032	0.039	82.06	0	0.036	0.044	77.68	0
15	0.008	0.003	83.002	0	0.008	0.003	82.243	0	0.017	0.011	78.5	0

The estimates of obtained from usual ordinary least square are linear, unbiased and asymptotically normally distributed in large samples but they are not efficient in comparison to other linear and unbiased estimates in the presence of hetroscedasticity and autocorrelation. Although the pictorial representation of return series indicates the clustering but Engle's ARCH test and Breush-Godfrey-Pagan test are further applied in the ARMA model to test the persistence and predictability of volatility in the Indian banking sector. The most common Durbin Watson test to detect autocorrelation is inapplicable in these autoregressive models. So, the residuals are tested for ARCH effect and the results of the same are displayed in table 5 and 6.

Table 5: Results of Engle's ARCH test

PANEL 1: BANKEX			
F-statistic	164.6013	Prob. F(1,2500)	0.0000
Obs*R-squared	155.1957	Prob. Chi-Square(1)	0.0000
PANEL 2: CNXBANK			
F-statistic	203.6823	Prob. F(1,2500)	0.0000
Obs*R-squared	189.4418	Prob. Chi-Square(1)	0.0000
PANEL 3: CNXPSU			
F-statistic	267.7342	Prob. F(1,2500)	0.0000
Obs*R-squared	242.0286	Prob. Chi-Square(1)	0.0000

Table 6: Results of Breusch-Godfrey Serial Correlation LM Test

PANEL 1:BANKEX			
F-statistic	0.058082	Prob. F(2,2679)	0.9436
Obs*R-squared	0.116357	Prob. Chi-Square(2)	0.9435
PANEL 2: CNXBANK			
F-statistic	0.204653	Prob. F(2,2679)	0.8149
Obs*R-squared	0.409987	Prob. Chi-Square(2)	0.8147
PANEL 3: CNXPSU			
F-statistic	1.208119	Prob. F(2,679)	0.2989
Obs*R-squared	2.418536	Prob. Chi-Square(2)	0.2984

Engle's ARCH test confirms the presence of conditional heteroskedasticity in the return series of BSE Bankex, CNX bank and CNX PSU as the probability value is zero. The results of Breush-Godfrey-Pagan test in table 6 also confirm that the estimated variance of the residuals is dependent on the independent variable as the probability value is more than 0.05.

6. LEVERAGE EFFECT: ESTIMATION OF MARKET VOLATILITY IN TERMS OF

ASYMMETRICAL RESPONSE TO NEWS

The differential response to good or bad news leads to the asymmetric response to the various shocks. It is also known as leverage effects. EGARCH model is estimated on the BSE Bankex, CNX bank and CNX PSU return series in order to test the significance of the asymmetric effects. The leverage effect in the EGARCH model is not quadratic but exponential. So, the forecast of conditional variance is non negative. Table 7, 8 and 9 portrays the results of EGARCH model estimation.

Table 7: EGARCH model estimation on BSE BANKEX returns series

Dependent Variable: RBANKEX				
Method: ML - ARCH (Marquardt) - Normal distribution				
Convergence achieved after 22 iterations				
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5) *RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-0.013520	0.014462	-0.934905	0.3498
C	0.128898	0.049842	2.586155	0.0097
Variance Equation				
C(3)	-0.106211	0.009494	-11.18664	0.0000
C(4)	0.173541	0.013684	12.68235	0.0000
C(5)	-0.057241	0.006854	-8.351162	0.0000
C(6)	0.978028	0.003301	296.2777	0.0000
Log likelihood	-5404.338	Akaike info criterion		4.030047
Durbin-Watson stat	1.731525	Schwarz criterion		4.043221

The uppersection in table 7 provides the output for mean equation and the lower section contains the coefficients, z statistics and prbability value of the coefficients of the variance equation. The value of EGARCH parameter is close to one. It implies that volatility shocks are persistent. The leverage effect term i.e C(5)*RESID(-1)/@SQRT(GARCH(-1)) in model is negative. It is significantly different from zero that proves that news impact is assymetric during the sample period. In other words, leverage effcet exists for the BSE Bankex return series during the sample period.

In CNX BANK return series also, the value of EGARCH parameter is close to one. It implies that volatility shocks are persistent. The leverage effect term i.e C(5)*RESID(-1)/@SQRT(GARCH(-1)) in model is also negative in table 8. It is significantly different from zero that proves that news impact is assymetric. In other words, leverage effcet exists for the CNX BANK return series during the sample period.

Table 8: EGARCH model estimation on CNX BANK returns series

Dependent Variable: RCNXBANK

Method: ML - ARCH (Marquardt) - Normal distribution

Sample (adjusted): 1/02/2004 10/31/2014

Included observations: 2685 after adjustments

Convergence achieved after 23 iterations

LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
      *RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-0.011526	0.014912	-0.772947	0.4396
C	0.130823	0.053972	2.423901	0.0154
Variance Equation				
C(3)	-0.101871	0.009442	-10.78923	0.0000
C(4)	0.169077	0.013521	12.50432	0.0000
C(5)	-0.054132	0.006732	-8.041220	0.0000
C(6)	0.978081	0.003412	286.6892	0.0000
Log likelihood	-5477.869	Akaike info criterion		4.084819
Durbin-Watson stat	1.730459	Schwarz criterion		4.097993

Table 9: EGARCH model estimation on CNX PSU returns series

Dependent Variable: RCNXPSU

Method: ML - ARCH (Marquardt) - Normal distribution

Sample (adjusted): 1/02/2004 10/31/2014

Included observations: 2685 after adjustments

Convergence achieved after 26 iterations

LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
    *RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-0.009493	0.017435	-0.544481	0.5861
C	0.112079	0.077794	1.440702	0.1497

Variance Equation				
C(3)	-0.078780	0.008900	-8.851975	0.0000
C(4)	0.187760	0.014449	12.99481	0.0000
C(5)	-0.039239	0.007423	-5.286024	0.0000
C(6)	0.957129	0.005800	165.0200	0.0000
Log likelihood	-5808.534	Akaike info criterion		4.331124
Durbin-Watson stat	1.721889	Schwarz criterion		4.344299

The value of EGARCH parameter in the model estimation of CNX PSU returns series is close to one in table 9. It implies that volatility shocks are persistent in CNX PSU returns series. The leverage effect term i.e C(5)*RESID(-1)/@SQRT(GARCH(-1)) in the model is also negative. It is significantly different from zero that proves that news impact is assymetric during the sample period. In other words, leverage effect exists for the CNX PSU returns series during the sample period. Table 10 portrays the value of log liklihood, Akaike info criterion and Schwarz criterion for the estimates of GARCH(1,1) model.

Table 10: Criterion of GARCH(1,1) Model

Criterion	BSE Bankex	CNX bank	CNX PSU
Log likelihood	-5392.347	-5470.556	-5784.413
Akaike information criterion	4.022673	4.080891	4.314764
Schwarz criterion	4.035791	4.094069	4.327942

A peculiar point to here is that the log liklihood in EGARCH model estimation for all series is higher than the estimates of GARCH(1,1) model. The Akaike info criterion and Schwarz criterion are lower in EGARCH model estimation as compared to GARCH(1,1) model. So, EGARCH model performs better results as compared to GARCH model.
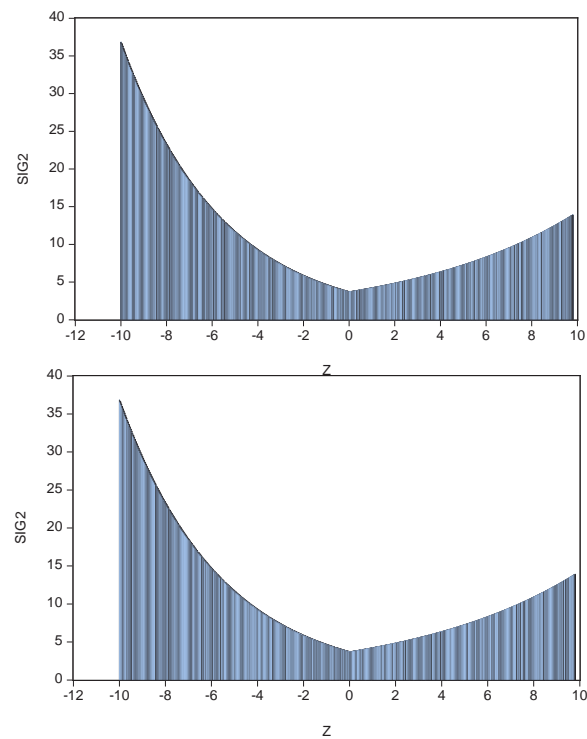
News Impact Curve

The news impact curve plots the volatility as against the impact (i.e. $z = \varepsilon/\sigma$) where

$$\log \sigma_t^2 = \omega + \beta \log \sigma_{t-1}^2 + \alpha |Z_{t-1}| + Y Z_{t-1} \qquad (7)$$

Initially, last period's volatility is fixed and then one period impact is estimated which is conditional on the last period's volatility. The next step is to generate the conditional variance series. The x axis of news impact curve is z series that is generated as a equispaced period between -10 and +10. The variance series is generated that is named as SIG2. Finally, news impact curves are estimated by highlighting the z series and SIG2 series from EGARCH model fitted to the BSE Bankex, CNX bank and CNX PSU return series. Exhibit 2 plots the news impact curve for the BSE Bankex, CNX bank and CNX PSU return series.

Exhibit 2: News Impact Curve From EGARCH Estimations

A) BSE Bankex return series

B) CNX bank return series
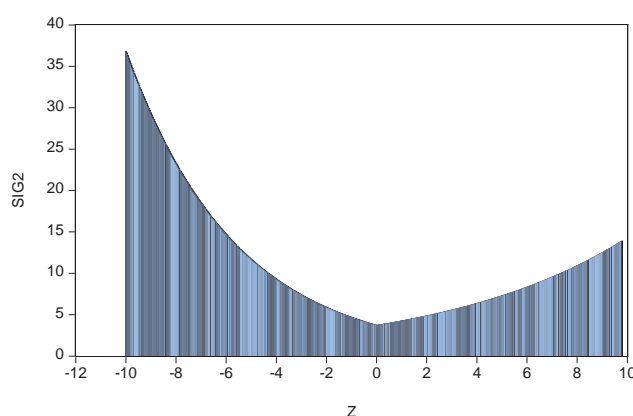
C) CNX PSU return series

The asymmetric leverage effect is clearly seen in news impact curve drawn from EGARCH model fitted to the BSE Bankex, CNX bank and CNX PSU return series. The conditional variance of all returns series indicates larger reaction to past negative shocks as compared to the positive shocks of the equal magnitude.

7. DISCUSSION

Black (1976), Christie (1982), Schewart (1989) and Crouhy & Rockinger (1997) have found that returns are negatively related with the volatility. Studies conducted on volatility in financial markets have completely discarded the volatility as constant and unconditional statistics. Vanilla GARCH model do not allow for asymmetries. So, EGARCH model was employed to study the impact of news on volatility in BSE Bankex, CNX bank and CNX PSU return series. It is found that the returns tend to be less volatile in response to good news and more vulnerable in response to the bad news. Some of the peculiar findings on impact of news are as follows:

1. News affects stock markets.
2. Positive and negative stock return innovations have different impact on the volatility.
3. Volatility following bad news is found to be higher than following good news.

The results of the present study is based on the daily returns indices only and these results can be further improved by extending the methodology on high frequency data to explore the volatility dynamics in Indian banking sector returns.

8. CONCLUSION

EGARCH model proposed by Nelson is employed to determine the asymmetries in the volatility. The daily banking sector return series are statistically studied for stationarity and autoregressive conditional heteroskedasticity. The results confirmed the stationarity and presence of ARCH effect in the return series. There is high persistent volatility in the BSE Bankex, CNX bank and CNX PSU return series. The conditional variance of the BSE Bankex, CNX bank and CNX PSU return series reacts differently to equal size of negative and positive shock. The news impact curve clearly indicates that an unanticipated decrease in return series leads to more uncertainty as compared to an unanticipated increase of equal size. This study will help the investors to estimate and forecast volatility in a better way for developing their risk management strategy.

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Econometric Study of Working Capital Management and Profitability of Firms

A Case of Auto Industry in India

Anurag Agnihotri *

Abstract

The working capital is an important factor in determining the profitability of the company. The present study has made an attempt to analyze the relationship between working capital management and profitability of the selected automobile companies which forms the part of NSE Auto index. The impact of working capital management on firms' performance is than investigated using balanced panel data of manufacturing firms listed at the National Stock Exchange. In this study we studied the data from 2011 to 2014 we found a negative relationship between the different factors of Working Capital Management on the corporate profitability. We concluded that profitability can be enhanced if firms manage their working capital in efficient manner.

Keywords: Net operating profitability, working capital management, average collection period, inventory turnover, average payment period, cash conversion cycle, net trading cycle

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1. INTRODUCTION

Working capital is the like a lubricant in the business which ensure the smooth functioning of business. Excess and deficiency of working capital in firm both are problems in business. Seeing the importance of the working capital, we have chosen this topic. Further, the automotive industry plays pivotal role in country's rapid economic and industrial development. The automotive industry comprises of the automobile and the auto component sectors. The auto companies required capital both for long-term purposes and for short-term purposes. Long-term finance is used to buy land, buildings, machinery and so on. Short term finance is required to meet day to day financial needs such as raw material, salary, rent and so on. The short-term finance is known as working capital. The auto industry has a huge demand for the working capital and its management is a difficult task for any company. It starts from estimating working capital of a company and is a continuous process. A firm will be able to meet their short-term financial obligations only when it manages its working capital efficiently otherwise it may not able to meet their short-term financial obligations. It will affect the reputation of the company and profit will go down due to decrease in sales. There is a strong relationship between the profitability of firm and its working capital management. This paper is an attempt to study and analyse relationship between working capital management and profitability of the automobile companies which form the part of NSE Auto index.

2. REVIEW OF LITERATURE

For understanding the earlier studies on the working capital and profitability of firm, we have conducted a brief survey of earlier studies. Some of them are given below:

Smith and Begemann (1997) had evaluated the relationship between traditional and alternative working capital measures and return on investment of a firm and found strong relationship between the two. Shin and Soenen (1998) investigated the trade cycle which is used to measure efficiency of working capital management and profitability of firm. They found negative relationship between lengths of the firm's net trading Cycle and its profitability. Deloof (2003) found significant negative relationship operating cycle and operating income of Belgian firms. He suggested that profitability of firm can be increased by reducing time involve in accounts receivable and inventories. Ghosh and Maji (2003) examined working capital management of the Indian cement companies. Findings of the study indicated that the Indian Cement Industry as a whole did not perform remarkably well during their period of study. Eljelly (2004) explained that efficient liquidity management eliminates the risk of inability to meet short-term obligations and also avoid excessive investment in current assets. He also observed that the cash conversion cycle is an important measure of liquidity than the current ratio. Filbeck G. et al. (2005) found out that firms are able to decrease financing cost of a project by reducing the amount of funds allocated for current assets. He further observed that there is significant difference exist across industries in working capital measures across time. Lazaridis and Tryfonidis (2006) observed a significant relationship between profitability based on the different components of working capital and suggested that profitability can be increased by keeping each component of the conversion cycle at an optimal level. Garcia-Teruel and Martinez-Solano (2007) studied the effects of working capital management on SME profitability using the panel data. The results explained that value of firm can be increased by reducing holding period for inventories and reducing days for outstanding receivables and cash conversion cycle to improve profitability of firm. Raheman and Nasr (2007) investigated the effect of different variables of working capital management and found that there is negative relationship between working capital management and profitability of firm. They also indicated that size of the firm, measured by natural logarithm of sales, and profitability had a positive relationship. Singh and Pandey (2008) studied the impact of working capital management on profitability and found that working capital to total assets ratio had statistically significant impact on the profitability of firm. Falope and Ajilore (2009) found a negative relationship between net operating profitability and also found no significant variations in the effects of working capital management between

large and small firms. Mathuva (2009) examined the impact of different components of working capital management on profitability and found significant negative relationship between accounts collection period and profitability. However he observed a positive relationship between inventory conversion period and average payment period with profitability of firm. This means he is of the opinion that by reducing the cash conversion cycle profitability of firm can be increased. Afza and Nazir (2009) suggested that value of firm can be increased by adopting conservative approach towards working capital investment and its financing policies. Sen. M (2009) found a negative relationship among variables of working capital management and profitability. He uncovered the importance of finance director to increase productivity of firm.

The above literature review indicates that working capital management impacts on the profitability of the firm but there still is ambiguity regarding the appropriate variables that might serve as proxies for working capital management. The present study investigates the relationship between a set of such variables and the profitability of a sample of Indian Automotive firms.

3. RESEARCH METHODOLOGY

The impact of working capital management on profitability of auto sector firm is tested by panel data methodology. The panel data methodology used has certain benefits like using the assumption that firms are heterogeneous, more variability, less collinearity between variables, more informative data, more degree of freedom and more efficiency. The data used is secondary in nature and collected from the published sources such as company websites and reports.

Explained and Explanatory Variables

In order to find out the relationship between different variables, first Pearson Correlation Coefficients are calculated. The impact of working capital management on firms' performance is than investigated using balanced panel data of manufacturing firms listed at the National Stock Exchange. We develop an empirical framework. We specify our model as:

→ $NOP_{it} = \beta_0 + \beta_1(WCM_{it}) + \beta_2(GWCTR_{it}) + \beta_3(CATAR_{it}) + \beta_4(CLTAR_{it}) + \beta_5(CR_{it}) + \varepsilon_{it}$

→ $NOP_{it} = 0.7 - 0.136(53.857) + 0.822(7.932) + 0.78(0.3415) - 0.141(0.4262) - 0.115(0.8991) + 0.19738$

→ $NOP_{it} = 0.7 - 7.3246 + 6.52 + 0.2664 - 0.0601 - 0.1034 + 0.1974$

→ $NOP_{it} = 0.1957$

(β = Industrial Risk in the Indian Automotive Sector = 0.7)

The terms used in the models are important components of working capital management and impact the profitability of firms. Where, Net Operating Profitability is used as a measure of firm's performance and Working Capital Management used as a vector of Average Collection Period (ACP), Inventory Turnover in Days (ITID), Average Payment Period (APP), Cash Conversion Cycle (CCC) and Net Trading Cycle (NTC) of the firm. We expected that WCM has negative relationship with profitability of firm and if we reduce number of days in receivables, inventory and Cash Conversion Cycle and Average Payment Period is directly associated with profitability of firms. Other explanatory variables assumed to affect firm performance are Gross Working Capital Turnover Ratio, Current Assets to Total Assets Ratio and Current Liabilities to Total Assets Ratio are used to check the investing and financing policy of working capital management respectively. η_i measures the specific characteristics of each firm called unobservable heterogeneity, whereas λ_t is a parameter for time dummy variables, which is equal for all firms in each year but changes over time and ε is the error term.

4. DATA ANALYSIS AND RESULTS

Table (1) below explained that automotive firms have an average 8 days of Cash Conversion Cycle with standard deviation of 102 days. The firms have an Average Collection Period of 39 days, Inventory Turnover in Days of 78 days and Average Payment Period of 106 days. The sample firms have on average about 50% of the total assets in current form and sales growth of almost 17% annually while on average 62% of the assets are financed with debt.

The performance measure used in the analysis is Net Operating Profitability of the firms, which is on average 14% with a standard deviation of 0.12. The median values for almost all the variables are near to mean values except average collection and average payment periods. The performance measure used in the analysis is Net Operating Profitability of the firms, which is on average 20.5% with a standard deviation of 0.136. The median values for almost all the variables are near to mean values except average collection and average payment periods.

Table 1: Descriptive Statistics

Factors	N	Minimum	Maximum	Mean	Std. Deviation	Variance
NOP	10	.03	.46	.2050	.13476	.018
CR	10	.297	1.810	.89910	.512821	.263
ACP	10	7.55	526.62	106.4260	161.40957	26053.048
APP	10	6.081	429.384	113.69950	144.674343	20930.665
GWCTR	10	2.98	20.47	7.9320	5.59870	31.345
CATAR	10	.128	.747	.34150	.182528	.033
CLTAR	10	.283	.731	.42620	.139928	.020
ITID	10	.590	69.193	15.56110	19.951718	398.071
CCC	10	-210.838	211.174	8.28720	102.082492	10420.835
NTC	10	-185.16	258.00	25.3120	107.77733	11615.952
Valid N (listwise)	10					

CR – *Current Ratio*, **GWCTR** – *Gross Working Capital Turnover Ratio*, **ITID** – *Inventory Turnover in Days* **APP** – *Average Payment Period* **CATAR** – *Current Assets to Total Assets Ratio* **CLTAR** – *Current Liabilities to Total Assets Ratio* **CCC** – *Cash Conversion Cycle* **NTC** – *Net Trading Cycle*

Table 2: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873[a]	.762	-1.145	.19738

a. Predictors: (Constant), NTC, ITID, CLTAR, APP, CATAR, GWCTR, CR, CCC

b. Dependent Variable: NOP

Table 3: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.124	8	.016	.399	.848[b]
	Residual	.039	1	.039		
	Total	.163	9			

a. Dependent Variable: NOP

b. Predictors: (Constant), NTC, ITID, CLTAR, APP, CATAR, GWCTR, CR, CCC

<p style="text-align:center;">Table 4 : Coefficients[a]</p>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.200	.566		.354	.783		
	CR	-.030	.618	-.115	-.049	.969	.043	23.185
	GWCTR	.020	.074	.822	.268	.833	.025	39.374
	ITID	-.004	.019	-.559	-.195	.877	.029	34.450
	APP	.000	.001	-.176	-.224	.860	.384	2.604
	CATAR	.058	1.756	.078	.033	.979	.042	23.724
	CLTAR	-.136	2.316	-.141	-.059	.963	.041	24.257
	CCC	.001	.016	.750	.063	.960	.002	585.475
	NTC	-.001	.016	-.558	-.044	.972	.001	674.853

Dependent Variable: NOP

CR – *Current Ratio* **GWCTR** – *Gross Working Capital Turnover Ratio* **ITID** – *Inventory Turnover in Days* **APP** – *Average Payment Period* **CATAR** – *Current Assets to Total Assets Ratio* **CLTAR** – *Current Liabilities to Total Assets Ratio* **CCC** – *Cash Conversion Cycle* **NTC** – *Net Trading Cycle*

From the above table, it is evident that none of the variables are significant. The VIF values for all the variables are above 10 (except APP). This suggests a multicollinearity problem. So, we need to make changes in the model. Taking into consideration the Correlation from the Pearson Test (later in the report), changes were made to the model and the following result was obtained:

the firm and the VIF value is also below 10 which does not imply a multi collinearity problem.

Correlation matrix of all variables included in the analysis is presented in the following table, which is calculated based on data of the top 10 NSE firms. The table shows that Operating Profitability

<p style="text-align:center;">Table 5: Coefficients[a]</p>

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.001	.163		-.004	.997		
	CR	.062	.098	.235	.630	.552	.359	2.785
	GWCTR	.022	.008	.924	2.676	.037	.420	2.378
	ITID	-.002	.002	-.251	-.955	.376	.724	1.380

a. Dependent Variable: NOP

The results in table 5 show that the Gross Working Capital Turnover Ratio (GWCTR) is significant i.e. it affects the Net Operating Profitability (NOP) of

is negatively associated with measures of working capital management i.e. Average Collection Period, inventory turnover in days, Average Payment Period,

Cash Conversion Cycle and Net Trade Cycle. The correlation coefficients for all measures of working capital management are significant except for Cash Conversion Cycle. These results are consistent with the view that making payment to suppliers, collecting payments from customers earlier and keeping product or inventory in the stock for lesser time are associated with increase in profitability. A negative relation between Average Payment Period and Net Operating Profitability suggests that less profitable firms wait longer to pay their accounts payables. These three variables jointly form Cash Conversion Cycle and there exists negative relationship between CCC and operating profitability but it is not significant. It might not be a surprise because all the three components of CCC have negative association with the profitability and Average Payment Period is subtracted from sum of ACP and ITID to form Cash Conversion Cycle. Another measure of working capital management is the Net Trade Cycle, which has also a significant negative relationship with profitability. It implies that if a firm is able to reduce the Net Trade Cycle period, it can enhance the profitability for the firm and will ultimately create value for the shareholders.

Table 6: PEARSON'S Correlations Metrix

		NOP	CR	ACP	APP	GWCTR	CATAR	CLTAR	ITID	CCC	NTC
NOP	Pearson Correlation	1	-.325	-.129	-.074	.752*	-.286	.382	-.324	-.163	-.198
	Sig. (2-tailed)		.360	.723	.840	.012	.423	.275	.361	.653	.583
	N	10	10	10	10	10	10	10	10	10	10
CR	Pearson Correlation	-.325	1	.340	-.051	-.710*	.819**	-.509	-.382	.535	.690*
	Sig. (2-tailed)	.360		.337	.889	.021	.004	.133	.275	.111	.027
	N	10	10	10	10	10	10	10	10	10	10
ACP	Pearson Correlation	-.129	.340	1	.788**	-.301	.156	-.361	-.411	.384	.508
	Sig. (2-tailed)	.723	.337		.007	.398	.667	.306	.238	.274	.133
	N	10	10	10	10	10	10	10	10	10	10
APP	Pearson Correlation	-.074	-.051	.788**	1	-.051	-.188	-.244	-.434	-.255	-.122
	Sig. (2-tailed)	.840	.889	.007		.889	.604	.497	.211	.476	.738
	N	10	10	10	10	10	10	10	10	10	10
GWCTR	Pearson Correlation	.752*	-.710*	-.301	-.051	1	-.591	.659*	.019	-.401	-.518
	Sig. (2-tailed)	.012	.021	.398	.889		.072	.038	.959	.251	.125
	N	10	10	10	10	10	10	10	10	10	10

CATAR	Pearson Correlation	-.286	.819**	.156	-.188	-.591	1	-.061	-.289	.456	.590
	Sig. (2-tailed)	.423	.004	.667	.604	.072		.868	.419	.185	.073
	N	10	10	10	10	10	10	10	10	10	10
CLTAR	Pearson Correlation	.382	-.509	-.361	-.244	.659*	-.061	1	.243	-.177	-.275
	Sig. (2-tailed)	.275	.133	.306	.497	.038	.868		.498	.624	.441
	N	10	10	10	10	10	10	10	10	10	10
ITID	Pearson Correlation	-.324	-.382	-.411	-.434	.019	-.289	.243	1	.161	-.064
	Sig. (2-tailed)	.361	.275	.238	.211	.959	.419	.498		.658	.860
	N	10	10	10	10	10	10	10	10	10	10
CCC	Pearson Correlation	-.163	.535	.384	-.255	-.401	.456	-.177	.161	1	.964**
	Sig. (2-tailed)	.653	.111	.274	.476	.251	.185	.624	.658		.000
	N	10	10	10	10	10	10	10	10	10	10
NTC	Pearson Correlation	-.198	.690*	.508	-.122	-.518	.590	-.275	-.064	.964**	1
	Sig. (2-tailed)	.583	.027	.133	.738	.125	.073	.441	.860	.000	
	N	10	10	10	10	10	10	10	10	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Data reflects high correlations between different measures of working capital management. The correlation between Net Trade Cycle (NTC) and Cash Conversion Cycle (CCC) is (0.964), NTC and ITID is (-0.64), CCC and APP is (-0.255), CCC and ITID is (0.161), CCC and ACP (0.384) and (0.508) between NTC and ACP. This has been taken into account in the regression analysis to avoid multi-co linearity problem.   The current liabilities to total assets ratio has a negative relationship with the operating profitability of the firm. One of the relationships between Current Ratio and Net Operating Profitability is contradictory to the traditional belief, which shows a positive association between Current Ratio and profitability.

5. CONCLUSION

Firms could achieve the optimality of working capital management by managing the trade-off between profitability and liquidity. In this study we found a negative relationship between the components of Working Capital Management including the ACP, CCC and NTC with profitability of firms. The negative relationship between NOP and CCC shows that longer the cash conversion cycle is, smaller is the profitability. Previous studies regarding the average days of accounts payable reported negative correlation of this variable and the profitability of the firm. However we have not found any statistically significant relationship between these variables. We found a significant positive relationship between Gross Working Capital Turnover Ratio (GWCTR)

and the Net Operating Profitability (NOP). These findings are in confirmation with (Deloof 2003), (Eljelly 2004), (Shin and Soenan 1998) who found a negative relationship between the measures of working capital management including the average collection period, average payment period and cash conversion cycle with corporate profitability.

Thus, the findings of this paper suggest that value for the shareholders can be increased by reducing the number of days for accounts receivables. In addition, the negative relationship between accounts receivables and firm's profitability suggest that less profitable firms will pursue a decrease of their accounts receivables in an attempt to reduce their cash gap in the cash conversion cycle. On the basis of findings of this paper, we also conclude that profitability can be enhanced if firms manage their working capital in a more efficient way. These results suggest that managers can create value for their shareholders by reducing the number of day's accounts receivable to a reasonable minimum. The negative relationship between accounts payable and profitability is consistent with the view that less profitable firms wait longer to pay their bills.

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Appendix : List of variables affecting working capital

Variable	Measurement	Abbreviation
Net Operating Profitability	(Earnings Before Interest and Taxes + Depreciation)/ Total Assets	NOP
Average Collecting Period	(Accounts Receivable*365)/Net Sales	ACP
Average Payment Period	(Accounts Payable*365)/Net Sales	APP
Inventory Turnover in Days	(Inventory*365)/Cost of Goods Sold	ITID
Cash Conversion Cycle	ACP + ITID – APP	CCC
Gross Working Capital Turnover Ratio	Net Sales/Current Assets	GWCTR
Current Assets to Total Assets Ratio	Current Assets/Total Assets	CATAR
Current Liabilities to Total Assets Ratio	Current Liabilities/Total Assets	CLTAR
Net Trading Cycle	ACP + (Inventory*365)/Net Sales – APP	NTC
Current Ratio	Current Assets/Current Liabilities	CR

Positioning Tzinga in Indian Energy Drinks Market: A Case Study

Sajjan Raj Singhvi*

Abstract

Hector Beverages was established by professionals having experience in the soft drink industry and financed by venture capitalists. The firm developed a scientific approach to look at the market and consumers. The case describes the situation and examines the steps followed by the firm.

Keywords: Hector beverages, soft drink, venture capitalist

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1. INTRODUCTION

Neeraj Kakkar was busy in formulating new initiatives to manage increased capacity of production for its newly launched energy drink 'Tzinga'. The first plant had already started working and the second plant was expected to come on stream soon. The company had always aimed to continuously engage its main customer- Indian youth. As the company was a newcomer in non-alcoholic beverages market, its principal concern was to succeed by right positioning of the brand and wise spends on consumer engagement. Neeraj had realized that the unique positioning has to be quickly established since summer months in India, the main season for beverages, were close. This would also provide him reassurance as to company's understanding of target market in India was right or wrong.

2. HECTOR BEVERAGES PVT. LTD

Hector Beverages Pvt. Ltd. was an Indian startup in $ 402 million functional drink market of India. The company was founded by Mr. Neeraj Kakkar, Mr. James Nuttall, Mr. Suhas Misra and Mr. Neeraj Biyani in October 2009. The company started its operations with an initial investment of INR 25 million from founders, INR 300 million from N. R. Narayana Murthy's venture capital fund Catamaran Investment Private Ltd and 'Footprint ventures' and INR 35 million from Four Angel Investors. In 2010, Hector Beverages raised INR 60 million as part of its first round of funding to set-up its manufacturing plant in Manesar close to New Delhi in North India. In 2011, the company raised INR 80 million in second round of funding from its investors. The third round of funding of INR 70 million was raised for company's new manufacturing facility at Hosur in Tamil Nadu located 40 kms from Bengaluru in Karnataka. The manufacturing capacity planned at Manesar was 170,000 cases of 12 packs a month by automated machines imported from Singapore and China. Hosur plant was expected to be 3 times bigger than the capacity at Manesar. It was expected to be operational by March 2013.

Hector beverages had plans for its international expansion in Sri Lanka, Bangladesh and countries of Africa in coming years. Company intended to sell around 1 million bottle/month of 'Tzinga' through its distribution network covering 150,000 outlets at 50 cities in the beginning. The company had plans to strengthen its distribution network by making 'Tzinga' available from 150,000 outlets to 300,000 outlets and build a strong sales team of 200 salespersons.

Mr. Neeraj Kakkar, 38 years old, CEO of Hector beverages Pvt. Ltd, was MBA from Wharton and MDI. He had earlier worked in Wipro and Union Carbide. His last engagement with industry was as General Manager - Area Operations at Hindustan Coca-Cola Beverages Pvt. Ltd., India-100% subsidiary of The Coca-Cola Company.

Mr. James Nuttall - a chemical engineer, was an alumnus of Wharton and had worked with Dow Chemicals for 6 years. He had created a number of food and beverage packaging concepts across the United States and Europe. He was CFO of the company and was also responsible for product development.

Mr. Suhas Misra, an alumnus of IIM Calcutta had worked with Coca – Cola and Nokia. Later he started India's first integrated sales process outsourcing company Channel Play. He was COO of Hector Beverages Pvt. Ltd.

Mr. Neeraj Biyani was an MBA from MDI. Prior to joining Hector Beverages he was working as Regional Manager (Key Accounts) at Hindustan Coca-Cola Beverages Pvt. Ltd., India. In Hector beverages, he was in-charge of sales department.

3. FUNCTIONAL BEVERAGES MARKET

The global functional drink market was 12,705 million liters having a value of $40,241 million in 2009. It was expected to grow to volume consumption of 16,813 million liters in 2014 having a value of $53,478 million. While USA accounted for 46.3 % of the global functional drink market in 2009, it was an emerging product category in India with a market value of $163 million in 2008. It was expected to grow by CAGR of 19.8 % during 2008-13 making this beverage category worth $402.4 million by 2013. PepsiCo was the largest market player grabbing 26.5% share of the market's volume globally in 2009.[1,3]

4. FUNCTIONAL BEVERAGES

Functional beverage is a non-alcoholic drink that contains ingredients such as herbs, vitamins, minerals, amino acids or additional raw fruit or vegetables. Each functional beverage often claims to provide specific health benefits. The product category primarily includes sports and performance drinks, energy drinks, ready to drink (RTD) teas, fruit & vegetable drinks, and enhanced water. They are categorized as under –

1. Fruit/Vegetable drinks comprise of Juices-100% fruit juice, Juice Drinks up to 24% juice and Nectars containing 25-99% juice.

2. Ready-to-drink Tea, also served as iced-tea and/or green tea.

3. Sports drinks, the non-caffeinated beverages, are meant to replenish fluids and electrolytes lost during exercise. They work primarily on the muscles.

4. Energy drinks are beverages which stimulate the mind and body with ingredients like Caffeine, Guarana, Taurine and Glucuronolactone. These drinks provide a short-term energy boost to the drinker. (See Exhibit 1)

5. Enhanced Water is a type of functional drink which contain with additional ingredients with water like natural or artificial flavors, sugar, sweeteners, vitamins, minerals and other enhancements.

5. ENERGY BEVERAGES (EBS) AND CONSUMER

Energy drinks (beverages) and "sport drinks" at times are perceived similar by consumers. Companies actively promoted EBs on the themes of effects such as psychoactive, performance enhancing and stimulatory. Some believed it, but others went for advice from physicians as EBs included multiple ingredients. It was also believed that the ingredients carried risks of heart disease and hypertension.

It was observed that additional vitamins, minerals and antioxidants increased the benefit from the product. It was considered important to have an interesting packaging, label and design of the product. It was also

found that younger age group had positive attitude towards product than older age group.[3,4]

6. CONSUMER BEHAVIOR IN INDIA

Young and working Indians within age range of 15-39 were the prime consumers of energy drinks in India. They preferred energy drinks over carbonates as they were more image conscious than their older counterparts and were willing to pay more for these beverages. Boys compared to girls preferred energy drinks. It was found that almost 55% of 12th standard boys consumed these drinks to boost their game. Young adults who visited Nightclubs and Pubs frequently consumed energy beverages not for its functional value but for the aspiration value and the mystique attached with it. These drinks had become a style statement for them[5].

Energy drinks recorded significant growth in urban areas especially in metropolitans like 45% in Mumbai, 42% in Bangalore and 40% in New Delhi in 2012. It was found that 71% of youth living in urban centers consumed these drinks. This had also been influenced by increasing health awareness, rise in standard of living and acceptance of new products.

A survey was conducted to understand users of Tzinga. The respondents were those who consumed energy drink 4 times a month or more. Most of them were in the age group of 19-25 years. Those who consumed Tzinga, 60 % of them mentioned that they drank it for gaining energy. It was perceived by them that it kept them energized for an hour. Lemon mint was the most preferred taste for 72 % of the respondents against other tastes like Mango Strawberry or Tropical Trip. Brand name (56%) supported by recall ads (17%) and followed by Word of Mouth (11%) were considered to be major buying influencing factors in case of Tzinga.

7. ENERGY DRINK MARKET IN INDIA

According to a Datamonitor report[6], energy drinks accounted for 57.6% of functional drinks in terms of market value globally. There was growing consumer acceptability for energy drinks globally. In India,

energy drinks accounted for 89.6 % (total value) of the functional drink market followed by nutraceutical drinks (5.5% share) and sports drinks (4.8% share). In 2008, the market was valued at $146 million, up from $ 6 million in 2003 and it was predicted to reach $ 369 million by 2013. The growth of Indian energy drink market in the last decade (50.2 %) was far ahead than its BRIC counterparts: Brazil (16.6%), Russia (14.5%) and China (7.2%)[7]. The growth of energy drinks in India was primarily driven by Red Bull GmbH.

8. COMPETITIVE SCENARIO

The prominent brands in the market were Red Bull, Cloud 9, Burn and Power Horse in the energy drink product category. The energy drink market in India was developed by Red Bull. The new brands in the Indian energy drink market were XXX, KS (KamaSutra), 28 Black & 28 White, Romanov Red, Gatorade and Tzinga.

Red Bull entered India in 2001. Being an early entrant it dominated the market both in sales and market value. Produced and marketed by Austrian company, Red Bull GmbH had established both on-trade and off-trade sales network in India. Other prominent player Power Horse was launched in 2003. It had 3 variants viz. regular, sugar-free and cola. Competing against established specialist players like Red Bull and Power Horse, soft drink giants Coca-Cola and Pepsi Co launched their brands Burn and Gatorade respectively. The aim was to establish them in this fast growing new segment in beverage market and get these brands perceived as Energy beverage. The availability of Burn was restricted to pubs, select modern trade outlets and gyms. It was not available at convenience stores. Gatorade targeted sport persons and youngsters. It was made available at all convenience stores.

A few local players had also launched their energy drinks in the Indian market. Goldwin Healthcare launched 'Cloud 9' in 2008 and became the second largest player in energy drink market in India. Cloud 9 was available in four variants- premium, wild berry, pomegranate and red grapes. Other local players included XXX by Viking Beverages, KS energy drink by Raymond and Romanov Red (a sub brand of Romanov Vodka) of UB group. For details see Exhibit 2.

9. TZINGA

Hector Beverages introduced Tzinga in March 2011. The product was launched after 14 months of in-depth research, 6 months of which was conducted in Europe. It contained natural ingredients such as lemon and ginseng and was available in three variants i.e. Lemon Mint, Tropical Trip and Mango Strawberry.

The brand was first launched in National Capital Region market and gradually covered important towns and metros in the states of Karnataka, Rajasthan, Madhya Pradesh, Andhra Pradesh, and Gujarat.

10. TZINGA'S POD (POINT OF DIFFERENCE)

Likable Taste - Tzinga's taste was non-cough syrup type unlike its rival 'Red Bull'. Tzinga's syrup was fruit based and was a key reason for its likable taste.

A reduced carbon footprint – Tzinga packaging was designed to keep it environment friendly. It was half in weight of a plastic bottle, which was packaging container for most of the energy drinks. Consequently, the energy utilized for manufacturing, transportation and the CO_2 associated with the manufacturing processes was halved.

Value to the customer – Tzinga was a value for money product for customer. It was priced INR 20, much below its competitors in the market. The reasons for its low price were

- Doy packaging instead of tin packaging used by most competitors.

[3]http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2966367/

[4]Asiraphot, V., & Waleetorncheepsawat, W. (2009, June 4). A study of attitudes towards energy drinks in Thailand (Master Thesis in Business Studies). Mälardalen University, Thailand. Retrieved from http://mdh.diva portal.org/smash/get/diva2:225451/FULLTEXT01

[5]http://www.assocham.org/prels/shownews.php?id=3828

[6]http://www.marketresearch.com/Datamonitor-v72/Functional-Drinks-India-Soft-6173962/

[7]http://www.datamonitor.com/store/News/coca_cola_a_second_shot_at_energy_drinks?productid=6BD05C0B-EA89-4593-BD39-9C95310FB3E7

- Unlike Red Bull and Power Horse it imported ingredients instead of finished goods helping the company to save on import duties. Import duty on finished product was 60% while on ingredients it was only 10%.
- Local manufacturing and low overhead costs.

Exhibit 3 provides the details of competitive information supported by photographs to make an assessment of what is happening in this product category.

Mr Kakkar thought that they have understood the target consumer well. The company also considered itself to have differentiated itself from the competitors well. It was assumed that the launch had been successful. Mr. Kakkar wanted to be convinced of it and therefore, invited MBA students to have a fresh look on what is being done. Could you relook at the following sequence of questions to assure Mr Kakkar?

- What bases of segmentation could be followed in Energy drink market in India?
- Which were the most important benefits consumers looks in Energy drink in India?
- What were the points of parity to call a functional drink as energy drink?
- Did Tzinga had the parity and what was its point of difference?
- Was the consumer engagement supportive of its positioning?

11. SUMMARY AND CONCLUSION

The global brand Red Bull was the first entrant to build a new product category of Energy Drinks in India. The success led several other entrants to enter the market. MNCs also wanted to cover the new segment of market by bringing alike products. Hector Beverages was also one of the entrants in the market. The firm was established by professionals with soft drinks experience and financed by venture capitalists. The firm developed a scientific approach to look at the market and consumer. Based upon the understanding, the firm had developed a model to target the market and created the differentiation for it. The case aims to describe the situation and examine the steps followed by the firms and its appropriateness to grow in the market.

EXHIBIT 1

INGREDIENTS & POSSIBLE FUNCTIONS

S.No	Ingredients	Function
1	Caffeine	Stimulates the central nervous system giving the body a sense of alertness.
2	Taurine	Usually body makes enough of it and supplement is not required. It is thought, but not proven that under "stress conditions" like illness physical exertion or injury it helps regulate heartbeat, muscle contractions and energy levels.
3	Guarana	Increase alertness and energy.
4	Ginseng	Helps stimulate the hypothalamic and pituitary glands, which then secrete something called adrenal corticotrophin hormone. Believe to increase energy, is anti-fatigue and supposedly relieves stress & increase memory.

Exhibit 2

Current MRP of Energy Drinks in Delhi (15.02.2013)

Beverage	Manufacture	Price (Rs.)	Content
Red Bull	Red Bull	95	250 mL
Cloud 9	Goldwin Healthcare	85	250 mL
XXX	Viiking Beverages Pvt. Ltd	75	250 mL
Burn	Coca Cola	85	250 mL
KS	Raymond	95	250 mL
Romanov Red	UB Group	75	250 mL
Gatorade	Pepsi	35	350 mL
Tzinga	Hector Beverages	20	200 mL

Exhibit 3

Competitor's Activities employed for Consumer Engagement

Brand	Company	Year of entry in market	Variants of product	Promo Budget (INR in millions 2011)	Print	Sports event	Cricket	Music event	College/ student event	Face book	Movies
Red bull	Red Bull GmbH	2001	1	71		Y	Y	Y	Y	Y	N
Cloud 9	Goldwin Healthcare	2008	4	0.2	Y	N	N	N	N	N	N
Xxx	Viking Beverages@	2009	2	8.3	Y	Y	Y	Y	Y	N	Y
Power Horse	S. Spitz Company#	2003	3	NA							
Burn*	Coca-cola	2009		NA	N	N	Y	Y	N	Y	
KS Energy Drink	Raymonds (India) & Ansell Int (Australia)	2012	2	NA							
Romanov Red $	UB	2010		NA							
Gatorde	Pepsico	2004	3	NA		Y	Y		Y	Y	
Tzinga	Hector Beverages	2011	3	NA		N	N	N		Y	Y

@- Agreement with Café Coffee Day to promote its brand

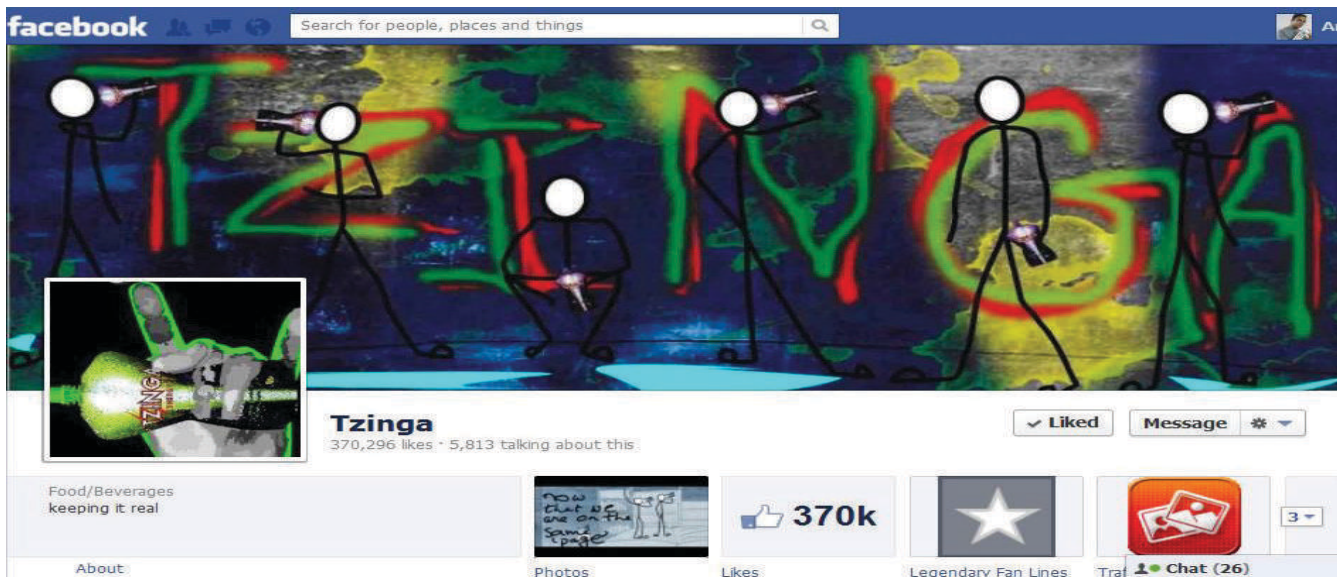#- Restricted to pubs, select modern trade outlets, and gyms

*- First attempt of "Shock Energy" failed

$- BTL activity like sampling and testing sessions at POS, discos, hotels and pubs

Exhibit 4: PHOTOGRAPHS:

1:

2:

3:

4:

5:

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Contents

Diffusion of Smartphones in India

Khimendra Singh* and Hamendra Kumar Dangi**

Abstract

This paper aims to forecast the growth of smartphones in India. The country has been experiencing very high smartphone adoption rate in the last few years. The tendency to adopt an innovation, low cost technology, and higher economic power are a few of the primary reasons responsible for such high rate. This is expected to continue till it reaches the saturation level. This paper uses analytical models to predict the smartphone adoption in the growing Indian market. Logistic and Gompertz models form the basis of this analysis. The Gompertz model fits better for the available dataset due to its higher R^2 value and lowest mean square error (MSE). The paper forecasts that the density of smartphone (number of device per 100 people) in India would reach to 53.6 by 2020 from its 2013 level (6.1). Due to such high adoption rate, the total number of smartphone users in India is projected to reach 716.74 million in 2020. This is equivalent to an average addition of 90.99 million new users per year to the total base. However, the addition would be slow, as the curve would start reaching the saturation level. The average annual addition of new users would be 47.23 million between 2025 and 2035. Since smartphone brings convenience in terms of internet accessibility, the mobile internet base in India has grown tremendously. This mobile - internet combination has triggered a very high growth in the m-commerce segment. Therefore, it is of paramount importance for mobile manufacturers, policy makers, e-commerce companies and retailers to adapt to this diffusion so that activities for better infrastructure, channels and products could be carried out well in advance in order to realize maximum market value.

Keywords: Smartphone diffusion; Technology diffusion; Logistic model; Gompertz model; Forecasting

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1. INTRODUCTION

India is one of the biggest markets for the mobile industry. As per the July 2014 report of Telecom Regulatory Authority of India (TRAI), the total number of wireless subscribers in India has increased to 914.92 million (TRAI, 2014). With such numbers, India now has the second largest number of mobile phone users in the world. However, there has been a slow but very promising shift in the preference of mobile users. More and more users are now using or planning to use 'smartphone'. Though, there is no standard definition of a smartphone; a cellular phone with an operating system which can perform complex applications (internet, entertainment, shopping, games etc.) like a computer could be called a smartphone. Communication was the sole purpose of cellular phones. However, smartphone have completely changed this view. Ability to perform many functions has made smartphone the preferable alternative. As per International Data Corporation, there has been a significant migration of mobile users from non-smartphone to the smartphone category. Low cost phones, cheaper 3G tariffs, increased purchasing power, better infrastructure, easy access to internet, urge to get connected 24/7 and growing number of generation C are other prominent factors which are responsible for high adoption rate.

In the first quarter of 2013, 10% of mobile users in India belonged to smartphone category, however, within one year, this share increased to 29% in first quarter of 2014 (IDC, 2014). It shows the ongoing change in the behavior of Indian consumers to buy technologically advanced phones (Please refer to Figure 4, Annexure 1 for details). This is expected to continue at similar rates in future. Though, Indian consumers were slow in adapting to this new phenomenon, the growth has been fuelled in recent times. In India, smartphone manufacturers (Samsung, Micromax, HTC, etc.) are continuously launching new products, with features customized for domestic consumers. As per International Data Corporation (IDC), the smartphone market in India grew by staggering 186% in first quarter of 2014. This growth is much higher than growth in other developing markets such as China where the market experienced only 31% growth for the same period. In 2013, 44

million smartphones were shipped to India which is almost 171% higher than 16.2 million shipments in 2012. The following figure clearly indicates the increasing adoption of smartphone in India (IDC, 2012).
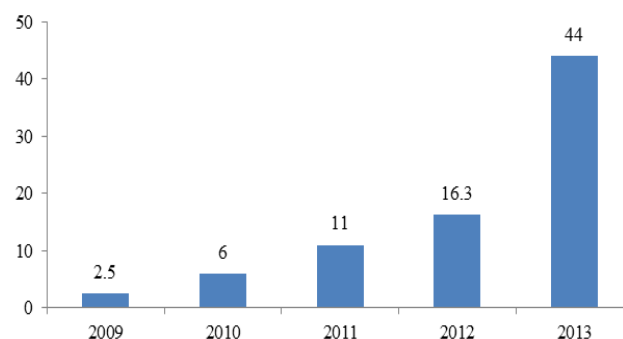
Figure 1: Smartphone shipment in India (million units per year)

Asia Pacific overall has experienced very high smartphone penetration. Highest penetration in Hong Kong and Singapore with 87%, followed by other countries, Malaysia, Australia and China (Nielsen, 2014). Though, India still ranks lower than other countries in terms of cumulative penetration, the corresponding rate has been explosive. From 2009 to 2013, smartphone subscriber market in India grew with a compound annual growth rate (CAGR) of 137.7%. Such high sales have resulted in an increase in smartphone density (number of smartphones per 100 people) in India. In 2013 and 2012, there has been 120% and 81% average growth in smartphone density compared to the respective previous year's values.
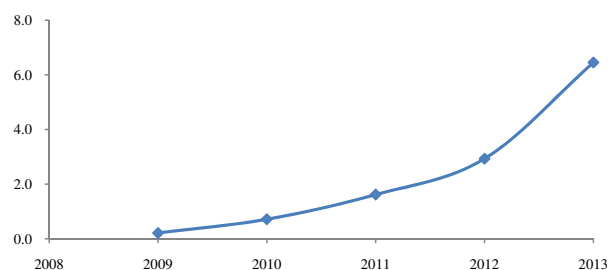
Figure 2: Smartphone cumulative density in India

Recently, the Indian market has been flooded with low cost smartphones (BBC, 2013). Many companies have been founded only over the last few years due to the huge market potential. Companies such as

Nokia used to be the biggest market shareholder in India. However, the crop of new companies such as Micromax and Karbonn has changed the entire picture. Now, Chinese vendors and Mozilla have also entered the race (BBC, 2014). Continuously new products are being introduced by Korean giant Samsung which currently holds the number one position in the Indian smartphone market. Micromax, Karbonn, LAVA and Nokia are other vendors in top 5. These top 5 companies represent almost 66% of the total existing market (Please refer to Figure 5, Annexure 1).

Wave of affordable smartphones has resulted in a larger mobile internet user base in India and vice versa. This has been observed globally. As per the latest estimates of the Telecommunication Development Sector (ITU-D), mobile-broadband penetration on a global scale would touch 32% by the end of 2014. This is five times of 2009 level (ICT, 2014). Though the penetration level of mobile broadband in developing countries is still at 21%, it is growing at a faster rate (26%) which is twice as high as growth rate in developed countries (11.5%). The same trend has been observed in India, where the number of mobile internet users has increased substantially.

According to Internet And Mobile Association of India (IAMAI), mobile internet users in India increased from 68 million (2012) to 130 million (2013), a growth of about 91 percent. This number is expected to reach 185 million in 2014 (IAMAI, 2014). The report also states that over 50% of internet users are accessing the internet on their mobile. This in turn has provided a platform for mobile commerce (m-commerce). Easy accessibility to the internet and online shopping activities has made smartphone a new medium for online sellers and retailers. The contribution of m-commerce site traffic to the online shopping category has increased from 8 percent to 20 percent in 2013. About 61 percent of smartphone users in the country has purchased via their mobile phones (Business Standard, 2014). High consumer movability which comes due to smartphone usage has forced retailers to change their advertisement and promotion strategy. With a significant focus on digital marketing, data using digital footprint of consumers is being used by manufacturers and retailers to target consumers with more customized products. Retailers are developing new smartphone apps which can perform various functions such as advertisements, shopping, bill payments, sending gifts etc.

Market potential, rate of adoption, consumer behavior are a few of the very important parameters which really describe how a smartphone market would pan out in future. Technology products generally tend to have a short life span due to continuous advancements. Therefore, it is extremely important for technology companies to be agile and adapt to the changing environment quickly. Particularly, stakeholders related to the mobile industry need to understand and envisage the developments which could take place due to quick adoption of smartphones. Various studies have been conducted to understand the diffusion of mobile phones for different countries (Chaddha et al., 1971; Gruber and Verboven, 2001; Botelho and Pinto, 2004). Similarly, few studies have also been conducted to estimate the market size for mobiles in India (Singh, 2008). However, no study has conducted for smartphone yet. Attributes of consumers and reasons for purchasing normal mobile phones are different from smartphones therefore a fresh look at the diffusion process of smartphone is required. This study would enable companies to see things from an analytical model's perspective and help them plan appropriate strategies for various fronts (investments, R&D, advertisement, pricing, distribution etc.).

This paper presents an overview of different literature available in the field of diffusion. The findings could not only be relevant for policy makers of the telecom industry, but also for company executives who use such policies and execute marketing activities based on sales forecast. The paper starts with a brief discussion of general trends in the smartphone industry. Next it looks at the basic bass model and the description provided by Rogers in Diffusion of Innovations. The paper also discusses relevant information from other papers which talk about diffusion of mobile in India. Then the paper directs us to the two prominent models frequently used for mobile diffusion, Logistic and Gompertz. Relevance of these two models is presented and then quantitative analysis using data for smartphone is carried out. Then paper outlines the conclusion, limitation and direction for further research.

2. LITERATURE REVIEW

Multiple studies have been carried out and several models have been defined in order to understand the diffusion process of innovation. Sales of a new product could be considered either in terms of the diffusion process or adoption process (Mahajan and Wind, 1986). Rogers defines diffusion as a process by which an innovation is communicated among the members of a social system through channels over time. It is a special type of communication in that the messages are concerned with new ideas. On the other hand, adoption could refer to a process in which consumer goes through a sequence of stages. This sequence starts with a consumer being made aware of the innovation and ends with the final acceptance and adoption of the innovation. The rate of adoption is the relative speed at which innovation is adopted by members of the system. It can be represented as the numerical indicator of the steepness of the adoption curve for an innovation (Rogers, 1983).

Rogers showed that perceived attributes of any innovation plays a major role in explaining the rate of adoption. The five attributes (Relative advantage, compatibility, complexity, trialability and observability) explain almost 49 to 87 percent variance in the rate of adoption (Rogers, 1983). In addition, other four variables (a) type of innovation-decision (b) nature of communication channels diffusing the innovation (c) nature of social system in which innovation is diffusing and (d) extend of change agent's promotional efforts in diffusing the innovation directly, affect the innovation rate of adoption (Rogers, 1983). There might be many reasons why certain people tend to adopt certain innovations. For example, the desire to seek specific social status by adopting a new innovation could be one of the indirect but main reasons for imitating the innovation (Tarde, 1903). More or less, all the reasons could be defined with the above attributes. However, irrespective of whether the product has been purchased once or frequently, it has been observed that it follows a common first purchase sales volume curve (Mahajan and Wind, 1986). Diffusion models are mathematical models which predict the diffusion of innovative technology. Many models have their origin from biology and ecology (Lotka, 1956; Pielou, 1969). One of the

first new product growth models in marketing was proposed by Fourt and Woodlock (1960). Then, Frank M. Bass proposed Bass model which described how certain population adopts new products (Bass, 1969). Bass model enjoyed acceptance among modelers since it generalized the framework of Fourt and Woodwork work. Since then, Bass model has been successfully applied to explain diffusion processes for various industries such as retail, consumer durables and telecommunications (Bass, 1969; Nevers, 1972; Dodds, 1973; Ismail and Abu, 2013). A behavioral rationale for the model is presented in terms of innovative and imitative behavior. Influentials are the first adopters of innovation and they influence other (called 'imitators') to adopt the innovation (Bulte and Joshi, 2007).

Mahajan stated that diffusion models generally focus on the generation of product life cycle to forecast the first-purchase sales volume (Mahajan and Wind, 1986). Rogers observed that the number of adoptions over time shows a bell curve, however, when the number of individuals adopting a new idea is plotted on a cumulative frequency basis over time, the distribution is a S - shaped curve (Rogers, 1983). Bass suggests a rationale of how individuals can be defined as a set of (i) Innovators (ii) Early adopters (iii) Early majority (iv) Late majority and (v) Laggards. The shape of the curve is a result of such process. Classification depends on the timing of adoption. First, only few (called 'innovators') adopt the innovation and then they influence others to adopt the same. Interaction between adopters and imitators generate a rapid growth in the diffusion process. Rate of adoption is high till the market starts getting saturated. As the time goes by, the number of potential adopters becomes less; therefore the adoption rate goes down. Using this concept, many literatures have followed these models and S curve to explain the diffusion of mobile phones (Singh, 2008), Botelho and Pinto, 2004, Gambo and Otero, 2009). Therefore, we also hypothesize that the growth of smartphone density would follow the S - curve.

3. MODELS FOR DIFFUSION

Many models could be used to explain the S

shaped curve, however, two mathematical functions, which have been used frequently to explain the new product diffusion process, are Logistic and Gompertz. Wang and Kettinger used the logistic model to survey the diffusion of number of cell sites and numbers of subscribers in US (Wang and Kettinger, 1995). Rai used these models to forecast the future development of Internet (Rai and Samaddar, 1988). Gurbaxani found the S shaped pattern of BITNET consistent with the logistic curve (Gurbaxani, 1990). Authors of the study additionally used exponential function to explain growth from January 1981 to Jan 1994. However, the authors also admitted that exponential function could only be used in the early stages of the diffusion, since this function has no saturation level. Logistic and Gompertz models allow growth rate to increase in a certain way and eventually slow down to a finite saturation level. Both describe the S shaped phenomenon for diffusion. However the rate of the function is defined differently.

As per the Logistic function, the rate of diffusion would be directly proportional to the product of existing smartphone subscribers and the remaining untapped market. Therefore, the function can be described by the following equation:

$$N = \frac{s}{(1 + xe^{-yt})} \tag{1}$$

The Gompertz function defines that the rate of smartphone subscribers is proportional to the existing level of the smartphone subscribers and the logarithm of the smartphone subscriber density level. Therefore, the following equation describes the model:

$$N = Se^{-xe^{-yt}} \tag{2}$$

Where, N is smartphone density (number of smartphones per 100 people); S is saturation level density (point of highest density when the growth rate of diffusion would tend to become 0); x and y are positive constants. Please refer to the Annexure 2 for further explanation on model equations.

One of the main parameters, which are used in the analysis, is the saturation level density of smartphone. A smartphone is a recent innovation and since its adoption is still in the process at a high rate, therefore it is logical to assume that the saturation level of smartphone in India is yet to be achieved. In order

to arrive at a number for smartphone saturation level which could be used for analysis, we would refer to saturation level of mobile phone in India (let's assume this value is 'A') from available literature and then assume that smartphone would reach the same level in India in few years. Since smartphone is an advanced version of mobile phone, we consider this assumption to be valid. However, to make sure that the most appropriate saturation value is being analyzed, we would consider a range of saturation level values around 'A' and carry out the model estimation. Saturation level, which provides the best R^2 value and lowest MSE would be accepted as the suitable value. Furthermore, the scenario analysis would provide the scenarios for different possibilities.

Various studies have estimated different saturation levels for different markets. Saturation level in Portugal was estimated to be at 67.4% (Botelho and Pinto, 2004). In Finland, Frank expected the penetration level to be 91.7% in 2009 (Frank, 2000). For India, Singh estimated the saturation level of mobile phones to be 120 phones per 100 people (Singh, 2008). Singh also described that the saturation level of mobile-density would most likely depend on country's adoption timing and tendency. Therefore, it would be important to identify whether the specific country is an early adopter or late adopter. Since developed countries (in this case early adopters) already have the infrastructure for landlines, they would incur high costs of switching (from landline to mobile). Therefore, they would tend to have a lower saturation point. However, developing countries (in this case later adopters) already lack infrastructure and therefore would tend to have a high saturation point due to lower switching costs. Current penetration of smartphone in other developed countries (such as Hong Kong and Singapore) has already reached a high level. Considering this, we would first assume that saturation level in India would easily cross the 90 level and reach the point of 100 smartphones per 100 people (India has high migration from feature phones to smartphones). Therefore, 100 is our 'A' value. Now, we would conduct the analysis with a range of saturation values starting from 70 to 120 (70, 80, 90, 100, 110 and 120). The value, which provides the lowest Mean Square Error (MSE), would be considered as the right saturation level.

Furthermore, it is very important to understand the start date of the diffusion. Apple's iPhone was one of the first innovative products which revolutionized the entire domain of smartphone. Soon, many other companies followed the same path with their own products. Considering such development, one could easily credit iPhone introduction for the beginning of smartphone era. In India, iPhone was introduced on August 22, 2008 (Reuters, 2008); therefore, we can assume 'Year 2008' as the start date for the beginning of this diffusion process in India.

4. METHODOLOGY

The paper follows the secondary data research methodology. Diverse set of literature has been reviewed in this regard. Such review enables us to understand the existing work which has been done in the space of diffusion and modelling for technology products, particularly mobile phones. It helps us understand whether estimating the diffusion of smartphone would be possible using available models. Post this analysis, suitable models (Logistic and Gompertz) have been selected for further study.

Data for the smartphone shipment in India was referred from International Data Corporation (IDC). The data was converted into density (no. of smartphones per 100 people) using overall tele density and population data referred from the Telecom Regulatory Authority of India (TRAI). Model equations were rewritten into linear forms and then ordinary least squares (OLS) method was used for these equations to find out the better fitting curve. OLS provides the value of equation parameters (x and y) for available density values. A range of saturation values was

used for estimation process. The specific saturation value, which provides the least mean square error, has been used for writing the final model equation. Final equation forecasts the smartphone density values India is estimated to experience in coming years. These forecasted density values coupled with the projected population data provides the total number of smartphone subscribers in India at different times. In addition, two different scenarios with lower and higher saturation values were also estimated.

5. ANALYSIS AND RESULTS

Model equations (1) and (2) could be rearranged and rewritten in the following logarithmic forms respectively:

$$ln\ (\frac{S}{N}-1)=\ ln\ x-yt \qquad (3)$$

$$ln\ (ln\ (\frac{S}{N})\ )=\ ln\ x-yt \qquad (4)$$

Using equations 3 and 4, data were plotted on linear graphs and then Ordinary Least Squares (OLS) method was used in Microsoft Excel to estimate the values of constant x and y. For the given density values, above stated linear log equations for Gompertz model provides better R^2 value than the logistic model (Please refer to the Annexure 3 for respective graphs). Therefore, it has been concluded that the Gompertz model fits better than the logistic model and is more appropriate to explain the S shaped phenomenon and forecast the diffusion process of smartphones in India. Going one step further, a range of different saturation values was used in the Gompertz model which yields different mean square error (MSE) values.

Table 1: Gompertz model parameters for different saturation levels

$N\ =\ Se^{-xe^{-yt}}$				
Saturation level (S)	lnx	y	R^2	Mean Square Error (MSE)
70	1.9694	0.2145	0.9936	0.07234
80	1.983	0.2069	0.9939	0.06694
90	1.9952	0.2006	0.9942	0.06293
100	2.0063	0.1954	0.9944	0.05908
110	2.0163	0.1909	0.9946	0.05597
120	2.0256	0.1869	0.9947	0.05384

Out of all the values, least MSE corresponds to the saturation value 120. Therefore, this is being used as the most suitable value for S. It estimates that in saturated state, the penetration rate would be 120 smartphones per 100 people in India. The OLS method also gives the following values for equation parameters: x = 7.5807 (where lnx = 2.0256) and y = 0.1869. Hence, the final Gompertz equation for smartphones could be written as:

$$N = 120 \ e^{-7.5807e^{-0.1869t}} \tag{5}$$

Following figure presents the above equation in a graphical manner (where Y axis presents the smartphone density (per 100 people) and X axis presents the time (years).
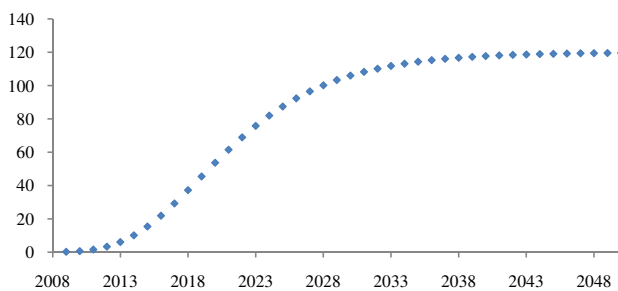
Figure 3: Estimation of smartphone penetration in India

At t = 0, the model provides the starting density value as N_0 = 120/ $e^{7.5807}$ = 0.061. However, when t becomes very large then N tends to reach the saturation value. The inflection point of the curve occurs at   or t = 10.84 years. The function reaches the maximum penetration rate at this point. Rate of growth of density would increase till 2018 and then would start decreasing. The density value would be approximately 44 mobiles per 100 people (N = S/e) at this point.

Using different t values, smartphone density values in India at different times can be forecasted. In order to calculate the total number of smartphone users, we would refer to the population estimates by a United Nations report "*World Population prospects: The 2012 Revision*". This report projects the population of India to reach 1418.75 million in 2025. This is equivalent to an average population growth rate of 1.11% per annum (from 2013 to 2025). The report also projects an average annual population growth rate of 0.57% from 2026 to 2050. Using estimated values of the population and smartphone density, it can be estimated that India would touch 716.74 million smartphone users in 2020. Therefore, one could say that on an average 90.99 million new users would be added per year (from 2013 to 2020)[1]. Furthermore, the total number is projected to reach 1234.61 million in 2025, with an average 103.58 million additions per year (from 2020 to 2025).

Table 2: Gompertz equation and estimation with saturation value 120

$N=120 \ e^{-7.5807e^{-0.1869t}}$		
Year	Smartphone density (per 100 people)	Smartphone subscribers (million)
2016	21.93	280.27
2018	37.26	486.82
2020	53.66	716.74
2022	68.97	941.77

5.1 Scenario analysis

We also project two different scenarios for the smartphone market in India. We understand that the market is always volatile and subject to many internal and external factors (such as policies, natural events, innovations, social trend etc.) which could easily impact the growth of any product. Therefore, this analysis presents two more scenarios with saturation values 80 and 100. If the market gets saturated at density value 80 smartphones per 100 people, Gompertz equation estimates the smartphone user base in India to be 582.52 million by the end of 2020 (an average addition of 71.82 million smartphones per annum). However, at the saturation value 100, India would have 654.79 million smartphone users in 2020. Following tables present the scenario analysis with an estimated density and cumulative subscribers.

---

1. Actual value for 2013 has been considered for this calculation

Table 3: Gompertz equation and estimation with saturation value 80

$N = 80 \ e^{-7.4.3.58e^{-0.1954t}}$

Year	Smartphone density (per 100 people)	Smartphone subscribers (million)
2016	19.97	255.19
2018	31.96	417.53
2020	43.61	582.52
2022	53.57	731.42

Table 4: Gompertz equation and estimation with saturation value 100

Year	Smartphone density (per 100 people)	Smartphone subscribers (million)
2016	21.07	269.22
2018	34.86	455.51
2020	49.03	654.79
2022	61.74	843.00

6. CONCLUSION

The telecommunication industry has experienced drastic growth over the last decade. The availability of cheaper mobile data tariffs, increasing spending power, low cost phones, growth of generation C, eagerness to try new products are some of the primary reasons responsible for such growth. In India, smartphone was first introduced in 2008. It had a slow adoption rate for the first 3-4 years, however, now the rate has gone up significantly. Gompertz and Logistic models enable us to forecast the smartphone diffusion in India. Mathematically, Gompertz model has found to be a better fit for the available data. Gompertz curve estimates that the adoption rate would keep increasing till 2018 (This is the inflection point). Then, the rate would start to come down, even though the cumulative density would keep increasing. This would result in a S shaped curve. In 2020, the no. of smartphone in India is estimated to be 716.74 million. By 2020, total 636.94 million smartphones would be added to the pool. New 517.88 million smartphone consumers would be added to the base

between 2020 and 2025. The curve also shows that the number of smartphones would exceed the population in 2028 when the smartphone density crosses 100.

Though the study projects scenarios for the diffusion process, it is bound by few limitations. First, our approach consists of one model to explain the diffusion process. Though, literature has already explained the S shaped phenomenon using these models, we think that other external market factors, such as the continuous innovation and infrastructure development could play a very big role. Innovation could drastically change the market. Mobile data offers and consumer preferences for pre-paid and post-paid mobiles have also emerged as one of the key parameters impacting adoption. Further research could be extended in these areas. The study could also be extended to include the impact of factors such as product utility, price and peer effects. In addition, government's recent policies such as e-waste handling could prompt manufacturers to adopt a new product distribution or recycling strategies, which could easily affect smartphone diffusion.

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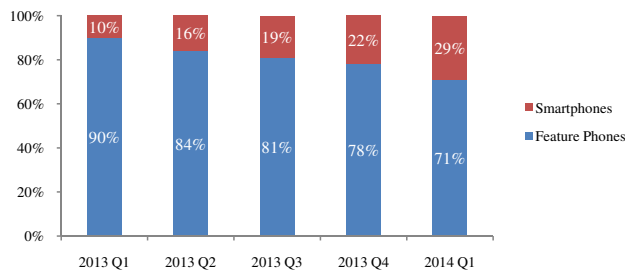
Figure 4: Migration from feature phones to smartphones
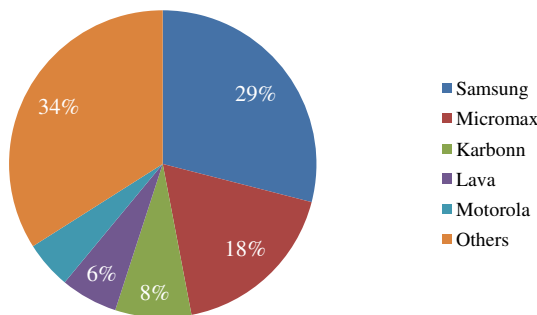
Figure 5: Smartphone vendor share in 2014 (Second quarter)

ANNEXURE 2

Let's take 'N' as the smartphone density, which is the dependent variable in the equation and 'S' represents the saturation density, which the curve would reach in the long term. As per the Logistic function, the rate of change in density of smartphone subscribers is directly proportional to the product of exiting smartphone subscribers and the remaining untapped market. Therefore,

Integration of the equation over t gives the following equation:

S = Saturation level (point of highest density when the growth of diffusion would tend to become 0); x is a positive constant. Values of x and y describe the shape and slope of the curve. At t = 0, N = S/(1+x). The rate would reach its maximum value at the inflection point. At that point   and   .

Similarly, the Gompertz function defines the rate of

smartphone subscribers. The rate of subscribers is proportional to the existing level of the smartphone subscribers and the logarithmic of the smartphone subscriber density level. Therefore;

Integration of the equation over t gives the following equation:

At t = 0, . At , the rate would be maximum with value.

ANNEXURE 3
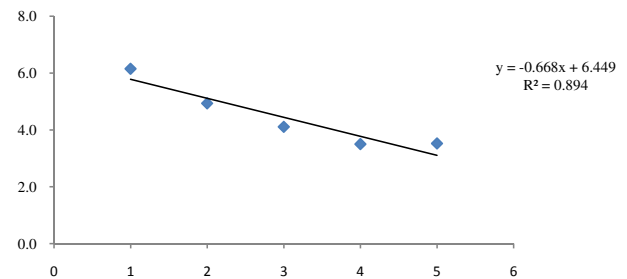
Figure 6: Linear logarithmic (Logistic) for saturation value -100
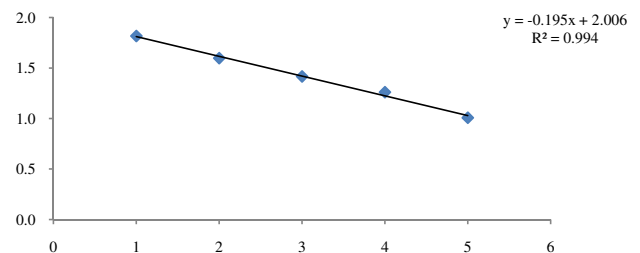
Figure 7: Linear logarithmic (Gompertz) for saturation value -100
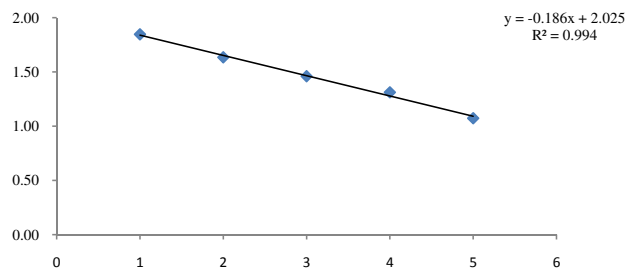
Figure 8: Linear logarithmic (Gompertz) for saturation value -120

Relationship between Market Structure, Efficiency and Performance in Indian Banking Industry

Swati Dhawan* and Madhu Vij**

Abstract

Recent changes in the banking business due to technological innovation, value creation, concentration and increased competition have all aimed to improve productivity and efficiency in banks. Keeping in view the changing landscape, Reserve Bank of India (RBI) has also been focusing on a globally competitive and robust banking sector in India. In this changing context, the major challenge before policy makers has been to allow development of appropriate institutional structures that would respond to challenges posed by an open and liberalized financial regime. Using data of scheduled commercial banks in India for the year 2013-14, two competing structural hypotheses explaining the relationship between performance and market concentration are tested in this paper. The empirical results reject the traditional structure conduct performance (SCP) hypothesis, instead making a case for efficient structure hypothesis. This is to say that efficient operation of banking firms is vital for having higher profitability in case of India. No evidence is however found to support the two intervening hypotheses. Further, size and ownership structure are also found to be variables significantly impacting the performance of banks.

Keywords: Productivity, Efficiency, Size, Ownership structure

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1. INTRODUCTION

The last decade has seen a rapid transformation in the Indian banking sector. The recent changes in the banking business due to technological innovation, value creation, concentration and increased competition have all aimed to improve productivity and efficiency in banks. Keeping in view the changing landscape, RBI has also been focusing on a globally competitive and robust banking sector in India. In this changing context, the major challenge before policy makers has been to allow development of appropriate institutional structures that would respond to challenges posed by an open and liberalized financial regime. Also, it has been emphasizing on financial inclusion, whereby banking services are accessed easily by the underprivileged sections of the society. Mr. Raghuram Rajan, Governor RBI, has recognized that strong national institutions are hard to build and thus the existing ones should be nurtured from the outside, and constantly rejuvenated from the inside, for there are precious few of them. (Times of India, 3rd April, 2015). These trends may however create a public policy concern about the degree of concentration in banking market. With this context in the background, the relationship between market structure, efficiency and performance assumes importance.

Two competing structural hypotheses explaining the relationship between performance and market concentration are Structure-Conduct-Performance (SCP) paradigm and Efficient Structure (EFS) hypothesis. The SCP postulates that fewer and larger firms (indicating higher concentration) are most likely to engage in anti-competitive conduct. Banks are able to generate higher profits when they collude and gain monopoly power in being able to set high prices. Alternatively, the EFS asserts that banks, with large size, are more efficient, thus boosting their performance. Accordingly, the levels of concentration and efficiency can be studied to see its impact on market structure of banking industry and banks' performance. The objective of the present study is to test the above-mentioned hypotheses in the Indian banking sector. Two intermediate hypotheses shall also be tested – Modified efficient structure hypothesis and Hybrid of efficient structure

and traditional SCP (developed by Schmalensee, 1987). The modified efficient structure hypothesis asserts that performance is a function of efficiency as well as market share. Alternatively, the hybrid hypothesis states that it is both, efficiency as well as concentration, which influence performance.

Apart from being within an institutional setting of an emerging economy, the Indian banking industry provides a suitable testing ground for several reasons. First, it is characterized by the existence of both public and private banks in a largely deregulated and an increasingly competitive environment. Second, the banking industry provides a test for performance differentials not only between public and private enterprises but also between different types of private ownership, foreign and domestic. A comparison across the entire spectrum of ownership forms can give important insights into the factors responsible for emerging trends. Further, Indian banking industry is highly concentrated. The public sector banks (SBI group and nationalised banks) occupy a dominant position in the market. As per RBI statistics, more than 70% of assets and deposits were held by PSBs in 2013-14. (Figure 1 and 2). Finally, such a study would provide insights with respect to an industry in which mergers have become an important policy issue.
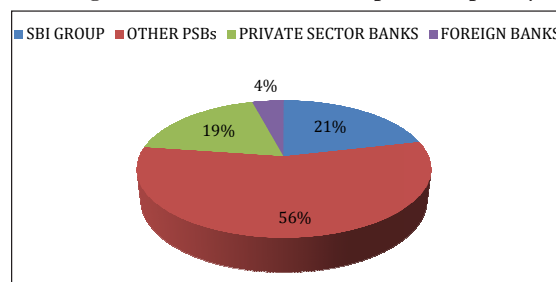

Figure 1: Percentage share of deposits- Bank group wise 2013-14
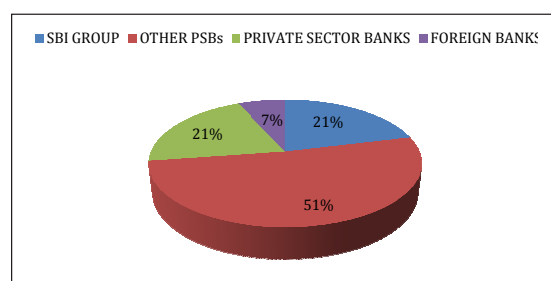

Figure 2: Percentage share of assets-Bank group wise 2013-14

The rest of the paper is organized as follows. The second section provides a review of literature. Section 3 describes the research design and methodology and empirical results are presented in section 4. Section 5 presents the major conclusions of the study and recommendations.

2. REVIEW OF LITERATURE

The objective of current review of literature is to examine the research methodologies employed in the past and the conclusions derived therefrom in various studies on market concentration, efficiency and performance in banking sector. Different studies in the past have used two alternate approaches to study bank behaviour – structural approach and non-structural approach. Structural approach finds its basis in the traditional industrial organizational theory. Herein, two competing hypotheses are used to explain the relationship between bank performance and market concentration - Structure-Conduct-Performance (SCP) paradigm and Efficient Structure (EFS) hypothesis.

It is observed that a majority of the studies on SCP in banking relate to US and European markets. Gilbert (1984), in his survey reports that out of 44 studies reviewed on the US banking industry, 32 studies have found support for traditional SCP paradigm. Notable amongst them have been Berger and Hannan (1997, 1998), Rhoades (1982) etc. While its theoretical foundations are well established, the applicability of SCP to banking firms is not rigorously justified. The alternative theory - efficient structure hypothesis, proposed by Demsetz (1973), has found support with authors such as McGee (1974), Jovanovic (1982), Brozen (1971), Evanoff and Fortier (1988), Berger (1995), Smirlock (1985), etc. The study by Maudos (1996) found results supporting the modified efficient structure hypothesis.

While a large number of studies have examined the impact of market structure and efficiency on performance, much systematic research as yet is needed for emerging market economies. The study by Gelos and Roldos (2002) discusses the main forces shaping bank consolidation in major emerging markets and describes the patterns of consolidation and concentration using traditional indicators of market structure. The study of banking industry of Sri Lanka by Lalith Seelanatha (2010) shows that performance does not depend either on market concentration or market power, but rather on the level of efficiency of the banking units. Ye, Xu and Fang (2012) tested for alternative structural hypotheses using panel data of 14 largest banks in China, concluding that neither SCP nor EFS holds true in case of China. They found a strong support for relative market power hypothesis, highlighting the role of product differentiation and market share driving bank profits. Indian banking has been an area of research by numerous scholars in the past. Notable amongst these have Sarkar, Sarkar and Bhaumik (1996), Bhattacharya and Das (2003), Sathye and Sathye (2004), Sahoo and Mishra (2012) etc. Bhattacharya and Das (2003) examined the nature and extent of changes in market concentration and its possible implications on prices and output of banking services. The paper finds a strong evidence of change in market structure of the banking sector and reveals that a major part of change occurred during the early 1990s. Sahoo and Mishra (2012) took the panel data set of Indian banks during 1999-2009 and suggested towards strong inter-linkages amongst structure, conduct and financial performance of banks.

However, dramatic changes taking place in Indian financial landscape sharply limits the significance of past literature for current policy decisions. The present study thus seeks to provide a fresh perspective using the data for SCBs in India for the year 2013-14.

3. RESEARCH DESIGN

This section seeks to provide a framework for testing whether the banking market in India is collusive or efficient. On the basis of knowledge gained by reviewing some important research efforts made in the past and an exploratory examination of the reports published by RBI, the research design is developed and presented. The following regression model is being estimated.

$$ROA = \alpha_i + \beta_1 \, HHI_i + \beta_2 \, EFF_i + \beta_3 \, DEPMKTSH_i + \beta_4 \, LOGASS_i + \beta_5 \, OWNDUM_i + e_i$$

We now define the dependent and independent variables as used in the study.

3.1 Profitability

Return on assets (ROA) is a measure of profitability used in analysis. It is a widely used measure and finds support with authors such as Rhoades (1985), Evanoff and Fortier (1988) etc. It indicates how profitable a company is relative to its total assets.

3.2 Market concentration

The importance of market concentration finds its theoretical justification in Structure – Conduct – Performance (SCP) paradigm (Bain 1951), which postulates that fewer and larger firms are more likely to engage in anti-competitive conduct. Hirschman-Herfindahl index (HHI) has been the most widely used measure of concentration by researchers as well as regulators. It is defined as the sum of squared market shares of all banks in the market. Being a summary measure, the structural changes in all parts of the distribution influence the value of concentration index. The current analysis computes HHI index based on market share of each bank in asset market. A significant positive correlation between profitability and market concentration would indicate that there is not enough competition and firms are able to extract higher profits because of collusive arrangements. In such a case, merger proposals would need to be very carefully analysed before being approved.

3.3 Efficiency

Efficient structure hypothesis alternately postulates that higher profits are generated when big firms with lower costs are more efficient than other firms in the market. The X-efficiency scores for individual banks are calculated using Data Envelopment Analysis (DEA). It is calculated by minimizing the ratio of weighted inputs to weighted outputs for a decision making unit (DMU), subject to a condition that similar ratios for all other DMUs be less than or equal to one. Here, each individual bank is treated as a DMU. The DEA measure compares each of the banks in the sample with the best practice in the sample and is thus a direct measure of efficiency. Following Berger et al (1989, 1993, 1994), the inputs used in the study for calculation of X-efficiency scores are interest expenses and non-interest expenses, while outputs used are interest income and non-

interest income. This measure is expected to have a positive and significant coefficient if efficient structure hypothesis is to hold true.

3.4 Market share

Market share of the bank is a variable used to account for characteristics of banks other than the efficiency. The deposits held by banks have been used to capture the market share variable (DEPMKTSH) in the present paper.

3.5 Size

Following the earlier studies (Goldberg et al 1996, Smirlock and Michael, 1985) bank's size is used to account for banks' diversification ability. If large banks were able to capture significant cost advantages over small banks, banks size should be positively related to the profitability. The total assets of the banks are accordingly taken as a proxy for size in our model. We use log of total assets (LOGASS) in our regression equation.

3.6 Ownership

Ownership structure may be assumed to have a limiting effect on the decision making capabilities of banks especially the state-owned banks. Several previous studies being reviewed have shown that privately owned banks are seen to have relatively more freedom to set firms' operational policies and procedures. It may accordingly indicate towards a positive influence of private ownership on bank's profitability. Thus the impact of ownership is accounted for by introducing a dummy variable (OWNDUM). The variable takes the value '0' if the bank is a public sector bank (which includes SBI group and nationalised banks) and '1' if bank is a private bank (including foreign banks).

Table 1 provides the variable names along with the symbols used.

The annual data is collected for all scheduled commercial banks in India for the year 2013-14. The total number of observations is 90. United Bank of Switzerland (UBS) AG bank is however excluded from the study on account of missing data. Thus the total banks finally included in the study are 89. The data is collected from an annual RBI publication – Statistical tables relating to banks

in India. Before regression is run to estimate the parameters, the usual checks are done.

Table 1: Variable names and symbols

Variable name	Symbol used
Return on assets	ROA
Herfindahl Hirschman index (measure of concentration)	HHI
X-efficiency scores using DEA analysis	EFF
Deposit market share	DEPMKTSH
Log of total assets	LOGASS
Ownership dummy	OWNDUM

Table 2: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Median
ROA	89	-6.570000	5.280000	0.907978	1.613020	0.880000
LOGASS	89	2.841779	7.253395	5.285237	1.086123	5.458766
EFF	89	0.008074	1.000000	0.187453	0.343410	0.008074
HHI	89	4.01E-07	267.2350	5.832848	28.86457	0.068807
DEPMKTSH	89	6.68E-07	16.34110	1.123596	2.173717	0.217656

Table 3: Correlation amongst variables

	DEPMKTSH	EFF	HHI	LOGASS
DEPMKTSH	1.000000			
EFF	-0.278862	1.000000		
HHI	0.874682	-0.111094	1.000000	
LOGASS	0.608987	-0.664504	0.311998	1.000000

4. EMPIRICAL RESULTS AND DISCUSSION

In this section we present the findings of the empirical analysis. First we review the descriptive statistics and correlation coefficient of data related to variables used in the analysis. Later we present the results of the analysis.

4.1 Descriptive Statistics

Tables 2 and 3 present descriptive statistics and correlation coefficients respectively, testing normality and correlation among the independent and dependent variables.

The standard deviation of the data shows large statistical dispersion in the data used indicating that the data points are spread over a wide range of values and are highly variable (Table 2). Amongst the variables studied, we find that the maximum variability is observed for only one - the HHI index. Table 3 presents the results of the correlation among the independent variables. The multicollinearity is tested using Variance Inflation Factor (VIF). We find no problem of multicollinearity in the independent variables chosen for our analysis.

4.2 Results

The main research question raised in this paper is whether it is the market power (which results from high market concentration) or the firms' efficiency that is important in determining overall firm performance. Table 4 presents the regression results. The estimated coefficient for market concentration variable (HHI) in the model is not statistically different from zero. The result finds that market concentration does not have significant association with banks' profitability. Rather it is the independent variable, X-efficiency score (EFF), that is found influencing ROA positively and significantly at 1% level. This is suggestive of efficient structure hypothesis appropriately describing the Indian banking market. However, it also needs to be noted that the efficiency scores for many banks

are found to be considerably less than 1, suggesting towards the untapped potential to improve efficiency. The variables proxing for the other two hypotheses – Modified efficient structure (DEPMKTSH) and Hybrid – are also not found to be significantly related with ROA.

Table 4: Regression results

Variable	Coefficient	p – value
CONSTANT	-4.445094	0.0090**
HHI	0.001098	0.9431
EFF	2.335458	0.0006*
DEPMKTSH	-0.056435	0.8245
LOGASS	0.789247	0.0090*
OWNDUM	1.149727	0.0217**
R^2	0.173813	
ADJUSTED R^2	0.124043	
DURBIN WATSON STATISTIC	2.185817	
Observations	89	

*significant at 1% level, ** significant at 5% level, *** significant at 10% level*

The log of assets, being used as a proxy for size, also shows a positive and significant relationship with bank performance at 1% level. Also the ownership effect comes out to be statistically significant at 5% level.

Table 5: Heteroskedasticity test-White

F-statistic	1.442129	Prob. F(19,70)	0.1361
Obs R-squared	25.31858	Prob. Chi-Square(19)	0.1503
Scaled explained SS	101.9891	Prob. Chi-Square(19)	0.0000

The Durbin-Watson statistic is close to 2 indicating that there is no auto correlation in the residuals. Further, the result of White test (p-value of observed r squared is greater than 0.05) suggest that residuals are homoscedastic as presented in Table 5.

5. CONCLUSIONS AND RECOMMENDATIONS

In this paper, two alternate structural hypotheses explaining the relationship between performance and market concentration are tested in case of Indian banking. Confirming the major arguments raised by Molyneux (1999) against the profit-concentration relationship, the present study rejects the traditional SCP hypothesis. On the contrary, the empirical results point out that efficient operation of banking firms are vital for having higher profitability, making case for efficient structure hypothesis. No evidence was however found to support the two intervening hypotheses. Size and ownership structure are also found to be variables significantly impacting the performance of banks.

The results of this paper have certain key policy implications. One, in case of India, where mergers have become a major policy issue, efficiency hypothesis finding support, can put forward the case of mergers being looked upon favorably. Also, though it is generally asserted that deregulation and liberalization are aimed at making banking industry competitive, acceptance of efficiency hypothesis provides the empirical evidence for the same. However, in developing economies like India, banks still remain to be highly regulated and thus collusion may not be that easy and prompt. In such a case, product differentiation may play a key role in achieving the desired objectives. Further, in the last few years, non-performing assets (NPA) of banks, particularly those in public sector banks, have been rising due to stalled projects, sluggish domestic growth and slowdown in many parts of the global economy. NPA topped Rs. 3 lakh crore as on December 2014, of which Rs. 2.62 crore belong to nationalized banks alone. (Hindustan Times, 3rd April, 2015). Also, major developments are taking place in the financial architecture with RBI giving licenses to payment banks to further the goal of financial inclusion, government's announcement of setting up of Banks Board Bureau (BBB) to deal with governance issues, stressed assets and raising of capital by PSBs etc. In this scenario, significant policy changes to improve the efficiency and productivity of the banking industry gain utmost importance.

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Status of Health and Safety Measures in Indian Automobile Sector

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Abstract

Success of any organization does not solely depend upon money but workforce also plays a very significant role because in today's scenario human resources are treated as an indispensable asset rather than a liability. Just like blood for a human body same as with human resources for the organization whether manufacturing or service. So, it is a prime obligation for an employer to maintain and develop this asset. In this epoch of intense competition foremost priority of an organization is to maintain the health & safety standards of its human capital. The aim of this paper is to find out whether the health and safety provisions as provided by the Acts and Statutes are implemented in automobile manufacturing organizations or not. The data was collected through a structured questionnaire from different automobile manufacturing units. Factor analysis was used to reduce the statements and carve out the relevant factors and t-test and ANOVA was applied to check the variations among the employees' responses.

Keywords: Health and safety, Accident, Injury, Safety management, Employees

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1. INTRODUCTION

With the rapid change in technology, machines have replaced human beings very effectively and efficiently. While not ignoring the positive aspects of these techniques, there are also some negative impacts as use of innovative machinery and flammable things at workplace affects the health and safety of employees. Health and safety measures refer to all facilities provided to the employees while performing their day to day tasks smoothly and helpful in reducing any types of causality and thus is a very central facet for any organization. It is true that quality products can enrich the image of organization but its goodwill is the more important. 1984, Bhopal gas tragedy was an eye opener not only for chemical industry but also for other sectors where thousands of people have lost their life due to that catastrophe. This was a strong signal to the government to create and implement laws for better health and safety measures for both employees as well as society. Basically, two forces motivate an employer to upgrade health and safety conditions i.e. quality products and its own reputation. Performance of an organization is directly associated with health and safety facilities provided by it and technology up-gradation, workplace safety, worker-supervisor relations, rule and regulations regarding health and safety and its implementation are some factors which plays a significant role in building health and safety climate in industry which cannot be ignored at any cost.

Use of highly technical machines while manufacturing somewhere increases the chances of fatal accidents. So, there should be proactive policies regarding health and safety of employees. Moreover, time to time revision and appropriate improvements should be done. In manufacturing, Automobile sector is very prominent sector which generates employment and increase growth rate of the country. In Haryana state, both foreign and Indian companies are engaged in manufacturing work for automobile sector which attracted the attention of the researchers for present investigation. Hence the locale of the present investigation is industrial organizations engaged automobile sector in the state of Haryana with particular focus on health and safety measures opted by these industrial units

2. REVIEW OF LITERATURE

Zohar (1980) argued that assessing the shared perceptions guiding appropriate and adaptive safety related behavior based on cues in the environment. In scientific literature on safety, a very little attention has been paid on finding the solutions of occupational hazards and from his own experience, Swuste (1996) remarked necessary improvements in health and safety. Both quality movement change in technologies and change in operational research regarding operation function; workforce diversity and organized labour interest regarding human resource functions are some factors that increases the importance of issues related to operational managers. External factors like Political, legal and public also have influences operation management. A cost based modeling approach has been developed for evaluating safety requirement by (2000). According to this approach a fuzzy set modeling and evidential reasoning are combined to assess both safety requirement and cost incurred. Both these are then combined to obtain the preference degree connected with all option of safety provisions specifications for selecting the best one. This approach is beneficial to the safety programs. In addition to this a risk assessment approach has been given by Cagno et al. (2003), which uses analytic hierarchy process (AHP) to estimate risk in a direct and holistic manner. These methods show a variance as compared to established method. Methodology allows supporting risk characterization and prioritization of hazards in a hierarchical structure. Influence analysis of key reason of risk machine, worker, measures and environment providing by management with a normal framework to make decisions and assign resources also supported by this study.

Analytic hierarchy process may be an alternative to current goal oriented approach and can be substituted with hybrid structural international matrix. Whitaker et al. (2003) argues that progress of a prototype judgment assist to encourage access scaffold safety

and guide by an examination of the root-causes and management deficiencies evident in: paper and by soft file by computer held by the Health and Safety Executive (HSE) in the UK since 2000. Major causes behind this are fitting of faulty machinery, unofficial alteration of the structure, omission of barriers, easily detectable structural faults, common managerial deficiencies, failure to control risk, unsafe methods & procedures, inadequate training and supervision etc. Furthermore, a quasi-experiment field study conducted by Hickman and Geller (2003) and found that employees, who work in relative isolation as compared to traditional industrial workers, may benefit from a process by which they can systematically observe themselves. Apart from these studies, Siu et al. (2002) found linear and curvilinear relation between age and safety performance and cleared that age was not related to accident rate and in curvilinear manner age is related to occupational injuries, firstly injuries is increased with age then decrease. A real option approach introduced by Farrow and Hayakawa (2002) for decision making in the private sector for regulatory decisions that involve irretrievable and uncertain safety impacts, social costs that differ from personal costs, and variation in perception among the stakeholders and decide if it is best possible to spend in safety even if the expected costs significantly exceed the estimated benefits.

An empirical demonstration has been given by Zohar's (2000) study of 53 work groups in a single manufacturing company corroborated both intra group homogeneity and inter group variation in safety-related perceptions within the organization at supervisory level and found that groups are differed in terms of perception of safety over a range of facets, or aspects of the organization. Further, Patel et al. (2011) discussed about the progress of the industrial safety and occupational health movement in the United States towards their goal of protecting the physical welfare of workers and also evaluate the current problems & relationship among safety health and compensation. There is positive influence on safety performance, competitiveness performance and financial performance

by safety management (Muniz et al., 2009). These are important factors which boosts the firm to implement a safety management system. Apart from previous study, Nenonen (2011) studied typical fatal occupational accidents, its contributing factors and their preventive measures while manufacturing tasks found that dangerous work practices and insufficient hazard identification most frequently contributed to accidents. Statistical difference was found between outsourced and in-house operations and suggests that safety of outsourced manufacturing operations should be considered thoroughly in order to prevent accidents and ensuring occupational safety. Further, Chan & Alan (2011) investigated the understanding of industrial safety signs and messages by registered and non-registered S O in Hong Kong with ten different user factors to examine the relationship between cognitive sign features and sign comprehensibility. Findings revealed that out of ten factors tested; only the factor of possession of registered safety officer status was a significant predictor of comprehension performance Quartey & Puplampu (2012) examined employee health and safety practices in the shipping and manufacturing industries and found that employees in the shipping and the manufacturing industries are prone to employee health and safety hazards. Shipping industry had more employee health and safety initiatives than the manufacturing industry. Demographic conditions do not influence employees' attitude towards health and safety practices. Punia & Kumar (2012) explored the reasons of accidents, coworker's safety, supervisor's safety; employees' compliance with safety behavior and as a whole health and safety climate and the safety management has a positive influence on performance of firm.

In terms of application to the issue of accident reduction in high risk industry, the safety culture approach to accident fall emphasizes the role played by social forces within an organization that act upon its members with respect to safety (Clarke, 1999). It had been suggested that culture reaches uniformly into all parts of the organizational structure and exerts a consistent effect. This is the reason for its improvement more effectively than increased

supervision or more precise procedures in enhancing safety performance (Reason, 1998). Reason (2000) proposed that an organization's safety culture takes on a deep implication at the point where accident rates reach a "plateau", i.e. where negative result statistics base out at some asymptotic value. In order to go beyond this "small but (seemingly) unassailable" plateau and to continue enhancement in safety performance, it is necessary to address the hearts and minds of the management and labour (Lee, 1998). This plateau is often reach after necessities for safety "hardware and software" (i.e. barriers and procedures) have been met (Cox and Cox, 1991). (Nunez & Villanueva 2011) combined the research framework on intellectual capital with traditional OSH concepts by developing a theoretical link and found occupational health and safety should be considered among the sources of intellectual capital of the firm. In addition to these studies Eid et al. (2013) examined authentic leadership related to risk perception in safety critical organizations with a hypothesis that authentic leaders influence risk perception through the mediating effect of safety climate and found that leadership are negatively related to risk perception and positively associated with rating of safety climate. Hon *et al.* (2014) compared the level of safety climate of workers, supervisors and managers in the RMAA sector; and explaining the impact of safety climate on these three categories and found that a positive workforce, safety attitude and acceptance of safety rules and regulations reduced the workers injuries at workplace and lowest mean score is found under supervisor group. Yoganandan & Sivasamy (2015) found in their study that majority of the employees belong to the age group of 31-40 year and there is a significance relationship between experienced and their perception on health and safety measures and suggested that the organization need to increase salary, take necessary action to reduce the air pollution caused by manufacturing in the light diverse laws. Though in our country there are many laws which focus on for better health and safety of employees working in various industries yet adoption of the Factories Act 1948 comes on the centre.

3. OBJECTIVES AND METHODOLOGY

The aim of this research paper is to examine the actual status of health and safety measures used in automobile companies. Nature of this study is exploratory cum descriptive which is based upon primary collected through survey. The survey was conducted in automobiles companies using a structured questionnaire having 25 statements regarding health and safety measures. The questionnaire was designed on five point scale ranging from highly available (5) to unavailable (1). Statements has been prepared with the help of health and safety provisions mentioned in factories act 1948 and all provisions have converted into simple statements for better understanding to the respondents so that they could give their best response. 600 questionnaires were distributed among the prospective respondents out of which 406 responses were received. Convenience sampling method was adopted to select the respondents. The collected data was analyzed with the use of SPSS (Statistical package for social science) software. Factor analysis technique is used for reducing the unnecessary statements to carve out factors. KMO and Bartlett's test is applied to check normality of data to access data suitability for factor analysis. Further t-test and ANOVA test have been used in the light of the objectives of the study.

4. RESULTS AND DISCUSSIONS

Table1 describes status of twenty-five statutory procedures to ensure health and safety measures in automobile industry in India. Data revealed that most available measure is 'Drinking Water' with a mean value of 4.33. Few other measures also have mean very close to highest mean value of 4.33. They are 'Lighting' (mean=4.22), Disposal of waste (mean=4.20) and Safety equipment for worker (mean=4.13). Employment of young person (mean=3.25) is least available measure. It is interesting to notice that all twenty-five measures lie in either 'Highly Available' or 'Available' category of five-point rating scale. It reflects satisfactory availability of health and safety measures in Automobile industry.

Twenty five dimensions are too large for deep analysis, thus factor analysis is applied for reduction of data. Firstly KMO and Bartlett's test is applied to check normality of data and to access suitability of data for factor analysis.

Table 1: Descriptive statistics

Dimensions	N	Mean	SD
1. Cleanliness	408	4.12	.849
2. Disposal of Waste	408	4.20	.825
3. Ventilation	408	4.11	.839
4. Temperature Maintained	408	3.88	.925
5. Environment free from dust	408	3.92	.894
6. Artificial Humidification	408	3.58	.986
7. Overcrowding	408	3.80	.948
8. Fencing of Machinery	408	4.02	.888
9. Safety equipment for worker	408	4.13	1.002
10. Employment of young person	408	3.25	1.159
11. Facility of striking gear	408	3.91	.925
12. Inspection of hoist and lift	408	3.95	.909
13. Inspection of moving machine	408	4.07	.848
14. Maintenance of Floors and Stairs	408	4.09	.892
15. Prohibition from carrying excessive weight	408	3.98	.914
16. Safety guard for protection of eyes	408	4.15	.831
17. Precautions against dangerous fumes	408	4.08	.824
18. Practicable measure taken to handle explosive	408	3.96	.886
19. Maintenance of buildings	408	3.89	.852
20. Safety officer	408	3.96	.937
21. Worker participation in safety Management	408	3.90	1.001
22. Sanitation	408	4.09	.898
23. Spittoons	408	3.89	.960
24. Lighting	408	4.22	.779
25. Drinking Water	408	4.33	.826

25 statutory dimensions of health and safety were subjected to principal components factor analysis in which to define factors (scales) clearly, loadings exceeding 0.40 were considered and included in a factor [Table2]. The KMO and Bartlett's Test of .926 reveal that data is appropriate for factor analysis. Thereafter factor analysis was administered to have distinct factors out of the 25 statements and in all six factors was extracted. One dimension (Employment of young person) has been excluded because it is making one factor separately and it is not fulfilling the conditions of making the factor. Bartlett's test is sensitive to departures from normality. Significant value (<.05) indicates that data is normally distributed. The data reduction tool has reduced the twenty five practices into seven factors, which could be studied in great depth. Different number of variables comes under different factors. Few factors inscribe as many as six variables while rest of factors consists of three or four or two variable only. This reduction of data

allows researcher to explore status and potential of these health and safety practices in great detail. Now extracted factors could be devoted with quality investigation to highlight various demographical variations and fluctuations. The Six factors extracted through factor analysis as shown in the Table 3 and have been discussed accordingly.

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)		0.926
Bartlett's Test of Sphericity	Approx. Chi-Square	4504.409
	Sig.	0.000

Table 3: Factor analysis

Factors	Loading	Eigen Value	% of Variance
F-1: **Body Safety Provisions**		9.301	38.752
Safety guard for protection of eyes	.781		
Inspection of moving machine	.654		
Prohibition from carrying excessive weight	.589		
Maintenance of Floors and Stairs	.520		
Precautions against dangerous fumes	.489		
Safety equipment for worker	.451		
F-2: **Pollution Reduction Measures**		1.738	7.241
Artificial Humidification	.770		
Temperature Maintained	.640		
Overcrowding	.628		
Environment free from dust	.536		
F-3: **Hygienic Conditions**		1.348	5.615
Spittoons	.757		
Lightening	.714		
Drinking Water	.652		
Sanitation	.633		
F-4:**Workers' Participation in Safety & Maintenance Practices**		1.026	4.275
Workers' participation in safety Management	.728		
Safety Officer	.680		
Maintenance of buildings	.662		
Practicable measure taken to handle explosive	.439		
F-5: **Operational Measures**		.973	4.053
Facility of striking gear	.774		
Inspection of hoist and lift	.596		
Fencing of machinery	.478		
F-6: **Climate Factor**		.835	3.479
Ventilation	.732		
Cleanliness	.700		
Disposal of waste	.689		

F-1: Body Safety Provisions: Measures to protect any direct physical injury are included in this factor. Protection of eyes and inspection of moving machines so that any misshaping could be avoided explains approx. 6.5% of variance.

F-2: Pollution Reduction Measures: Air pollution is an integral aspect of industrial production. It has dangerous impact on health of the employees. Thus this factor considers protection for dust and fumes in factory premise and it include Artificial Humidification, Temperature Maintained, Overcrowding and Environment free from dust & fume, all these measures contribute in reduce the pollution from workplace.

F-3: Hygienic Conditions: Maslow explained that absence of hygienic conditions may lead to dissatisfaction among employees. And this psychological state is critical to health and may cause compromise with safety measures too. Thus sanitation, spittoons, lightening and drinking water etc. are included in this factor.

F-4: Workers' Participation in Safety and Maintenance Practices : It includes three variables i.e. measures to handle explosives and workers' participation in safety management, safety Officer, maintenance of buildings and practicable measure taken to handle explosive. This factor has an Eigen value of 1.026.

F-5: Operational Measures: Health and safety issue is directly related to operational process of manufacturing. In this factor Inspection of hoist and lift, Facility of striking gear and Fencing of machinery etc. are to be taken care of. This factor includes all these measures related to manufacturing process. The factor could explain 4.053% variance and has an Eigen value of .973.

F-6: Climate Factor: Working environment is one of the important factors that could affect performance and safety of the employees. Extreme or unpleasant conditions leads to psychological draining of the employees and hence chances of accidents increases. The factor includes ventilation, cleanliness and disposal of waste related issues. It has Eigen value of .835 and explains approx. 3.479 % of variance.

Now these extracted factors are subjected to further analysis to determine status of health and safety measures in Automobile sector.

Table 4 describes the six factors that come after applied the data reduction technique. Data revealed that most available factor is F6 'Climate Factor with a highest mean value of 4.14. Another factor has very close mean to highest mean value of 4.13 that is 'Hygienic Conditions. Pollution Reduction Measures (mean=3.79) is least available. It is remarkable to note that all seven factors lie in either 'Highly Available' or 'Fairly Available' category of five-point rating scale. It shows satisfactory availability of health and safety measures in Automobile industry.

Table 4: Descriptive statistics for six extracted factors

Factors	N	Mean	SD
F1: Body Safety Provisions	408	4.08	.65060
F2: Pollution Reduction Measures	408	3.79	.73875
F3: Hygienic Conditions	408	4.13	.68904
F4: Workers' Participation in Safety & Maintenance Practices	408	3.92	.72065
F5: Operational Measures	408	3.99	.69099
F6: Climate Factor	408	4.14	.68118

Source: *Primary data*

Table 5 depicts the results of t-test applied to explore statistical difference based on marital status. The responses regarding first factor (Body safety provisions) is found significantly different with married (M=4.149) and unmarried (M=3.952) respondents. The [p value - 0.004*] is less than .05 at 95% degree of confidence scale shows that there is a significant difference. In case of pollution reduction measures, the [p value - 0.034] is found

again significant and showed Married employees (M=3.851) getting higher mean value in comparison to unmarried employees (M= 3.687). Further, in Operational measures factor married and unmarried employees again differ significantly [p value - 0.021*] showed that Married employees (M=4.054) responses are falling in 'available' on five point response scale whereas unmarried employees (M=3.888) feel 'fairly available' of these measures. With respect to hygienic conditions, Workers' Participation in Safety and Maintenance Practices and Climate Factor there was no significant difference found in married and

unmarried employees' responses. Eventually, the results signify that married employees are more aware about these safety measures prevailing in the organizations instead of the unmarried employees. The reason behind these findings may be that the married employees are having more responsibilities in their personal lives and they are more conscious about health and safety and thus have additional sense of dependability of their families and relationships on them and that is why they have maturity of saving themselves and soundings from damage.

Table 5: T-test statistics for marital status and status of health & safety measures

Factors	Marital Status	N	Mean	SD	t-value
F1: Body Safety Provisions	Married	267	4.149	.6217	2.937 (.004)*
	Unmarried	141	3.952	.6858	
F2: Pollution Reduction Measures	Married	267	3.851	.7177	2.131 (.034)*
	Unmarried	141	3.687	.7683	
F3: Hygienic Conditions	Married	267	4.176	.6345	1.791 (.074)
	Unmarried	141	4.047	.7774	
F4: Workers' Participation in Safety & Maintenance Practices	Married	267	3.969	.6897	1.600 (.110)
	Unmarried	141	3.849	.7722	
F5: Operational Measures	Married	267	4.054	.6694	2.321 (.021)*
	Unmarried	141	3.888	.7200	
F6: Climate Factor	Married	267	4.158	.6962	.702 (.483)
	Unmarried	141	4.108	.6528	

Significant at 0.05 level

Table 6 explain the result of t-test applied to investigate statistical difference based on working experience of employees engaging in automobile sector. In respect to third factor (Hygienic Conditions) responses is found significantly different with experience holder (M=4.226) and employees who have no experience (4.025). The [p value - 0.003*] is less than .05 at 95% degree of confidence scale cleared that significant difference is found here. In case of Climate factor, the [p value - 0.000*] is found again significant and showed experience holder employees (M=4.310) have greater mean value as compared to without experience employees (M= 3.953). With respect to rest of the factor body safety provisions, pollution reduction measures, workers participation in safety & maintenance practices and operational measures differences is found in the response but significant difference is not found at 95% degree of confidence scale. Results of this table show that in relation to every case, experience holder employees mean value is higher as compared to fresher employees. With increasing experience, employees become more conscious towards health and safety measures may be the reason behind it. Experience holder employees can easily recognize the reasons of accident.

Table 6: T-test statistics for work experience and status of health & safety measures

Factor	Experience	N	Mean	SD	t-value
F1: Body Safety Provisions	Yes	215	4.130	.6531	1.593
	No	193	4.027	.6451	(.112)
F2: Pollution Reduction Measures	Yes	215	3.838	.7036	1.260
	No	193	3.746	.7749	(.208)
F3: Hygienic Conditions	Yes	215	4.226	.6878	2.968
	No	193	4.025	.6765	(.003)*
F4: Workers' Participation in Safety & Maintenance Practices	Yes	215	3.930	.7353	.075
	No	193	3.924	.7058	(.940)
F: 5 Operational Measures	Yes	215	4.015	.6909	.553
	No	193	3.977	.6922	(.580)
F: 6 Climate Factor	Yes	215	4.310	.5562	5.465
	No	193	3.953	.7558	(.000)*

Significant at 0.05 level

Table 7 elucidates the result of t-test applied to found statistical difference based on locality of employees. In relation to body safety provisions employees' responses is found significantly different with rural background employees (M=4.158) and employees those belong to urban area (M=4.019). The p value (0.032*) is less than significant level corroborated that significant difference is found here. In case of Climate factor, the [p value-0.035*] is found again significant and showed employees belonging to rural area (M=4.062) have lower mean value as compared to urban area employees (M=4.205). In case of other factors including Pollution reduction measures, hygienic conditions, workers participation in safety & maintenance practices and operational measures differences is found in the response but significant difference is not found at 95% degree of confidence scale. Results of this table show that on the basis of locality only two factors are significantly different. Reason of these findings may be only these two factors are important for employees whether they belong to rural or urban background.

Table 7: T-test statistics for locality and status of health & safety measures

Factors	Locality	N	Mean	SD	t-value
F1: Body Safety Provisions	Rural	182	4.158	.5557	2.147
	Urban	226	4.019	.7131	(.032)*
F2: Pollution Reduction Measures	Rural	182	3.774	.6998	-.490
	Urban	226	3.810	.7698	(.624)
F3: Hygienic Conditions	Rural	182	4.192	.5399	1.596
	Urban	226	4.083	.7867	(.111)
F4: Workers' Participation in Safety & Maintenance Practices	Rural	182	3.979	.6111	-.101
	Urban	226	3.886	.7968	(.920)
F: 5 Operational Measures	Rural	182	4.071	.5814	.566
	Urban	226	3.938	.7640	(.572)
F: 6 Climate Factor	Rural	182	4.062	.6747	-2.113
	Urban	226	4.205	.6811	(.035)*

Significant at 0.05 level

Table 8 explore the results come after applied t-test on the basis of qualification category and in respect to all factor no significant difference is found. In every case p value is more than significant level (0.05) confirmed that no significant difference is found in responses given by respondents whether they belong to technical or general qualification category. But on the basis of higher mean value (M=4.100) in respect to body safety factor, (M=4.146) in respect to hygienic conditions, (M=3.949) in case of Workers' Participation in Safety & Maintenance Practices, (M=4.017) in relation to operational measures and (M=4.169) with respect to climate factor of employees belong to technical qualification as compared to general qualification category employees in every case demonstrated that availability of all health and safety measures in the organization. The reason may be that technical employees are directly involve in production process and they know each and every aspect related to any causality or reason of accident occurred during the work.

Table 8: T-test statistics for qualifications and status of health & safety measures

Factors	Qualifications	N	Mean	SD	t-value
F1: Body Safety Provisions	Technical	338	4.100	.6197	1.256
	General	70	3.992	.7819	(.210)
F2: Pollution Reduction Measures	Technical	338	3.794	.7075	-.021
	General	70	3.796	.8798	(.983)
F3: Hygienic Conditions	Technical	338	4.146	.6749	.947
	General	70	4.060	.7547	(.344)
F4: Workers' Participation in Safety & Maintenance Practices	Technical	338	3.949	.7068	1.357
	General	70	3.821	.7803	(.176)
F5: Operational Measures	Technical	338	4.017	.6644	1.299
	General	70	3.900	.8052	(.195)
F6: Climate Factor	Technical	338	4.169	.6633	1.849
	General	70	4.004	.7517	(.065)

Significant at 0.05 level

Table 9 depicts ANOVA test statistics for age and exiting status of health and safety measures adopted by the automobile sector. In respect to body safety provisions employees' responses is found significantly different with 21-30 age group (M=4.002), 30-40 age group (M=4.194) and above 40 (M=4.221). On the basis of p value (0.010*) it is demonstrated that significant difference is found in the response given by the different age group. In case of third factor (hygienic conditions), the [p-value-0.015*] is found again significant and showed employees belong to 21-30 age group (M=4.053) and 30-40 age group (M=4.226) have lower mean value as compared to above 40 age group (M=4.309). Further in relation to Workers' Participation in Safety & Maintenance Practices, Operational Measures and Climate Factor and significant difference are also found and mean value is increasing with the increase in age. With respect to pollution reduction measures differences is found in the responses given by different age group category but not found at significant level at 95% degree of confidence scale but mean value is increasing here also with the increase in age. The reason behind this as the age increase employees' consciousness regarding health and safety is also increased.

Table 9: ANOVA test statistics for age and status of health & safety measures

Factor	Age (years)	N	Mean	SD	F-value (p-value)
F1: Body Safety Provisions	21-30	246	4.002	.6948	4.678 (.010)*
	30-40	116	4.194	.5525	
	Above 40	46	4.221	.5774	
F2: Pollution Reduction Measures	21-30	246	3.738	.7610	2.729 (.067)
	30-40	116	3.829	.7174	
	Above 40	46	4.005	.6335	
F3: Hygienic Conditions	21-30	246	4.053	.7442	4.267 (.015)*
	30-40	116	4.226	.5585	
	Above 40	46	4.309	.6262	
F4: Workers' Participation in Safety & Maintenance Practices	21-30	246	3.855	.7586	3.158 (.044)*
	30-40	116	4.028	.6296	
	Above 40	46	4.059	.6915	
F5: Operational Measures	21-30	246	3.918	.7200	4.124 (.017)*
	30-40	116	4.109	.6321	
	Above 40	46	4.137	.6229	
F6: Climate Factor	21-30	246	4.056	.7104	6.058 (.003)*
	30-40	116	4.218	.6386	
	Above 40	46	4.398	.5334	

Significant at 0.05 level

Table 10 depicts ANOVA test statistics for department and exiting status of health and safety measures adopted by the automobile sector. Only significant difference is found in operational measures dimension of health and safety [p value- 0.031]. Higher mean value (M=4.136) belong to production department as compared to quality department (M=39.00), PPC (M=3.940) and others (M=3.968). The reason behind it could be that the employees belonging to production department can easily understand the health and safety measure used in the organization as compared to other various departments in the organization.

Table 10: ANOVA test statistics for department and status of health & safety measures

Factor	Department	N	Mean	SD	F-value (p-value)
F1: Body Safety Provisions	Quality	148	4.056	.5984	2.298 (.077)
	Production	137	4.193	.5989	
	PPC	39	3.987	.6368	
	Others	84	3.988	.7956	
F2: Pollution Reduction Measures	Quality	148	3.792	.7684	1.078 (.358)
	Production	137	3.819	.6233	
	PPC	39	3.602	.9099	
	Others	84	3.848	.7703	

Factor	Department	N	Mean	SD	F-value (p-value)
F3: Hygienic Conditions	Quality	148	4.148	.6961	1.767 (.153)
	Production	137	4.204	.5950	
	PPC	39	4.121	.7114	
	Others	84	3.988	.7923	
F4: Workers' Participation in Safety and Maintenance Practices	Quality	148	3.925	.7257	1.442 (.230)
	Production	137	4.016	.6588	
	PPC	39	3.814	.6379	
	Others	84	3.839	.8301	
F5: Operational Measures	Quality	148	3.900	.6927	2.988 (.031)*
	Production	137	4.136	.6124	
	PPC	39	3.940	.6437	
	Others	84	3.968	.7976	
F6: Climate Factor	Quality	148	4.157	.7184	.177 (.912)
	Production	137	4.143	.6233	
	PPC	39	4.068	.6451	
	Others	84	4.142	.7286	

*Significant at 0.05 level

Table-11 explicit the results come after applied t-test on the basis of educational qualification category, the table shows that in case of 'climate factor' significant difference is found with mean value (M=3.631) of matric passed employees, (M= 4.229) of Diploma/degree, and (M=4.105) of Post Graduate employees shows that responses regarding body safety measures are falling in fairly available to available on response scale. . The [p value - 0.000*] is less than .05 at 95% degree of confidence scale shows that there is a significant difference. In respect to rest of the cases Body Safety Provisions, Pollution Reduction Measures, Hygienic Conditions, Workers' Participation in Safety and Maintenance Practices and Operational Measures no significance difference is found but interesting findings is here that mean value is increasing with lower to higher educational qualification. The reason behind this may be as the education increase the employees also want to know about the health and safety measures adopted by the organization to reduce the any causality at work place.

Table 11: ANOVA test statistics for qualifications and status of health & safety measures

Factor	Educational Qualification	N	Mean	SD	F-value (p-value)
F1: Body Safety Provisions	Matric	47	3.943	.6032	1.306 (.272)
	Diploma/Degree	298	4.106	.6086	
	PG	63	4.066	.8464	
F2: Pollution Reduction Measures	Matric	47	3.611	.7368	1.845 (.159)
	Diploma/Degree	298	3.807	.6978	
	PG	63	3.873	.9023	

Factor	Educational Qualification	N	Mean	SD	F-value (p-value)
F3: Hygienic Conditions	Matric	47	4.106	.5411	.321 (.726)
	Diploma/Degree	298	4.147	.6819	
	PG	63	4.075	.8164	
F4: Workers' Participation in Safety and Maintenance Practices	Matric	47	3.819	.6270	1.146 (.319)
	Diploma/Degree	298	3.923	.7202	
	PG	63	4.027	.7830	
F5: Operational Measures	Matric	47	3.865	.5138	1.034 (.356)
	Diploma/Degree	298	4.008	.6738	
	PG	63	4.042	.8644	
F6: Climate Factor	Matric	47	3.631	.7525	16.988 (0.000)*
	Diploma/Degree	298	4.229	.6213	
	PG	63	4.105	.7352	

Significant at 0.05 level

5. CONCLUSION AND POLICY IMPLICATIONS

To increase the productivity and enrich the working environment, the role of health and safety measures are very important in manufacturing unit whether it belong to automobile sector or any other sector. Health and safety measures directly affect the employees' capacity while performing their duty on manufacturing process. On the basis of this research, it is revealed that all measures are adequately implemented in well-defined manner. However the task of Human Resource department has been increased due to change in laws related to health and safety of employees. But it facilitates the employees to maintain their health with the help of measures provided by the Factories Act, 1948. This paper explored the current status of health and safety measures adopted by various automobile companies and almost each aspect has been covered under this research paper and attempted to find out the facts from every direction. During the collection of data i.e. survey period one important aspect has emerged though informally that organizations follow the health and safety measures largely due to compulsion of the government legislative yet the need of the hour is the adoption health and safety measures by choice for the cause of individuals and the institutions.

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An Investigation on Impact of Psychosocial Mentoring on Motivation of Protégées in Formal Mentoring Program

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Abstract

The value of having a mentor has been well established. In tune with acknowledgment in current times that employees are the only source of competitive advantage in business a sizeable number of corporate organizations have implemented formal mentoring programs. These programs are seriously used as intervention tools by human resource professionals to motivate and engage high potential talent and providing employee's opportunity to foster personal and professional bond within the organization,. While mentoring programs have become increasingly popular, there have been few empirical studies in the country on such a topical subject. The paper seeks to examine the effectiveness of psychosocial mentoring in context of its impact on motivation of protégées, an important outcome of a formal mentoring program. Questionnaires were administered to 183 protégées engaged in a formal mentoring program in service sector organization in Delhi NCR. Correlation and regression analysis was used to find the relationship between psychosocial mentoring and motivation of protégées. Friendship and Parent dimensions of mentor psychosocial function were found to have predictive characteristics with respect to motivation of protégées. Human resource professionals may design trainings for mentors which emphasizes on comrade and ally based approach as opposed to a disciplinarian during their engagements with protégées.

Keywords: Formal mentoring, Psychosocial function, Motivation, Protégées, Organization

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1. INTRODUCTION

The popularity of mentoring as an emerging tool in the hands of human resource professionals aiming to nurture and develop employees has been increasing in recent years. It has been acclaimed to be a career management and development tool in organizations (Baugh & Sullivan, 2005; O_Reilley, 2001). In a recent article in Times of India, 2015, credited India with the history of having mentoring in form of Guru-shishya relationship. Mentoring has over years become a corporate mantra for training, nurturing and retaining talent. It is well established that presence of a mentor leads to motivation and engaging protégées. While many organizations may claim to believe in a culture of mentoring and coaching, few have a formal structure in place. According to Noe, (1988), almost five decades back, many organizations have attempted to formalize mentoring relationships to capitalize on the potential developmental aspects of such relationships). Especially in early 1970's, quite a few organizations have made attempts to replicate the benefits of mentoring process by initiating formal mentoring programs (Zey, 1985; Burke, Mckeen and McKenna,1994).

In a recent study titled "CEO as Chief Talent Officer 2014" it was discovered that more than ninety percent of CEOs believe in active involvement in participation in talent endeavors of human resource department, an amazing two third of the CEOs are believed to be driving mentoring program in respective organizations. CEOs are now involving themselves not just with the strategy of hiring appropriate talent, but also with how the organizations groom them for future leadership roles (Business Standard, December, 2014). Companies have commonly used mentoring as a means for supporting employees' personal and professional development and have also been found to increasing employee motivation and performance.

Today, many organizations are attempting to replicate these benefits by developing formal mentoring programs (Burke, Mckeen and McKenna,1994). As of 1989, one third of United States companies had formal mentoring programs (Bragg, 1989) and formal mentoring is an ongoing workplace practice today (Ragins, Cotton, & Miller, 2000).   Deutche Bank found that in the aftermath of the financial crisis, a diverse workforce had become even more of a priority for financial service companies. Internal company research revealed that female managing directors who had left the firm did so because they were offered better positions elsewhere. In response, Deutche Bank created a sponsorship program aimed at assigning women to critical posts. The company paired female executives with executive committee members who served as mentors. This not only raised the women's visibility, but also ensured that they would have a powerful advocate when promotions were being considered. As a result of this mentoring program, one-third of the participants were in larger roles, and another third had been deemed ready to move-up by senior management (http://www.forbesmedia.com). Many major US companies such as Bank of America, Marriot International, and Charles Schwab have formal mentoring programs in place to help them attract, retain and develop high performers.

In India, companies across sectors like Siemens, Samsung, Inter Globe Enterprise, Bharti Airtel, Radission, HDFC have explored the utility of formal mentoring programs for meeting pressing talent management challenges such as attracting, motivating and engaging the generation Y workforce, developing a diverse pipeline of talent in underrepresented populations, and aligning mentoring to their overall employee development strategy. In one of the earliest studies done Gaskill and Sibley (1990) upper – level mentored executive's perceived higher levels of job motivation than non mentored executives. Consistent with the youth mentoring literature, Ragins (2010) endorsed the opinion of Liang, Tracy, Taylor and Williams (2002) and propounded that high-quality relationships are further characterized by authenticity, engagement and empowerment, which lead to increased self-worth, motivation, new skills, and the desire for greater connection. In view of Noe (1988), observation that protégés who demonstrate greater motivation are likely to receive more mentoring support from mentors and lack of empirical studies on the subject in the country, it was found prudent to explore the impact of psychosocial mentor function on motivation of protégées.

Construct of mentoring

An examination of published works on organizational mentoring reveals that as far back as early as 1980s (e.g. Campion and Goldfinch, 1983; Hunt and Michael, 1983) and as until 2000s (e.g. Higgins and Kram, 2001), there is a lack of consensus on the definition of mentoring and mentor in literature (Chao, 1998; Minter and Thomas, 2000; Noe, 1988a). Surprisingly, some researchers have not directly stated a definition of mentoring or mentor either in their survey or interviewing of participants (Phillips-Jones, 1982; Whitely et. al., 1992) thus allowing participants to draw on their own intuitive understanding of the mentor and mentoring concepts (Ragins and Cotton, 1993).

Mentoring has been viewed as a dyadic, face to face, long-term relationship between a supervisory adult and a novice student that fosters the protégé's professional, academic or personal development (Donaldson, Ensher and Grant, Vallone, 2000). Mentoring has evolved as a multipurpose developmental tool in the employment life cycle of employees (Adhikari, Ishita and Moshal, B.S, 2015).

The mentor is ordinarily several years older, a person of greater experience and seniority in the world the young man is entering. It is pertinent to note that no word currently being used is adequate to cover the nature of this pristine relationship. Words such as 'counselor' or 'guru' suggest more subtle meanings, but do not holistically define mentoring. The term "Mentor" is generally used in a much narrower sense, to mean teacher, advisor or sponsor. Levinson et al. (1978), aptly summarizes "as we use the term mentor, it means all these things, and more". The following two definitions capture the essence of the word mentoring:

Mentoring is a nurturing process where a more experienced person serves as a role model, teacher, sponsor, encourager or counselor to a less experienced person for promoting the mentee's professional, personal and leadership development (Lee et al., 2006).

Higgins and Kram (2001) state "A traditional mentoring relationship is one in which a senior person working in the protégé's organization assists the protégé's personal and professional development."

Both definitions highlight prominent functions of a mentor, his/her competence and key objective of mentoring viz. professional / personal development of the protégé.

2. OUTCOMES OF MENTORING PROGRAMS FOR THREE KEY STAKEHOLDERS

Mentoring relationships are important because they have the potentials to offer both organizations and their members a wealth of benefits. Most of the senior management in organizations would not contest that mentoring programs can bring considerable advantages to the three key stakeholder in the process, the mentor, the protégé and the organization. Companies have been continuously assessing the value of mentoring and comparing the effectiveness of formal and informal mentoring programs. Managers who mentor their direct reports were benefited by various outcomes, including job performance, satisfaction, organizational commitment and turnover intentions (Scandura and Schriesheim, 1994; Sosik, Godshalk and Yammarino, 2004; Raabe and Beehr, 2003; Scandura and Williams, 2004; Brashear, B. et. al., 2006; Ghosh, Rajashi and Reio Jr., Thomas G., 2013). Additionally, mentors benefit from rejuvenation, increased promotion rates, an increased power base and access to related information (Burke, Mckeen and McKenna,1994; Aryee et al., 1996; Allen et al., 1997; Ragins and Scandura, 1999).

Organizations benefit from opportunities for enhanced organizational learning, competitive advantage, strategic functioning, employee motivation, better performance, and executive development and retention (Kram and Hall, 1989; Viator and Scandura, 1991;). Mentoring can improve communication within the firm and help in merging different cultures. Even when organizational rewards are not congruent with individual performance (as in politically turbulent organizations), the financial, career and other performance – based rewards received by the protégé are an approximate index of the benefits accruing to the organization. Given its potential benefits,

organizations are increasingly interested in establishing mentoring program (Raabe and Beehr, 2003; Viator and Scandura, 1991). Mentoring is a win all strategy for mentor's, protégée's and organizations. It has a ripple effect across i.e. employees, organization, client and community.

Eventually protégé's are, perhaps, the most obvious, more immediate beneficiary, and best documented (Dreher and Ash, 1990, Kram, 1985, Scandura, 1992: Scandura and Schriesheim, 1994; et al.,). Mentoring is also intended to develop protégés' skills and knowledge as well as develop confidence in their talent (Noe, 1988; Tonidandel et al., 2007). In one of the earliest studies done Gaskill and Sibley (1990), upper – level mentored executives perceived higher levels of job motivation than non mentored executives. In a recent study, Welsh, Bhave and Kim (2012) opined that "in the case of informal mentoring, both protégés and mentors may be motivated to feel good about being in a mentoring relationship and may, therefore, assess their workplace relationships more positively than their potential partners".

Mentoring relationships is a broad and intricate construct which has been applied to a wide range of context (Adhikari, Ishita and Moshal, B.S ,2015). Perceptions regarding mentoring have been scrutinized from view point of both mentors and protégées. However, most studies investigated the impact of mentoring on career advancement e.g. salary, promotion, fewer opportuned to look at the intangible and softer aspects of motivation which would to employee engagement or job commitment. The current study undertakes to examine the impact of psychosocial mentor function on the motivation of protégée in a formal mentoring program in Indian context.

3. STUDY VARIABLES

Psychosocial mentoring focuses on enhancing protégé's sense of competence and identity. Psychosocial mentoring is related to the interpersonal relationship between the mentor and protégé and includes the functions of role modeling, acceptance–and-confirmation, counseling and friendship (Kram, 1985; Noe, 1988). *Role modeling* involves the mentor

setting a good example of set of desirable attitudes, values and behavior for the protégé. The protégé is happy to conduct on the same line as the mentor. *Acceptance*, involves both the mentor and protégé developing a sense of self from each other's support. This supportive relationship creates an environment in which the protégé feels comfortable taking risks and experimenting with new behaviors.

Counseling involves the mentor providing a resource for the protégé to talk openly about personal concerns, fears and anxieties in which the mentor will actively listen and provide feedback and advice based upon the past personal experiences. Lastly *friendship* involves mutual liking and understanding that results from the social interaction between the mentor and protégé.

In further researches on the psychosocial mentor function, Ragins and McFarlin, (1990) identified two additional psychosocial related roles i.e. *parent and social* interactions. According to Kram (1985a), these roles may emerge in response to gender issues in mentoring relationships; protégé may seek to avoid sexual issues in cross gender relationships by viewing their mentor as a parent figure or by avoiding informal, after-work social interactions. Generally psychosocial mentoring assists in the development of the protégé by focusing on the personal aspects of the relationship with the mentor. Kram (1985) suggested that greater the number of functions provided by the mentor, more beneficial the relationship will be for the protégé. Thus, mentoring is not an all or none phenomena; rather a given mentor may provide just some of these functions (Ragins & Cotton, 1999).

Motivation is understood as all that causes some behavior, action or reaction (Kern et. al. 1999). Clusters, i.e. groups of principal, secondary motives mutually affecting each other and frequently also mutually overlapping each other, are termed motivation (Lenka, K et. al. 2014). On one hand few researchers consider motivation one of general signs of predicting success, while some others (Atkinson, 1978) ,another set consider motivation as the most important source of variation in performance. Based on the review of literature, the researcher proposed following conceptual framework of mentor psychosocial function in relation with motivation as a mentoring outcome.
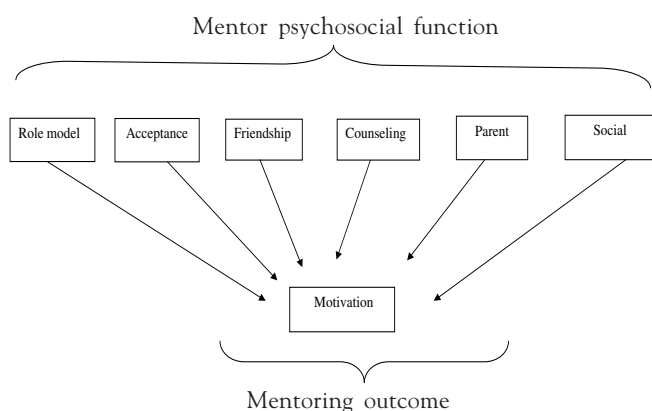
Figure 1: A conceptual framework of mentor psychosocial function impact on motivation of protégé

4. RESEARCH METHODOLOGY

The underlying purpose of the current research study is to determine the dynamics of mentoring programs in context of impact of mentor psychosocial function on motivation of protégées. The researcher also aims to examine the presence of mentoring function in a formal mentoring set up. The survey was conducted in 15 organizations based in Delhi NCR.

The following are specific objectives of the study:

1. To examine psychosocial mentoring function in a formal mentoring program in the Indian context

2. To evaluate the impact of psychosocial mentoring function on motivation of protégé in a formal mentoring program:

a. To investigate relationship between role model function of mentor and motivation of protégé.

b. To study relationship between acceptance function of mentor and motivation of protégé.

c. To examine relationship between counseling function of mentor and motivation of protégé.

d. To investigate relationship between friendship function of mentor and motivation of protégé.

e. To study relationship between parent function of mentor and motivation of protégé.

f. To study relationship between social function of mentor and motivation of protégé.

5. QUESTIONNAIRE AND GENERATION OF THE SCALE ITEMS

The researcher used a combination of standardized scale and self-designed instrument to measure the study variables. Development of a research questionnaire is a complex and tedious process. The entire exercise involves different phases starting from evolving a clear definition of the research variable, and identification of the constituents involved in defining the variable. Questions can be framed only after a thorough understanding of the subject.

In order to collect primary data and make it more empirical Mentor Role Instrument (MRI, Ragins & McFarlin, 1990) which is used to map protégé perception of psychosocial mentoring for assessing mentor functions was selected for the proposed study. Psychosocial mentoring role behaviors of mentor which include counseling, friendship, social, parent, role modeling, and acceptance/confirmation which aim at enhancing the protégé's' self-efficacy, personal development, identity and work-role effectiveness were measured by eighteen items from the MRI scale. Each of these psychosocial roles was assessed by three items each. From the protégé perspective, a sample item included, "My Mentor is someone I can trust"; "My Mentor represents someone I identify with". One statement was partially tweaked to simpler English, without diluting or deviating from its essence, considering that it is not the first language in India i.e. the item to measure protect function was defined by the statement " My Mentor "runs interference" for me in the organization" was transformed to "My Mentor blocks potential troublesome matters for me in the organization."

Motivation is a series of activities which begins with a physiological or psychological need leading to stimulating a behavior that is aimed at a defined objective. Since every employee is supposed to enhance productivity and efficiency, it is implicit that the environment be conducive. Motivation is learnt to be impacted by monetary rewards but also work environment which includes good superiors, cordial relations, mentoring opportunities. Motivation has another interesting quality of being a precursor of mentoring provided (Aryee, Chay & Chew, 1996)

and mentoring received and Noe (1988) suggests that protégées who demonstrate greater motivation may receive more mentoring support from mentors. Hence it becomes an interesting subject to research.

There were several theories like achievement motivation, extrinsic and intrinsic motivation, task motivation to name a few which were studied to find relevant definitions. Recent findings on LMI (Achievement Motivation Inventory (Leistungsmotivations Inventar), a standard tool to measure motivation indicated that the seventeen dimensions of the LMI lead to a 3-factor structure, which consists of ambition, independence and task-related motivation. In the current study, motivation was measured by collating 5 items from extensive review of literature. The sample item included statements, "I prefer working independently "(Pareekh, Udai and Purohit, Surathi (2009) and "I am appealed by situations allowing me to test my abilities. All items were measured using Likert scale. The instrument captured demographic information from the protégé's in terms of their gender, experience, level in the organization, education and gender of the mentor.

The face validity, criterion validity and content validity of the scale was done by an expert panel constituting of nine reputed academician and six senior industry professionals. The experts gave their views on the ease of language, appropriateness and if these were double barreled. Changes were carried out post deliberations on the same. Reliability of the motivation scale was measured, with a Cron Balch of .818. The final questionnaire was ready for administration.

6. SAMPLING

Sampling procedures in the social and behavioral sciences are often divided into primarily two group probabilities and purposive. A list of large organizations was prepared using purposive sampling. Purposive sampling is also known as **judgmental**, **selective** or **subjective** sampling; purposive sampling relies on the **judgment** of the researcher when it comes to selecting the **units** that are to be studied. Maxwell (1997) further defined purposive sampling as a type of sampling in which, "particular settings, persons, or events are deliberately selected for the

important information they can provide that cannot be gotten as well from other choices. For the purpose of the current study, protégé profile was someone who is a part of a formal mentoring program being conducted in the organization.

A request for participation from 15 organizations from service sector yielded in 183 respondents. The data was keyed into an excel file and spss was used for further statistical analysis.

7. STATISTICAL ANALYSIS AND INTERPRETATION

In order to examine presence of all six dimensions of psychosocial mentor functions; descriptive statistics of frequency, mean and standard deviation were used. Mean describes the central position of a frequency distribution for a group of data and standard deviation, a measure of spread helped to summarize how spread out these scores are. The following table displays the statistical output.

Table 1: Mean and SD scores of all six dimensions of psychosocial mentor function

Psychosocial Mentor functions	Mean	Standard Deviation
Friendship	4.93	1.139
Social	4.13	1.516
Parent	3.57	1.682
Role model	4.24	1.455
Counselling	4.60	1.234
Acceptance	4.85	1.219
Aggregate	4.38	1.156

A high majority of the protégées agreed that the mentor provided support and encouragement. Over all *friendship* dimension was the highest amongst all the psychosocial function's (mean = 4.93, SD =1.139) of a mentor. *Social* function had a high mean and relatively higher standard deviation (mean = 4.13, SD =1.516). The mean score of *parent* function of the mentor was the lowest of all psychosocial dimension (mean = 3.57, SD =1.682) and an overall high standard deviation indicate that there was less uniformity in the response with respect

to the parent dimension. Possibly there were few protégé respondents who positively answered that their mentor is like a father/mother and perceived the mentor as a parent and even fewer perceived that the mentor treats them like son/daughter. Almost majority of the respondents answered that their mentor serves as a role model for them, that the mentor is someone they could identify with and that the mentor represented who they wanted to be. Overall the mean score of *role model* function of the mentor indicated a positive perception amongst the protégé (mean =4.24 SD =1.455).

Majority of the respondents viewed that their mentor serves as a sounding board and that the mentor guided their personal development. Overall the mean score of *counseling* function of the mentor indicated a positive perception amongst the protégé (mean = 4.60, SD =1.234). Finally, close to two third of the respondents viewed that their mentor accepts them as a competent professional, sees them as being competent and thought highly of them . Overall the mean score of *acceptance* function of the mentor was second highest among all psychosocial roles indicating a highly positive perception amongst the protégé (mean = 4.85, SD =1.219)

The overall mean for combined set of mentor psychosocial function was high (mean = 4.51, SD =1.015) implying that all the dimensions were experienced by the protégé respondents. The results also reinforce the key proposition that a mentor indeed dons all these roles albeit the intensity of experience of each dimension may differ from individual to individual and organization to organization.

The researcher used statistical tool of "correlation" to study the relationship between psychosocial mentor function and protégé motivation. The table below shares the level of significance and value of coefficient of correlation of the psychosocial function with motivation of protégé.

Table 2: Relationship correlation as a coefficient of dimensions of mentor psychosocial function with respect to mentoring outcomes

Independent Variable Psychosocial Function	Dependent Variable Motivation
Friendship	271**
Social	-.047 NS
Parent	-.126 NS
Role model	-.027 NS
Counseling	.054 NS
Acceptance	.133 NS

** Correlation is significant at 0.01 level

NS : Not significant

The results from the above table help the researcher infer that amongst sub dimensions of psychosocial function, only friendship has a statistically significant correlation with motivation of protégé (r= .271, $p \leq$ 0.01). The value of r (coefficient of correlation) is low but cannot be ignored, as in the case of research in field of social sciences. The dimension of social (r= -.047, *NS*), parent (r= -.126, *NS*) and role model (r= -.027, *NS*) surprisingly have an insignificant and negative correlation with motivation. Acceptance is positively but insignificantly correlated (r= .133, *NS*) and so is counseling (r= .054, *NS*).

Further, to understand the predictive association between the six sub - dimension of psychosocial mentor function and motivation of protégé, statistical tool of step wise regression analysis was applied. The table below shares the level of significance and value of Beta coefficient .

Table 3: Determinants of motivation - regression

analysis with set of independent variables of psychosocial function of mentor

Independent Variables : PS Function	Dependent Variable : Motivation		
	Beta	p-value	*t*-value
Friendship	.390**	.000**	4.767
Parent	-.330**	.000**	4.035
$R^2 = .126$			

** Significant at 0.01 level

The above stated results revealed that motivation of the protégé is very significantly predicted by the dimension friendship (β = .390, t=4.767, p ≤ 0.01). A surprising revelation was that the parent function has a highly significant negative contribution (β = - .303, t= 4.035, p ≤ 0.01). Together friendship and parent dimension of psychosocial function of mentor accounts for 12.6 percent (R^2 = .126) variance in motivation of the protégé.

Mentors in the function of friends are recognized as the best motivators. Protégées look for a friend and guide in her/his supervisor or mentor. They are charged with a self desire to do better when they have someone who they can trust and confide. A mentoring relationship begins with establishing of a bond between the two individuals in a relationship. Donning the role of a friend cements this further. The regression result establishes parent function to be a negative predictor of protégé motivation. There is a substantial increase in young mentor – managers especially in service sector, protégé are likely to find it hard able to correlate with them as parents. Instead protégées would look for a "buddy" or a "friend" rather than a parent in the work environment. Parental function could be seen more as a control function which is not the acceptable style of today's mentor managers.

As an inference of the above results, it can be concluded that amongst all the six psychosocial functions of a mentor, friendship and parent are the only two having a predictive characteristic with respect to motivation of protégé.
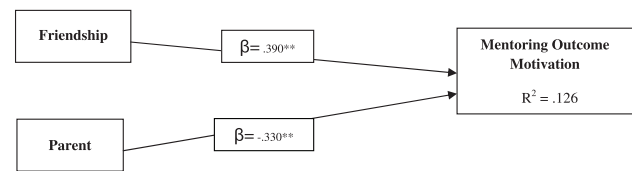

Figure 2: Framework for mentor psychosocial function and motivation

8. CONCLUSION

Mentor in the function of *friends* are recognized as the best motivators. The relationship between friendship function and degree of motivation of protégé was found to be highly significant. The era of boss and supervisor being correct has gone by and today the Gen Y i.e. people born between 1980 until 2000, (Meir, Justin et al., 2010) look for a friend and guide in his supervisor or mentor. Gen Y constitutes overwhelming majority of protégé population. They are charged with a self desire to do better when they have someone who they can trust and confide. In a formal mentoring program, the mentor is likely to be a skip level manager or from a different department, rather than a supervisor and maybe confiding in him/her is easier and convenient.

Another reason could be that a mentoring relationship begins with establishing of an attachment and mutual liking between the two individuals' viz. the mentor and the protégé. Donning the role of a friend cements this further. In the current environment of workplace stress and with the breakage on the Indian nuclear family, there is no one to fall back on for counsel or support. It is likely that mentor fulfills that gap of a shoulder to lean on. A word of praise or encouragement from a trustworthy source is likely to make protégé get energized both at a professional level and personal level. Hence the predictability level of motivation is highly influenced by friendship function of a mentor.

Examinations of impact of parent function on motivation of protégé, presented result which was unexpected and an eye opener too. Not only the mean value of the function was lowest, correlation results inferred that there was an insignificant but negative association between parent function and motivation. The regression results established parent function

to be a negative predictor of protégé motivation. A key reason could be that today young managers being appointed as mentors in the service sector, hence protégés are hardly able to correlate with them as parents.

The above result could be attributed to the rationale that protégées look for a "buddy" or a "friend" rather than a parent in the work environment. In a collectivist culture like India, it was hypothized that the parent function of a mentor would be most sought after. From the review of literature it was understood that mentor would be a revered personality, placed higher than all. However, realty seems to have changed in the 21st century. The plausible reason for lack of accepting parent function of a mentor could be due to lesser gap in the age of the mentor and protégé, given that we have a sizable number of young managers in the work force. Maybe parental function is seen more as a control function which is not the acceptable style of today's mangers. Moreover motivation comes from independence at the job. Hence if mentors are seen in a parent function which is perceived as a disempowering function, it could lead to a negative impact on motivation of protégé.

It would be prudent to conclude that, the human resource professionals desirous of implementing an effective mentoring program with the aim of motivating and engaging protégées make efforts to train mentors appropriately. Mentors need to emphasize on the function of professional friendship than mentorship. The study gives an insight on how using a systematic process with clear and defined function of mentors can be more valuable in enhancing the motivation level of protégés. This would lead to maximizing returns on investment in a structured mentoring program.

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Contents

Sectoral Decomposition of FDI Impact on Market Indices in the Pre and Post-Crisis Period

P.K. Gupta* and Sankersan Sarkar**

Abstract

Foreign Domestic Investment has a positive impact on the economic performance of developing economies. Numerous researches have been conducted on the relationship between FDI and GDP. Globalisation has resulted in volatility in financial markets, particularly stock markets and indirect contribution to GDP growth rate simultaneously creating concerns for the government policy makers and regulators especially in a country like India. FII portfolio investments create a significant impact on the stock markets of a country like India evidenced from various researches. However, little research has been conducted to examine the relationship between the FDI investment through equity route in a given sector and the market indices of that sector. We select a sample of six sectors and examine the association between FDI investments through equity route and the respective NSE sectoral index for the period 2004-2015. We find that contrary to the general notions that FDI investments have a positive impact on the indices (sectoral), we find no co-integrating or causal relationship.

Keywords: foreign direct investment (FDI), gross domestic product (GDP), sectoral index, foreign institutional investors (FII)

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Sectoral Decomposition of FDI Impact on Market Indices in the Pre and Post-Crisis Period

1. INTRODUCTION

Foreign Direct Investment (FDI) is the process by which investors belonging to one country invest capital to acquire ownership and control of an enterprise in another country for the purpose of doing business and earning profits. So on the one hand it brings in foreign financing and on the other it results in the creation of productive enterprises in the host country. Typically the capital flows in an FDI come in the form of equity investments made by foreign investors for owning and controlling business enterprises in the host country. Owing to such nature of financing involved in FDIs they result in creation of new enterprises in the host country, which are less dependent on debt financing and hence less exposed to financial risks. Moreover because of the equity investment involved the foreign FDI investor generally has a long-term investment horizon in such investments – hence such investments by the foreign investors are generally stable in nature.

Apart from financing and establishment of new enterprises in the host country FDI also brings in new technology, technical know-how, new skills and knowledge, resulting both in new capital formation and in improvement of human capital by transfer of skills and knowledge in the host country. Blomstrom *et al.* (1994, 1996) lay emphasis on the augmentation of human capital that results from FDI. Moreover as demonstrated by Borensztein, Gregorio & Lee (1998) FDI impacts long run growth through technological diffusion. Chakraborty & Basu (2002) explain that FDI related spillover of knowledge promotes growth and growth in turn attracts more FDI.

Rodan (1961), Chenery & Strout (1966) have explained that inflows of foreign capital have a favourable effect on the economic efficiency and growth in the developing countries through a favourable short-term effect on economic growth as it expands economic activity.

According to Feenstra & Markusen (1994) FDI can result in higher growth by bringing in new inputs and techniques. This generally happens because in order to carry out their operations effectively MNCs bring with them high levels of technology, as they recognize technology to be among the important factors that can strengthen their international competitiveness. In a recent study of the U.S. economy Kashibhatla & Sawhney (1996) have found evidence of a unidirectional causality from GDP to FDI; evidence of the reverse causation has not been found. This might be due to the fact that GDP acts as an indicator of the market size for a developed economy and FDI tends to follow GDP.

It is generally understood that FDI leads to economic growth and a two-way relationship is often suggested. As explained by various researchers, inflow of FDI is an important factor for accelerating economic growth (Jackson & Markowski, 1995; Aitken & Harrison, 1999; Cheng & Yum, 2000; and, Coughlin & Segev, 2000). Further, it is also explained by other researchers that a steady economic growth is also an essential factor for attracting inflows of FDI into an economy (Goldberg, 1972; Lunn, 1980; Schneider & Frey, 1985; Grubaugh, 1987; Lucas, 1993; Aziz, 1999; Zhang, 2001; and Globerman & Shapiro, 2003). While the former view implies economic growth resulting from FDI the latter

implies FDI inflows resulting from economic growth.

This suggests a two-way causality between FDI inflows and economic growth. Evidence of such bidirectional causality has also been found by Choe (2003) who has studied the relationships between economic growth and FDI using the Granger causality test in 80 countries during the period 1971 to 1995. It was found that FDI causes economic growth as well as economic growth also cause FDI. However, the evidence provided greater support for the effect of growth on FDI than the effect of FDI on growth.

Blomstrom *et al.* (1994), Ghosh Roy & Van der Berg (2006), and Xu & Wang (2007) found that FDIs positively influence economic growth in host countries. Borensztein, De Gregorio, & Lee (1998), have found evidence in developing countries over a period of two decades which shows that FDI is a medium for transfer of technology from the industrialized countries to the developing ones, leading to comparatively higher economic growth than domestic investments. This is subject to the condition that the host country has a threshold level of human capital. Further FDI results in an increase in the total investment in the host country, which indicates complementary effects with the domestic firms. The positive impact of FDI on growth has been found in studies in different contexts by several researchers (Sharma & Abekah, 2008; Khaliq & Noy, 2007). However at the same time it has also been found that domestic investment is also important in this matter.

The trickling down of benefits such as the spillover of technology from MNCs to the local firms is another aspect of FDI that has been

an important matter of study. According to Blomstrom & Kokko (2003) such benefits can only be realized if local firms attain a minimum threshold level for absorbing the spillover and effective intervention of state policy happens to streamline the spillover from MNCs to the domestic firms. Further, the existence of quality infrastructure, scientific knowledge, human capital, research and development, etc., is critical in the trickle down of benefits from MNCs to local firms (Porter, 1986; and Dunning & Lundan, 2008). Hence in this regard the factor endowment of the country is a pre-requisite for the trickle down to happen. Further according to World Investment Report (UNCTAD, 1997), the entry of foreign investment may lead to crowding out of local investment without adequate factor endowment and effective intervention by the regulatory authority.

Romer (1993) explains that in transfer of technology, foreign investment can facilitate the transfer of technological and business philosophy to poorer countries. Such transfers in turn may have significant spillover effects for the entire economy. Various studies have found positive effects of FDI on economic growth in the long run, which arise out of accumulation of capital and technological or knowledge transfers, especially under open trade conditions (e.g., Basu *et al.*, 2003). According to Dash & Sharma (2011) virtually all countries have provide facilities for the expansion of foreign investment through changes in their regulatory environments. According to them the economic rationale for offering special incentives for attracting FDI generally arises out of the belief that foreign investment produces externalities in the form of technology transfers and spillovers.

According to a study by Sahoo & Mathiyazhagan (2003) during the period 1979 to 2001 in the Indian context, there is a existence of a long run relationship between Gross Domestic Product (GDP), FDI, and exports. Chakraborty & Basu (2002) have studied aggregate data on Indian economy from 1974 to 1996 and have found a one-way causality that runs from GDP to FDI. FDI is positively related to GDP and openness to trade in the long-run. Chen, Chang & Zhang (1995) have carried out a study of the Chinese economy using time series data during the period 1979 to 1993, and have found that there is a significant positive relationship between FDI and GNP.

According to World Investment Report 2002 by UNCTAD (2003) trade policy reform by countries generally involves extensive investment by the governments for attracting FDI, this partly happens because of a supposed linkage between FDI and the improvement in export competitiveness of the host country. Various country-specific studies have recognized the significance of the export enhancing role of FDI in the host countries (Blake & Pain, 1994 in UK; Cabral, 1995 in Portugal, Pain & Wakelin, 1998 in Europe; Barry & Bradley, 1997 in Ireland; Sun, 2001 and Zhang, 2005 in China; Oliveira, 2001 in Brazil) and World Investment Report 1999 by UNCTAD (2000).

Aitken, *et al.* (1997) have shown the external effect of FDI on export, with the example of Bangladesh, where the entry of a single Korean multinational in garment exports resulted in the establishment of a number of domestic export firms; this in turn created the country's largest export industry. Hu & Khan (1997) have studied the Chinese economy during the period 1952 to 1994 and have explained that the

spectacular growth rate of the Chinese economy has been mainly due to the productivity gains resulting from market oriented reforms, such as the expansion of the non-state sector and the "open-door" policy of China, which has led to a remarkable expansion in foreign trade and FDI.

2. NEGATIVE EFFECTS OF FDI

According to Bornschier (1980), however, in the long run the growth rate reduces due to "decapitalization". This happens in the long run because the foreign investors repatriate their investment by contracting the economic activities. Further as explained by several experts the growth effect of FDI is dependent upon the sectors that receive the same and that the sectoral flows reinforce the positive effects compared to the negative ones (Wei, 1996; Dutt, 1997; and Kathuria, 1998).

According to Nanda (2009) the evidence of impact of FDI on the economic growth of the developing countries as well as their experience in attracting FDI inflows is not conclusive at all; moreover there have not been enough studies for drawing any conclusions on growth effects of FDI. Nanda further explains that it would be naive to expect homogeneous growth effects even in similar situations. According to the author a comparison across Brazil, China and India, suggests that although Brazil attracted greater amounts of FDI than India, it had remained stagnant while India has performed better in terms of economic growth; on the other hand China has been able to attract FDI inflows as well as maintain a high economic growth.

According to some researchers the empirical evidence available on the impact of FDIs in terms of economic growth is mixed (Nunnenkamp 2002; Fontainer 2007). The findings of Agosin &

Mayer (2000) indicate that the effects of FDI on overall capital formation differed considerably across regions and host economies. While FDI induced additional local investment in Asian economies, it was found in Latin America that FDI resulted in the crowding-out of local investment. According to Kumar & Pradhan (2005) the crowding-out effect of FDI in Latin America may have happened because FDI in that region was largely in the form of M&As. Mencinger (2003) attempts to explain that the negative relationship between growth and FDI found in the Central European host countries has been possibly due to the predominance of M&As in those regions.

Alfaro & Charlton (2007) have studied various indicators of quality of FDI based on industry and sector characteristics and have shown that the growth effect of FDI is significantly dependant on the quality of FDI. In an earlier study Alfaro *et al* (2003) have found that the empirical evidence of the contribution of FDI alone to economic growth is not clear.

Moreover the existence of a positive relationship between the FDI and economic growth, that varies across various regions and over time, depends critically on the absorptive capacity of the host country (Borzenstein et al. 1998; Edison et al. 2002; Alfaro *et al.* 2003; Durham 2004). Such absorptive capacity arise out of the presence of certain conditions such as: the initial level of development (Blomstrom et al. 1992), trade policy (Balasubramanyam et al. 1996), the existing level of human capital development (Borensztein et al. 1998), government policy (Edison et al. 2002), extent of financial development (Alfaro et al. 2003; Durham 2003), and the legal system (Durham 2004; Edison et al. 2002).

Some of the researchers have also explained that the quality of FDI is of greater importance than the quantity. According to Enderwick (2005) FDI is considered to be of higher quality if it is export-oriented, leads to transfer of foreign technologies to the host country and results in economic spillover that benefits local enterprises. Pradhan (2002) has estimated a Cobb-Douglas production function using aggregate data during the period 1969–97, and has found that FDI has no significant impact on growth.

Kumar & Pradhan (2002) have found that the relationship between FDI and growth is Granger neutral for India because the direction of causation is not clear. Similar findings have been reported by Bhat et al. (2004) by applying Granger causality test. Agrawal (2005) has analysed panel data for five South Asian countries including India, during the period 1965 to 1996 and have reported that the growth impact of FDI is negligible. It has also been explained that FDI may have adverse effect on growth if it crowds out domestic saving (McCombie & Thirlwall, 1994; Fry, 1995).

3. EVIDENCES FROM INDIA

Dua & Rashid (1998) do not find support for the unidirectional causality from FDI to economic growth; the Index of Industrial Production (IIP) is taken as a proxy for GDP. Alam (2000) has carried out a comparative study of the relationship between FDI and economic growth for India and Bangladesh, and has found that though the impact of FDI on economic growth is more in case of India, it is not satisfactory. Sharma (2000) has attempted to evaluate the role of FDI in the export performance of India. The study has not found a statistically significant role of FDI in export promotion in the Indian context.

Chakraborty & Basu (2002) have attempted to study the short run dynamics of FDI and growth in the Indian economy. Their study shows that in India GDP is not Granger caused by FDI. The causation tends to run from GDP to FDI; moreover the trade liberalization policy of the Indian government appears to have some positive impact on the FDI flow in the short run. According to Sahoo & Mathiyazhagan (2003) the common consensus of the studies in the Indian context is that FDI is not growth stimulant rather it is growth resultant.

We argue that most of the developing economies are passing through phases of economic reforms, which aim to attract FDI for the purpose of achieving economic growth. However, so far the evidence of the impact of FDI on economic growth is not clear enough to be conclusive. FII portfolio investments create a significant impact on the stock markets of a country like India evidenced from various researches. We are therefore motivated to examine the relationship between the FDI investment through equity route in a give sector and the indices of that sector.

4. METHODOLOGY

We have selected six industrial sectors represented by NSE indices namely (a) Auto, (b) IT, (c) Realty, (d) Pharma (e) Energy and (f) Services. These sectors majorly represent a significant market capitalisation and suitable to the research construct. We assume a period of 2004-2015 covering the *pre* and *post* crisis period. We examine the two way casualty between FDI and sectoral indices by pooling the data into 72 data points using the popular causality test as proposed by Granger (1969). To examine the

relationship between the sectoral indices and respective sectoral FDI we use the cross-section random effects with index as the dependent variable and FDI as the explanatory variable and their reversals. Also, we have conducted two-way random effects with FDI as the dependent variable and index as the independent variable.

In order to estimate long run coefficients of the co integration relationship we have used FMOLS is a between-dimension approach proposed by Pedroni (2001) compared to the conventional OLS estimator, which is a biased and inconsistent estimator when applied to co integrated variables. It can handle the likely endogeneity of the regressors and serial correlation and also the form in which the data are pooled allows for greater flexibility in the presence of heterogeneous co integrating vectors. FMOLS can be derived from the following equation -

$$y_{it} = a_i + x_{it}\beta + u_{it}, i = 1, \ldots \ldots, N; t = 1, \ldots \ldots, T$$
$$x_{it} = x_{it-1} + \varepsilon_{it}$$

Where y is the dependent variable (FDI/INDEX) and x is the regressor and the vector of error $\xi_{it} = (\mu_{it}, \varepsilon_{it})'$ process is stationary with asymptotic covariance matrix Ω_i , which can be decomposed as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i.$

Here, Ω_i^0 is the contemporaneous covariance and is a weighted sum of autocovariances. Thus, the variables $y_i x_i$ are said to be cointegrated for each member of the panel, with cointegrating vector β if y_i is integrated of order one. The term allows the cointegrating relationship to include member specified effects. If y_i and x_i are cointegrated, the between-dimension panel FMOLS estimator can be expressed as:

$$\hat{\beta}_{FMOLS,i} = \left[\sum_{i=1}^{T} x_{ij}^{*} x_{ij}^{*'} \right]^{-1} \left[\sum_{i=1}^{T} x_{ij}^{*} y_{ij}^{*} - T\hat{\gamma}_i \right]$$

$$\text{where } y_{it}^{*} = (y_{it} - \bar{y}_i); x_{it}^{*} = (x_{it} - \bar{x}_i)$$

$$\bar{y}_{it} = N^{-1} \sum_{t=1}^{T} y_{it}; \bar{x}_{it} = N^{-1} \sum_{t=1}^{T} x_{it};$$

$$y_{it}^{*} = y_{ij}^{*} - \hat{\Omega}_{u\varepsilon} \hat{\Omega}_{\varepsilon}^{-1} \hat{\Omega}_{\varepsilon i}; \hat{\gamma}_i = \hat{\Gamma}_{\varepsilon i} \hat{\Omega}_{\varepsilon}^{-1} \hat{\Gamma}_{u\varepsilon}$$

Dynamic OLS Estimator equation of co-integrated system for a panel of i=1, . . . , N members is -

$$y_{it} = \alpha_i + \beta x_{it} + \mu_{it}$$
$$x_{ii} = x_{ii} + \beta x_{it} + \mu_{it}$$

where the vector error process $\xi_{it} = (\mu_{it}, \varepsilon_{it})'$ is stationary with asymptotic covariance matrix Ω_i

Thus, the variables x_i, y_i are said to co integrate for each member of the panel with co integrating vector β if y_t is integrated of order α_i allows the co integrating relationship to include member specific fixed effects.

The long-term relationship between FDI and sectoral indices in the panel data has been analysed using Pedroni residual co-integration Test. Karaman (2004) explains Pedroni residual co-integration Test as follows. The starting point of the residual-based panel co integration test statistics of Pedroni (2001) is the computation of the residuals of the hypothesised co-integrating regression.

$$y_{i,t} = \alpha_i + \beta_{1i} x_{1i,t} + ... + \beta_M x_{M,t} + e_{i,t}$$
$$t = 1,....T; i = 1,..., N; m = 1,...., M$$

where T is the number of observations over time, N denotes the number of individual members in the panel, and M is the number of dependent variables. It is assumed here that the slope of co-efficients $\beta_{1i},....\beta_{Mj}$ and the member specific intercept can vary across each section.

5. RESULTS

Our findings do not have prior evidence from earlier research on FDI. Earlier researches on FDI have been carried out in relation to other economic variables such as GDP or exports or industrial production or other economic variables. Therefore, a direct comparison of our findings cannot be made with the findings of the prior studies. However as an evidence of the impact of FDI on various economic variables we refer to their findings in this paper.

Chakraborty & Basu (2002) find that at a parsimonious lag length (change in GDP with a lag of one period) GDP Granger causes FDI. Kamath (2008) has analysed the impact of FDI on economic growth in the Indian context, using GDP as an indicator of economic growth and find evidence of a positive and statistically significant impact of FDI on GDP, with high coefficient of determination.

Further evidence on causality between FDI and GDP in the Indian economy has been found in Pradhan (2010). Pradhan(2010) has applied Granger causality test to find out whether causality runs from FDI to GDP or from GDP to FDI, in the Indian economy. The evidences found by the authors show that there is unidirectional causality between FDI and GDP and the direction of causality is from FDI to GDP; in other words FDI Granger causes GDP. So literature reveals causal relationships between FDI and other economic variables such as FDI.

Therefore, there is no prior evidence of any granger causality existing between sectoral indices and FDI. If the sectoral indices can be supposed to reflect the changes in GDP then this opens up the scope of further investigation on this matter. We attempt to link the Sectoral indices

with the FDI in that sector. Results indicate that the FDI through equity route does not have any significant effect on the sectoral indices in the post-crisis period. The results of pair-wise granger causality test shows that no significant causality exists between Sectoral indices and FDI in both directions (Table 1 for pooled data and Table 2 for panel data). The recent volatility as observed by various authors is on account of portfolio investments by Foreign Institutional Investors (Calvo and Mendoza, 2000, Jain, 2012). We find no significant relationship on OLS (Table 3 and 4).

Table 1: Pairwise Granger Causality Tests - Pooled Data

Null Hypothesis:	Obs	F-Statistic	Prob.
INDEX does not Granger Cause FDI	56	2.27495	0.1255
FDI does not Granger Cause INDEX		0.14316	0.8674
Sample: 1 70, Lags: 2			

Table 2: Pairwise Granger Causality Tests – Sectoral Panel data

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause INDEX	36	0.47305	0.6334
INDEX does not Granger Cause FDI		0.43399	0.6570
Sample: 2004 2015, Lags: 2			

Table 3: Panel Least Squares Regression (Dependent Variable: INDEX)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4652.894	497.5089	9.352385	0.0000
FDI	-0.019359	0.181993	-0.106374	0.9162

Effects Specification				
Cross-section fixed (dummy variables)				

R-squared	0.800962	Mean dependent var		4607.066
Adjusted R-squared	0.749040	S.D. dependent var		2720.376
S.E. of regression	1362.798	Akaike info criterion		17.47343
Sum squared resid	42716044	Schwarz criterion		17.80038
Log likelihood	-255.1015	Hannan-Quinn criter.		17.57802
F-statistic	15.42601	Durbin-Watson stat		1.892717
Prob(F-statistic)	0.000000			

Sample: 2004 2015, Periods included: 12, Cross-sections included: 6, Total panel (balanced) observations: 70

Table 4: Panel Least Squares Regression (Dependent Variable: FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2484.265	1136.407	2.186069	0.0392
INDEX	-0.025400	0.238783	-0.106374	0.9162

Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.515646	Mean dependent var		2367.243
Adjusted R-squared	0.389293	S.D. dependent var		1997.511
S.E. of regression	1561.010	Akaike info criterion		17.74502
Sum squared resid	56045310	Schwarz criterion		18.07196
Log likelihood	-259.1753	Hannan-Quinn criter.		17.84961
F-statistic	4.080986	Durbin-Watson stat		2.137364
Prob(F-statistic)	0.006238			

Sample: 2004 2015, Periods included: 12, Cross-sections included: 6, Total panel (balanced) observations: 72

We have estimated the regression relationship between index and FDI using panel EGLS- cross-sectional random effects and panel EGLS- two way random effects using Swamy and Arora estimator of component variances. The results of both panel regressions indicate that coefficient for FDI is insignificant (Table 5 and 6). Our results differ from Sahoo and Mathiyazhagan (2003) who find that in their OLS estimation that FDI has a significant impact both on GDP and index of industrial production. Also, the panel regression with random effects (Table 7) show no relationship. It is derived that there may be a relationship of FDI with GDP and index of industrial production, but not with any Sectoral indices.

Table 5: Panel EGLS (Cross-section random effects, Dependent Variable: FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2649.553	1094.347	2.421126	0.0222
INDEX	-0.061277	0.184073	-0.332898	0.7417

Effects Specification			S.D.	Rho
Cross-section random			1543.774	0.4944
Idiosyncratic random			1561.010	0.5056

Weighted Statistics				
R-squared	0.004079	Mean dependent var		975.3896
Adjusted R-squared	-0.031489	S.D. dependent var		1510.857
S.E. of regression	1534.460	Sum squared resid		65927898
F-statistic	0.114689	Durbin-Watson stat		1.898572
Prob(F-statistic)	0.737394			

Unweighted Statistics				
R-squared	0.014906	Mean dependent var		2367.243
Sum squared resid	1.14E+08	Durbin-Watson stat		1.266280

Sample: 2004 2015, Periods included: 12, Cross-sections included: 6, Total panel (balanced) observations: 72, Swamy and Arora estimator of component variances

Table 6: Panel EGLS (Cross-section random effects, Dependent Variable: INDEX)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4686.198	1247.385	3.756819	0.0008
FDI	-0.033428	0.177797	-0.188011	0.8522

Effects Specification				
			S.D.	Rho
Cross-section random			2810.957	0.8097
Idiosyncratic random			1362.798	0.1903

Weighted Statistics				
R-squared	0.001301	Mean dependent var		976.2062
Adjusted R-squared	-0.034367	S.D. dependent var		1319.013
S.E. of regression	1341.487	Sum squared resid		50388423
F-statistic	0.036480	Durbin-Watson stat		1.514364
Prob(F-statistic)	0.849905			

Unweighted Statistics				
R-squared	0.005830	Mean dependent var		4607.066
Sum squared resid	2.13E+08	Durbin-Watson stat		0.527205

Sample: 2004 2015, Periods included: 12, Cross-sections included: 6, Total panel (balanced) observations: 72, Swamy and Arora estimator of component variances

Table 7: Method: Panel EGLS (Two-way random effects, Dependent Variable: FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2650.328	1073.641	2.468542	0.0199
INDEX	-0.061446	0.180759	-0.339933	0.7364

Effects Specification				
			S.D.	Rho
Cross-section random			1542.524	0.4921
Period random			0.000000	0.0000
Idiosyncratic random			1567.179	0.5079

Weighted Statistics				
R-squared	0.004110	Mean dependent var		979.2443
Adjusted R-squared	-0.031458	S.D. dependent var		1511.771
S.E. of regression	1535.366	Sum squared resid		66005726
F-statistic	0.115554	Durbin-Watson stat		1.896776
Prob(F-statistic)	0.736444			

Unweighted Statistics				
R-squared	0.014928	Mean dependent var		2367.243
Sum squared resid	1.14E+08	Durbin-Watson stat		1.266158

Sample: 2004 2015, Periods included: 10, Cross-sections included: 6, Total panel (balanced) observations: 60, Swamy and Arora estimator of component variances

We have created a series of unstructured data by pooling the data points of FDI and indices for all the sampled sectors. Our results of Panel Fully Modified Least Squares (FMOLS) by reversing FDI and index as dependent and independent variables further show insignificant regression coefficients. This implies that neither FDI nor index of a given sector significantly affect each other (Table 5 and 6). Therefore the future investments via FDI through equity route are not likely to directly affect the movements in the respective Sectoral indices. However there may be existence of multi-colinearity in the regression relationships.

We find no co integration between index and FDI for the pooled data set of 60 observations (Table 10). This implies that there is no relationship between the Sectoral indices and FDI during the post-crisis period. Chakraborty & Basu (2002) find in their co integration tests that there is a long-run positive relationship between FDI and GDP. Further they find that in the short-run, FDI in India adjusts to equilibrium through changes in GDP only. They also find that in the short run other variables like unit labour cost and import duty in total tax revenue do not have significant impact in the adjustment process. Moreover they find that the liberalization measures introduced in the mid-1980s did have some positive effect on the FDI inflows in the Indian economy. However, they have assumed that the degree of trade liberalization is weakly exogenous to the co integrating relationship between FDI and GDP.

Table 8: Panel Fully Modified Least Squares (Dependent Variable: FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDEX	0.506232	0.558104	0.907057	0.3771
R-squared	0.447307	Mean dependent var		2319.350
Adjusted R-squared	0.252238	S.D. dependent var		1954.572
S.E. of regression	1690.181	Sum squared resid		48564096
Durbin-Watson stat	3.120727	Long-run variance		1513066

Sample (adjusted): 2005 2015, Periods included: 10 Cross-sections included: 6, Total panel (balanced) observations: 60, Panel method: Pooled estimation, Cointegrating equation deterministics: C, Coefficient covariance computed using default method, Long-run covariance estimates (Bartlett kernel, Newey-West fixed bandwidth)

Table 9: Panel Fully Modified Least Squares (Dependent Variable: INDEX)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI	0.010520	0.153524	0.068524	0.9462
R-squared	0.958059	Mean dependent var		5090.013
Adjusted R-squared	0.943256	S.D. dependent var		2662.718
S.E. of regression	634.2873	Sum squared resid		6839446.
Durbin-Watson stat	1.828438	Long-run variance		801408.9

Sample (adjusted): 2005 2015, Periods included: 10, Cross-sections included: 6, Total panel (balanced) observations: 60, Panel method: Pooled estimation, Cointegrating equation deterministics: C, Coefficient covariance computed using default method, Long-run covariance estimates (Bartlett kernel, Newey-West fixed bandwidth)

Table 10: Pedroni Residual Cointegration Test (INDEX FDI)

	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-0.233931	0.5925	-0.379069	0.6477
Panel rho-Statistic	0.385080	0.6499	0.354519	0.6385
Panel PP-Statistic	-2.017402	0.0218	-2.221596	0.0132
Panel ADF-Statistic	NA	NA	NA	NA
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	1.535458	0.9377		
Group PP-Statistic	-1.942348	0.0260		
Group ADF-Statistic	NA	NA		

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
1	0.257	350446.2	589519.3	1.00	4
2	-0.404	651612.6	515982.4	1.00	4
3	-0.254	3387.298	3387.298	0.00	4
4	-0.106	793158.0	666969.8	1.00	4
5	-0.131	624735.7	873919.6	1.00	4
6	0.382	491571.1	491571.1	0.00	4

Sample: 2004 2015, Included observations: 40, Cross-sections included: 6 in non-parametric (PP) test; 0 (6 dropped), parametric (ADF) test, Null Hypothesis: No cointegration, Trend assumption: No deterministic trend, User-specified lag length: 1, Newey-West automatic bandwidth selection and Bartlett kernel, Alternative hypothesis: common AR coefs. (within-dimension)

6. CONCLUSION

FDI has a positive as well as negative impact on the stock market as evidence from the large literature on the subject. Various researchers have examined the relationship between FDI and GDP and find some positive association in short and long run. Our motivation is to find that actual FDI through equity in a particular sector has any level or lag impact on the market valuation of the sector. We find no relationship between sectoral indices and FDI – equity route investments. We conclude that changes in FDI policy creates a direct impact on the individual stocks and indices in the form of FII investments, but no evidence to believe that after effect investment through equity route in a given sector has any significant impact on the market capitalisation of that sector.

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Comparative Analysis of Hedging Performance of Index Options and Index Futures

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Abstract

The motivation behind this paper comes from the significant rise in the volatility in financial markets during the past several years, resultant need for protection hedging against price risk and the use of futures and options contracts for the same. While futures and options contracts can both be reliably used for hedging against price risk, relative effectiveness of the two types of contracts for protection purpose has remained unexplored. Using a completely diversified portfolio of 20 stocks carved out of Nifty 50 index along with futures and options contracts available against Nifty 50 index, the futures contracts were found to be more effective than options contracts in hedging against price volatility.

Keywords: portfolio hedging, index options, index futures

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1. INTRODUCTION

Financial markets have always been in flux and the trends shows that greater uncertainties in the global environment will fuel the volatility further in coming times. This can well be gauged from the infamous stock market crashes like the Black Monday of 1987, the dot-com bubble of 2000, the stock market downturn of 2002 across the USA, Canada, Asia, and Europe, the global financial crisis of 2008, European crisis of 2011 or the dramatic fall in oil prices in 2015. Similarly, the bullish trends in September 2007 when the Sensex jumped to 17,000-mark from the 16,000 mark in just five trading sessions or the exponential rise in stock markets in 2014-15, after NDA Government took over, clearly underline the volatility on the upper side. The constant threats of US interest rate increase or British exit from the European Union have long rattled the markets.

Lodha (2008) observed that the lethal mock tale of price volatility, integration of financial markets, volatile risk environment, availability of cheaper and faster information, and the increased ability to analyse this information have lead to a greater need for protection against price risk, counter-party risk and operating risk. This need for enhanced protection rises further in case of concentrated portfolios (Modern Portfolio Theory emphasises diversification; Goetzman & Kumar, 2005 offer a discussion of the reasons why some investors may still hold concentrated portfolios).

While the need for protection against unforeseen risk has increased over time, markets have kept pace with availability of instruments and strategies for hedging against this risk. Today, a number of specialised instruments are available that allow participants to hedge against unexpected price movements (Kumar, Singh & Pandey, 2010). Broadly, we can classify these into three types, namely hedging through short-selling, hedging through options, and hedging through futures. Among these, short-selling involves very high costs because of the associated collateral and margin requirements (for details of collaterals and margin requirements and other conditions for short-selling, visit the security lending and borrowing (SLB) section of www.nseindia.com), loan interest, and potential risk of a short squeeze or even non-availability of short-selling (for example, National Stock Exchange allows short-selling only on those stocks which are available under F&O section). Not only that; small investors face a significant downside risk on short selling of uncovered positions in the portfolio (Foltice & Langer, 2015). These factors make short selling not only very costly but also very risky – contrary to the original objective of hedging.

The second alternative that is, futures contracts offer a clean tool for protection against adverse movements as there are no premiums; transaction costs are low and full transparency is on the block. While using futures contracts as a protection, the change in the price of an asset and the corresponding futures contract should ideally offset each other. Investors therefore, go short on futures contracts if they hold a long position of the underlying asset and vice-versa. Hedging with futures takes various forms viz., hedging

through index futures, hedging through single asset futures, or cross-hedging (using futures contracts of a closely related asset). Benefits of hedging with index futures/ single asset futures have been widely studied and reported (for instance, see Kenourgios, Samitas & Drosos, 2008; Kumar, Singh & Pandey, 2010; Moon, Yu & Hong, 2010; Serrano & Martin, 2011; Aggarwal & Gupta, 2013), and cross hedging with futures has been implemented successfully in various financial markets including commodities (for example, see Foster & Whiteman, 2002; Franken & Parcell, 2003), foreign exchange (for example, see Serrano & Martin, 2011).

The flexibility inherent in the options contracts and the predetermined cash outflows have made options one of the most favoured instrument for protection. Among different option based protective strategies presented in the literature, protective put, which was introduced way back by Leland and Rubinstein in the year 1976, has been quite popular. It consists of a portfolio invested in a risky asset (such as stocks or a basket of stocks or any other asset class) and a long position in an exchange traded put option. At the maturity, whatever be the value of the risky asset, portfolio value will always be greater than the strike price of the put option (Bertrand and Prigent, 2005). Investment performance of optioned portfolios vis-a-vis those without option positions have been widely studied (for example, see Morard & Naciri, 1990; Whaley, 2002; Feldman & Roy, 2004; Hill, Balasubramanian, Gregory & Tierens, 2006; Abid, Mroua & Wong, 2007; Kapadia & Szado, 2007; Constantinides, Jackwerth, Czerwonko & Perrakis, 2008; Aggarwal, 2011; Pezier & Scheller, 2011; Aggarwal & Gupta, 2013). In fact, a conclusion seems to have emerged that an optioned portfolio is capable of outperforming a portfolio without options on a risk adjusted basis.

While the importance of portfolio protection is increasing day by day, it is also becoming more and more difficult for investors to decide about which instrument to use for protection against adverse price movements. Although futures offer a clean instrument, marked-to-market adjustments and inability to participate in upward market movement make them less palatable to many. Similarly, the initial cash outflow in case of options renders them unattractive to others. In this article we therefore, evaluate the effectiveness of both futures and options based portfolio protection strategies.

2. METHODOLOGY

Modern portfolio theory emphasises that nobody gets any premium for bearing unsystematic risk; therefore, diversification is must. Going by this, we first of all created a diversified equity portfolio. To do so we selected stocks from those constituting Nifty 50 index, a well diversified value weighted index of 50 stocks accounting for 22 sectors of Indian economy. In order to create the portfolio, 20 most traded stocks were selected and an equally-weighted portfolio, with investment of Rs 10,000 in each stock, was created. In case two or more stocks from same industry got selected, only one with the highest trading volume was retained, so that all the 20 stocks came from different sectors, thus offering maximum diversification. This diversified portfolio was then hedged using futures and options contracts available on Nifty 50. Relevant data for Nifty 50 futures and options contracts and the selected stocks for the period of January 1, 2011 to December 31, 2015 were then extracted

from the NSE website. This period consisted of both bullish and bearish phases in the market; and is therefore deemed to be representative of general market conditions. Although longer duration F & O contracts were available during the period under study, owing to volume considerations only one month contracts were employed in this study.

In case of options, literature shows that ATM (at-the-money) and ITM (in-the-money) put options have been most popular for protection purposes. In line with the same, ATM and 2% ITM put options were utilised in the study. In case, strike prices as required were not available, nearest available strike prices were utilized (see Aggarwal, 2011). In order to execute the protective put strategy, on the F&O expiry day of Jan, 2011, the equity portfolio was purchased at the closing price, and the two put options were also purchased at their closing prices. Appropriate number of option contracts were purchased to have the value of option contracts as close as possible to the value of equity portfolio. On the next month's F&O expiry day, all the positions were squared–off at the closing prices; and a new cycle was started, which was squared-off on the next month's F&O expiry day and so on . Returns from long position in the equity portfolio were combined with those from option positions to arrive at the total returns.

For the calculation of returns, the following are defined:

R_t : Return for the month t

S_t : Closing price of the equity portfolio on F&O expiration day of month t

S_{t-1} : Closing price of equity portfolio on F&O expiration day of month t-1

P_{t-1} : Premium paid for buying put option on F&O expiry day of month t-1

P_t : Premium received on selling the put option on F&O expiry day of month t

D : Dividends from the long position in the equity portfolio

TC : Transaction costs

For any month t, the return from a portfolio with protective put is calculated as:

$$R_t = \{[(S_t + D - S_{t-1}) + (P_t - P_{t-1}) - TC] / (S_{t-1} + P_{t-1})\} \times 100$$

For protection of the portfolio through futures, traditional techniques of one-to-one and beta hedging were utilised. Under one-to-one hedging, futures contracts amounting to as close as possible to Rs 2,00,000 were short using closing price of the day on which a long position in the buy & hold portfolio was created. On the next month's F & O expiry day, the futures contracts were bought back at closing price. The cycle was repeated till the month of December, 2015. Returns on monthly basis were recorded and combined with those from the equity portfolio to arrive at returns from the hedged portfolio. For beta hedging, the beta of the 20 stock portfolio was calculated by regressing excess monthly returns from the equity portfolio on the excess monthly returns from Nifty 50 for the past 24 months on rolling basis . Each month, Nifty 50 futures contracts amounting as close as possible to beta times the value of equity portfolio were short. The cycle was repeated every month under study and the returns were calculated the same way as one-to-one hedging.

For the calculation of returns, the following are defined:

R_t : Returns for the month t

S_t : Closing price of the equity portfolio on F&O expiration day of month t

S_{t-1} : Closing price of equity portfolio on F&O expiration day of month t-1

F_{t-1} : Price at which futures contracts were short on F&O expiration day of month t-1

F_t : Price at which futures contracts were long on F&O expiration day of month t

D : Dividends from the long position in the equity portfolio

TC : Transaction costs

For any month t, the return from a portfolio with futures contracts was calculated as:

$$R_t = \{[(S_t + D_t - S_{t-1}) + (F_{t-1} - F_t) - TC] / S_{t-1}\} \times 100$$

Transaction costs included the bid-ask spread, securities transaction tax, brokerage, service tax on brokerage, and stamp duty. For calculation of these costs methodology used by Aggarwal (2010) was utilised.

3. FINDINGS

In the following text we provide summary statistics for five portfolios, that is simple buy & hold; portfolios with one-to-one and beta hedging using futures contracts; options based portfolios using ATM put and 2% ITM put. We present both average returns and standard deviation of returns for each strategy implementation. As the literature reports non-normality in the returns from portfolio consisting of derivative securities, results of normality check are also presented. In the light of the same, risk measured through standard deviation may not be an effective measure, alternative measures such as the maximum and minimum along with range are also presented. Hedging effectiveness of different strategies has been measured as variance of the unhedged position minus variance of hedged position divided by variance of unhedged position (see Aggarwal and Gupta, 2013). Although the purpose of hedging is to contain the risk of a portfolio, reference to returns is as important. Anderson and Danthine (1981), suggest that it is always better to talk about risk reduction when reference to returns is made and vice-versa. In other words, risk and returns cannot be optimized in isolation but one should talk about risk adjusted returns. In this light, we therefore report risk adjusted performance measure of CV and Sharpe ratio.

Table 1 presents the returns statistics for the five strategies taken up in the study. The mean returns were highest for the beta hedging 0.09% and the lowest for 2% ITM put based portfolio at -0.11%. However, the range of returns was largest in case of portfolio with ATM put option at 18.64% and lowest in case of buy & hold at 0.37%. The standard deviation of returns was however, highest for buy & hold portfolio at 1.98% and the lowest for beta-hedged portfolio at 1.38%. This indicates that protection through derivatives in the portfolio helps in risk reduction, irrespective of the instrument used. Results of Anderson-Darling test for normality show that returns from all strategies were normally distributed. Application of conventional measures like CV or Sharpe Ratio was thus right in place.

Table 1: Statistics for returns from different portfolio protection strategies

Measures	Futures		Protective Put		Buy & Hold
	One-to-One	Beta-Hedging	ATM	2% ITM	
Mean	0.04	0.09	-0.07%	-0.11%	0.06%
Minimum	-5.48%	-4.98%	-8.41%	-9.77%	-0.28%
Maximum	4.33%	2.22%	10.23%	6.72%	0.09%
Range	9.813%	7.216%	18.64%	16.49%	0.37%
Standard Deviation	1.60%	1.38%	1.76%	1.71%	1.98%
Protection Effectiveness	34.69%	51.41%	20.97%	15.54%	--
Anderson-Darling A^2	0.32*	0.33*	0.82*	0.88*	0.34*
CV	40.00	15.33	-25.14	-15.54	33.00
Sharpe Ratio	0.02	0.06	-0.04	-0.06	0.02
* Non-significant					

As the essence of protection is to reduce the risk of the portfolio; the same was captured through protection effectiveness. As shown, the protection effectiveness was the highest in case of beta hedging at 51.41% and lowest for 2% ITM put option at 15.547%.

To check the performance in mean-variance framework, coefficient of variation (CV) offers the most basic tool. The CV was the lowest in case of beta hedging at 15.33. The same was highest at 40.00 for one-to-one, -25.14 for ATM put option, -15.54 for 2% ITM put option, and 33.00 for buy & hold, again reflecting the usefulness of derivative securities. Risk adjusted performance measures also presented similar picture as Sharpe ratio was the highest for beta hedged portfolio at 0.06 and the lowest for buy & hold portfolio at 0.02. The same stood at -0.04 for portfolio with ATM option and -0.06 for portfolio with 2% ITM put option.

4. CONCLUSION

Rising volatility in the financial markets has constantly forced investors to look for protective measures for their investment portfolios. Today, a number of specialized instruments including short-selling, futures, and options contracts allow market players to protect themselves against adverse market movements. While short-selling has its own limitations, futures and option contracts offer potent and effective ways to protection. Since both have their own merits and limitations, choosing between the two offers a difficult situation to many investors and traders. This research was carried out to check the relative hedging performance of the two types of instruments.

Using a diversified portfolio of twenty Nifty 50 stocks and Nifty 50 futures and options contracts while incorporating all transaction costs, it can be concluded that derivative securities definitely

help reducing risk of a portfolio. However, when it comes to choosing between futures and options contracts, futures definitely outperform options contracts. Among the techniques chosen for deciding about the number of futures contracts to go short or long, beta-hedging turned out to be the most reliable.

5.   REFERENCES

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Gender and Risk: A Framing Analysis

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Abstract

The existing literature digs into the effect of gender, personality characteristics, and age on economic education. This paper covers literature by studying gender and risk to decision making of individuals for matters of risk and uncertainly. This paper studies violation of expected utility theory by framing risky situations differently among men and women. In this study, four situations are framed in two different ways and presented to respondents to study how framing and gender influence behavior. These findings exhibit that framing plays an important role in risk perception among gender. The study also reveals that gender plays an important role when individuals evaluate risky outcomes. The findings are consistent with view point of behavioral finance that human beings are irrational in decision making under risk and uncertainty. Gender is found to yield significant difference in choice of risky outcomes.

Keywords: behavior, decision making, framing, gender, and risk.

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1. INTRODUCTION

Individuals don't behave as per the expected utility theory. The economic interactions in which individuals are involved consist of some kinds of risk. Taking into account significance of economic interactions, a fairly large body of research in social science especially psychology, economics, and finance has tried to know and comprehend the nature of how decision makers incorporate risk in their choices.

Expected utility, the dominant theory of decision making under risk, makes some testable empirical predictions. Expected utility theory is a descriptive model of decision making under risk (Sewell, 2007). Expected utility theory states that individuals choose between risky prospects by comparing their expected utility values (Linciano & Soccorso, 2012). However, under expected utility the actual level of risk-taking behavior by the agent is left as a free parameter, allowing for individual differences (Charness & Gneezy, 2012).

All humans are subject to context sensitivity. Humans simply don't see through the way in which questions are asked (Montier, 2010). Individuals have a tendency to be risk averse when situations' outcomes are framed positively but risk seeking when these are framed negatively (Tversky & Kahneman, 1981).Framing is basically of three types: - attribute framing (in which only single attribute is subject to manipulation), absolute versus relative framing (whether loss or gain is presented in absolute or relative terms), and number size framing (people assign more significance to smaller numbers than to the small differences between large numbers) (Panasiak & Terry, 2013).

Levin, Schneider, & Gaeth (1998) classified framing into three major types: - risky choice, attribute, and goal framing. Hallahan (1999) classified framing into seven major types: - situations, attributes, choices, actions, issues, responsibility, and news. In this research paper, framing is a combination of above mentioned classifications.

Experimental studies have documented that decision-makers react differently to the same proposition depending upon the manner in which it is presented. This phenomenon is known as preference reversal and violates a strict expected utility analysis of decision-making (Machina, 1987). When the emotional context rather than the outcome influences managerial decisions, the issue of framing arises. For example, a reference point may influence the manager. The choice of reference point determines whether an uncertain choice is perceived as a gamble, (with a chance to win) or as insurance (where the certain choice limits loss) and influences the subject's decisions (Schoemaker & Kunreuther, 1979; Hershey & Schoemaker, 1980; McNail, Pauker, Sox & Tversky, 1982; Slovic, Fischoff & Lichtenstein, 1983).

To demonstrate this concept, alternate scenarios are presented with the same expected value outcomes. These alternate scenarios focus on four different risky situations and evaluate the impact of framing these four risky situations on decision making among men and women. Tversky and Kahneman (1981, 1986) present the classic decision for certain scenario and the same decision cases are used to study framing analysis in present research.

Gender is one of most important variable to be studied if we are studying risk and decision making (King & Hinson, 1994).Since birth a

human holds a set of heuristics and biases inherently, and an emotion is attached to choice because of these heuristics and biases which influences decision making (Qawi, 2010). This paper is an attempt to understand that if risky situations are presented differently, how perception of risk between male and woman varies. Behavioral studies have shown that framing of questions changes perception among individuals, but this study is unique because role of gender is studied and analyzed in this study.

2. REVIEW OF LITERATURE

Framing effect has been explained with different theories (Kuhber-ger, 1998). Gonzalez, Dana, Koshino, & Just (2005) divided these theories into formal, cognitive, and motivational theories. Under formal theory; the widely explained theory is Prospect Theory. Prospect theory describes value framing effect as a function of gains and losses from a reference point. The gain or loss perception of an outcome depends upon individual's reference point. The weighting of gains and losses is determined by cognitive processing through cognitive theories.

A fuzzy-trace theory and cost-benefits tradeoff are two critical theories in cognitive theories (Gonzalez, Dana, Koshino, & Just, 2005). Fuzzy trace theory states that superficial and simplified processing of information results in framing effect (Reyna & Brainerd, 1991). Cognitive cost benefit theory states that when there is a compromise between the desires to make a correct decision and the desire to minimize effort, the framing effect is framed (Payne, Betman, & Johnson, 1993).The third type of theory in framing effect is motivational theory. Motivations theory states that consequences of hedonic forces (fears and wishes) of an individual result in framing effect (Lopes, 1987; Maule, 1995).

The risk women are taking in decision making is different from men. Literature concludes that women have a lower preference for risk than men (Hyde, 1990: Powel &Ansic, 1997: Sonfield, Lussier, Corman, & KcKineey, 2001) but no difference in decision making values or styles (Powel, 1990). Gender is one of the most important independent variable that should be investigated when looking at risk and decision making (King & Hinson, 1994). Women are considered to choose more certain outcomes. In an abstract lottery choice, Schubert, Gysler, Brown & Brachinger (1999) frame choices as either potential gains or as potential losses. They find that women were more risk averse than men in the gain domain frame, consistent with the evidence presented earlier. For the loss-domain gambles, however, this result is reversed: men are more risk averse than women. Women communicate and make better decisions than men (Parker & Spears, 2001). Parker & Spears (2002) conducted a study on 249 students and found that behavior is influenced by personality types and gender.

Stanovich & Siegel (1994) found the same results that women hold a conservative long term investment strategy which can result in lower wealth accumulation. However, Zhong & Xiao (1995) found no gender effect on dollar holding of stocks). Sung & Hanna (1996) found than women have lower rates of participation in retirement plans as compared to men. Existing research gives a mix of results for role of gender in decision making. Women choose to invest their financial resources more conservatively and are generally more risk averse than men (Hinz, McCarthy, & Turner, 1997). The determinants for retirement plan for men and women are same (Devaney & Su, 1997).

3.   NEED OF THE STUDY

The need for the study is not only for investment decisions but is also important for social and economic decisions. The study is relevant for individuals, corporations, and policy regulators. Framing of situation plays an important role in decision making among men and women. Corporation can present the information differently across gender to increase shareholder's wealth, individuals can try to avoid the trap of being caught in biases of narrow framing, and policy makers can plan and implement policies depending on the manner in which information is presented. However, there have been very few studies on framing analysis of risky situations among gender in India. The present study has been carried out to fill the research gap.

4.   OBJECTIVES OF THE STUDY

The study is based on following objectives: -

i).   To study and analyze the role of framing in change of risk perception.

ii).   To study and analyze the role of gender in risk perception.

5.   HYPOTHESES OF THE STUDY

The objectives generate the following hypothesis:

H1: There is a role of framing in change of risk perception.

H2: There is a role of gender in risk perception.

6.   RESEARCH METHODOLOGY

The research methodology for the research titled "Gender and Risk: A Framing Analysis" is given below:

Study Design: - The study design for the present study is descriptive in nature because it addresses the questions of how, what and why of gender and framing analysis.

Sample Size: -The sample size for survey is 200 respondents. A total of 200 questionnaires and 400 responses are obtained because each questionnaire consists of two rounds. Hence 400 responses are analyzed.

Sample Selection: -A total of 200 business management or commerce students are selected for the study. To study role of gender equal proportion (100 male and 100 female students) of male and female students is selected to collect information.

Data Collection Instrument and Procedure: - In order to study and analyze gender and risk: - a framing analysis, a survey instrument, which captured framing and relative risk preferences based on alternate scenarios of four uncertain decisions, is used. In order to capture alternate framing environment four different questions were askedto each respondent. The questions which were used in survey response were based on scenarios of money, death, jobs, and stock. The question for money was presented as a straight monetary gamble in the first round; in the second round same type of question was framed differently as a decision to an investment in the stock market. Similarly questions of death, jobs, and stock were presented differently in round 1 & 2. The questions were same but the framing was done differently. On the same ground of methodology adopted by Parker, et.al (2001), the study was administered to a population of 200 business management and economics students.

Once the survey responses were collected, discrete measures were created for the variables. The variables on the four scenarios were dependent variables in the study. Hence, the

dependent variable includes: Money, with value equal 1 if the respondent chooses the uncertain option for the money question; death with value equal 1 if respondent chose the certain option for life and death question; Jobs, with value equal 1 if the respondent chooses the certain option for jobs; and Stocks with value equal 1 if respondent choose uncertain option for the stock question. Cross variable was then created between Frame and Gender variables.

7. RESEARCH METHODOLOGY FOR FRAMING AND RISK.

Framing issue arises when outcome is influenced by emotional context. The reference point is most critical point in such decisions because it is reference point only which decides whether a risky choice is perceived as gain or loss and reference point influences subject's decisions (Schoemaker & Kunreuther, 1979; Hershey & Schoemaker, 1980; Slovic, Fischoff & Lichtenstein, 1983). The below mentioned are four classic decision problems used in this research. These problems are taken from Tversky & Kahneman (1981, 1986).

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

a. If program A is adopted 400 people will die.

b. If program B is adopted, there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die.

Versus

a. If program C is adopted 200 people will be saved.

b. If program D is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that nobody will be saved.

The results described in Program A are similar to Program C. Both of these cases deal with situations where 200 people will live and 400 people will die. On similar grounds, the situations in Program B and Program D are similar. Both cases have a 1/3 probability that 600 people will live and 2/3 probability that 600 people will die. Now, both the situations have similar outcomes, but the results show that there is difference in risk perception of male and female.

The survey instrument captured framing and relative risk preferences based on alternate scenarios of four uncertain decisions. The same methodology is followed by Parker & Spears, 2002. The respondents were asked four different questions with an objective to capture how decision making changes if alternate framing environments are considered. The framing of one question is done as straight monetary gamble; alternatively, another question presents the same type of decision as an investment in stock market. One more situation discussing life and death choice with disease prevention strategies was included. Apart from these situations, a situation of corporate restructuring involving job loss was presented. In the questionnaire, no respondent was asked only questions framed as loss or gain rather both questions were asked from same respondent. The question with each variation is given in appendix.

The study was administered on 200 students in business management and commerce. Both the versions of questions were administered on all the respondents. The information of the gender of the respondents was also collected. Parker & Spears (2002) stated that results with student's survey used in framing literature can be replicated for other populations.

In order to get the data, the survey results gave discrete variables for analysis. The dependent variable includes: MONEY, with value of 1 if

the respondent chooses the uncertain situation for money questions; DEATH with value of 1 if the respondent chooses certain option for life and death question; JOBS. With value of 1 if respondent choose uncertain option for the stock question. To capture the influence of the framing of the question another 0 or 1 variable, FRAME, was created identifying the form used (Parker & Spears, 2002). For FRAME and GENDER, the cross variables were created.

A total of four discrete variables, MONEY, DEATH, JOBS, and STOCKS, were collected. In order to analyze the relationships, logistic probit procedure estimation technique was used. A value of Z under a normal curve is estimated by determining the probability of dependent variable with the help of probit procedure. In order to calculate probability associated with independent variable, a change in Z statistic as the dependent variable is introduced is evaluated.

Once the data was collected, a value of 0 or 1 is assigned to the responses. Depending on the version of situation formed, a value of 0 or 1 is assigned to the variable FRAME. In order to determine the probability a constant term can be used and a value of 1 is coded when respondent

chooses the decision. In order to identify if a significant change in responses is linked with use of alternate statement, the coefficient on FRAME can be used. Framing is presumed to occur, when coefficient on FRAME is significantly different from 0.

The primary attribute in consideration is risk and gender. The change in risk preference is captured by incorporating an attribute directly into the model by the coefficient. A cross term is used for illustrating differences in framing behavior by entering the attribute.

8. RESULTS

The evidence from the series of estimation reflects that framing plays an important role in risk perception of individuals and gender also influences risk perception. The four questions posted shows that framing plays a significant role in risk perception.

The results of probit analysis of Framing are reported in Table 1. The intercept term captures the basic tendency to opt for either the choice of certain outcome or choice of the gamble for each situation; so it measures risk preference. For example, the first column shows an intercept of -.218 for Money variable and for others as well.

Table 1: Probit Analysis of Framing				
	Money	Death	Jobs	Stocks
Intercept	-.218	.015	-.060	-.375
Standard Error	.286	.315	.292	.296
Wald Chi-Square	.584	.002	.042	1.605
n = 200				

The results of probit analysis of Gender are reported in Table 2. The results are shown at a cut value of .500. The results show that percentage correct for male is 65% while for female is 44%. The overall correct percentage for gender is 54.5%.

Table 2: Classification Table				
		Predicted gender of respondent		Percentage Correct
		Male	Female	
Gender of respondent	Male	65	35	65.0
	Female	56	44	44.0
Overall Percentage				54.5
a. The cut value is .500				

The results of Omnibus tests of model coefficients are reported in Table 3. The Omnibus tests of model coefficients table reports the chi square associated with each step in step wise model. There is only one step from the constant model to the block containing predictors so that all three values are same. The significance value or p value indicator our model is significantly different from the constant only model, meaning there is no significant effect for the combine predictors on the outcome variables.

Table 3: Omnibus Tests of Model Coefficients			
	Chi-square	df	Sig.
Step	2.336	4	.674
Block	2.336	4	.674
Model	2.336	4	.674

The results of Model summary are reported in Table 4.

Table 4: Model Summary		
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
274.923[a]	.012	.015
a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.		

The Nagelkerke R Square is the power of explanation of model, which is .015 in the results reported. The model is fitted with above mentioned percentage points. This number adjusts Cox and Snell in order to make the range of value equal to 1. The two R square are not the only r squares, there are pseudo r squares. Nagelkerke R Square is calculated in such a manner that it is between 0 and 1. In it, we want p value to be greater then cut off .05 to indicate good fit.

The ratio of likelihood represents the improvement of full model over the intercept model. The ratio here is .012, which indicates the greater the improvement because the ratio is small comparatively. Cox and Snell R uses L(M), it uses conditional probability of dependent variable given independent variable. It is y=used to determine convergence of logistic regression.

9. CONCLUSION

This study reports findings of framing of risky decisions and reports that framing of risky decisions results in choosing different outcomes. This study also reports that gender plays an important role in evaluating risky outcomes. The findings measure the significance of gender

while evaluating decisions in risky outcomes. The study reports framing and gender to produce differences in choice of risk preference and framing.

The study used four outcomes to study and analyze role of framing in change of risk perception and the role which gender plays in risk perception. The four situations of Money, Death, Jobs and Stock were easily understood by students. The increased risk aversion for female students characterizes females being risk averse compared to males. The example of Jobs also induces framing behavior by showing a loss of jobs. These four examples are most universally understood examples of framing behavior.

10. LIMITATIONS OF STUDY AND FUTURE DIRECTIONS FOR RESEARCH

The present study focused only on management and commerce students, this study can also be extended for financial analyst, investment advisors, and mutual fund managers. The present study focused only on framing and gender, other personality characteristics can also be studied. Framing can also be linked to the age, occupation, personality type, and other attributes. So the variable of interest for the study can be increased and more detailed research can be conducted with a view to gain more insights into framing and gender or other personality characteristics. The present study is conducted with existing data collection instrument; further research can be conducted by developing a new instrument as per the existing situations in Indian economy. Nevertheless, the present study investigated and found critical results which are useful for the practitioners, and academicians.

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Stock Market Interlinkages among Indian Equity Market and Bangladesh Equity Market

Vandana Dangi*

Abstract

The financial markets of interlinked nations exhibit an increasing co-movement trend. The knowledge of their integration, causality and innovation response enhances the vision of investors and financial regulators. Investors on the basis of gained knowledge make their investment decisions and financial regulators monitor the financial contagion. The present treatise aims to explore the inter-linkages between equity markets of two neighbour countries; India and Bangladesh; on the basis of return correlations, cointegration, causality and spillovers. The daily stock price data for the period of September 2014 to September 2016 on BSE Sensex and DSE 30 have been taken from the online database maintained by the Bombay Stock Exchange and the Dhaka Stock Exchange respectively. The data of these two indices was studied for stationarity, serial correlation, cross correlation, integration, causality and spillovers with the help of augmented Dickey–Fuller test, autocorrelation function and partial auto correlation function, Ljung-Box Q-statistics, cross correlogram, Johansen cointegartion test, vector autoregression Granger causality tests (Block exogenity test), impulse response function and variance decomposition. The results provide evidences on the segmentation of equity markets of India and Bangladesh as there is no significant inter-linkage between these two markets. The findings of this paper have implications for policy makers and international investors. The segmentation of these markets provides signals to policy makers to take appropriate decisions that may attain and sustain the financial stabilisation of their country. The international investors can avail the long-run diversification benefits across these two segmented markets.

Keywords: block exogenity, cointegration, cross correlation, impulse response function, serial correlation, spillovers, stationarity, variance decomposition and vector autoregression.

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1. INTRODUCTION

India and Bangladesh are South Asian neighbours having civilisational, social, cultural and economic links. They are like normal neighbours who share a relationship of friendship along with disputes over some issues that can be resolved with positive efforts. These two nations have been in friendly relation in general with some murky border disputes. Recently, they have signed a historic land boundary agreement on 6 June 2015 that stopped all irritants in ties and opened a new era in their relations. There are many facets that connect these two countries like shared history, common heritage, linguistic ties, cultural ties and economic ties. They are common members of South Asian Sub-regional Economic Cooperation (SASEC), South Asian Association for Regional Cooperation (SAARC), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), Indian Ocean Rim Association (IORA) and the Commonwealth. The inter-linkages among economies have been quantitatively estimated by the analysis of data of their bilateral trade, investment and financial markets. The researchers have studied the inter-linkages among various economies largely on the basis of main indices of national stock exchanges of the economies. Eun & Shim (1989) studied daily stock market returns of Australia, Japan, France, Canada, Switzerland, Germany, US and the UK. The study confirmed the substantial interdependence among the national stock markets with US being the most influential market. All European and Asia-Pacific markets respond strongly against US innovations with a one day lag and the most responses are completed within two days. Hamao, Masulis & Ng (1990) used daily and intraday price and stock returns

data to find spillover effects in the US, UK and Japanese stock market. They found significant spillover effects from the US and the UK stock markets to the Japanese market but there was no spillover effect from Japanese market to the US and the UK stock markets. Park & Fatemi (1993) examined the linkages between the equity markets of the Pacific Basin countries with those of the UK, US and Japan. They also concluded that the US market was the most influential as compared to that of Japan and UK. They concluded that Australia was most sensitive to the US market; Singapore, Hong Kong and New Zealand exhibited moderate linkages; Korea, Taiwan and Thailand exhibited little linkage. Lin, Engle & Ito (1994) found that foreign returns significantly influence the domestic returns of Japan and US. They also found that cross-market interdependence in returns as well as volatilities. The interdependence was bi-directional between the New York and Tokyo markets. Booth, Martikeinan & Tse (1997) examined the price and volatility spillovers in the four Scandavian stock markets by employing the multivariate EGARCH model. They investigated for the period 2 May 1988 to 30 June 1994. They found that volatility transmission was asymmetric in Danish, Norwegian, Swedish and Finnish stock markets. Janakiramanan & Lamba (1998) empirically examined the linkages between the Pacific-Basin stock markets. The results showed that the US influenced all other markets, except for relatively isolated market of Indonesia. Markets that were geographically and economically close and/or had large number of cross-border listings exert significant influence over each other. Overall, the influence of the US market on the Australian markets had diminished over more recent years, and the emerging market

of Indonesia was becoming more integrated with these markets. Kanas (2000) examined the volatility spillover effect between the exchange rate and the stock price of the United States, the United Kingdom, German, Japan, France and Canada. They concluded that there was a significant volatility spillover effect from the stock market to the exchange market in all nations except Germany. Johnson & Soenen (2002) investigated the degree of integration of equity markets in Asia with Japanese equity market. They found that the equity markets of China, Australia, Hong Kong, Malaysia, New Zealand and Singapore were highly integrated with the Japanese stock market. They also found that the Asian markets became more integrated over time. Balaa & Premaratneb (2002) investigated volatility co-movement between the Singapore stock market and the markets of UK, US, Hong Kong and Japan. They employed Univariate GARCH, Vector Autoregression and Multivariate and Asymmetric Multivariate GARCH model with GJR extensions to the daily returns from 1992 to 2002. They found a high degree of volatility co-movement between Singapore stock market and UK, US, Hong Kong and Japan. The order of volatility co-movement was Hong Kong, US, Japan and UK. There was small but significant volatility spillover from Singapore stock market into Hong Kong, Japan and US markets. Kaur (2004) employed various volatility estimators and diagnostic tests to investigate the nature and characteristics of volatility in the Indian stock market. She found that volatility clustering, asymmetry, intra-week and intra-year seasonality were present in Sensex and Nifty. There was mixed evidences of volatility spillover between the US and Indian markets. Beirne, Guglielmo, Marianne & Nicola

(2009) modelled volatility spillovers from mature stock markets to emerging stock markets, tested for the changes in the transmission mechanism during turbulences and examined the implications for conditional correlations between mature market returns and emerging market returns. They applied Tri-variate GARCH-BEKK model and Wald test on the data of 41 emerging market economies. They found significant volatility spillovers from mature stock markets to emerging stock markets. They also found that spillover parameters change during turbulent episodes and conditional correlations between local markets and mature markets had increased during these episodes. Chang et al. (2009) applied GJR-GARCH model and found that there was an asymmetric threshold and a co-integration relationship between the exchange and the stock markets. Choi (2009) used the multivariable EGARCH model to measure the volatility spillover between the exchange market and stock markets of New Zealand after the Asia financial crisis in 1997. The study concluded that the volatility of the stock price had a spillover effect on the New Zealand's three indices. Zhizhen & Xiuquan (2010) used co-integration Granger causality test to examine the interaction of the exchange and stock markets. They confirmed that there was a long-term and stable relationship between the exchange and stock markets. They also concluded that there was a one-way price spillover effect and volatility spillover effect between these markets. Xinling & Peng (2011) examined the volatility spillover effect of China's exchange rate and stock price. Contrary to earlier studies they found two-way volatility spillover effect between the exchange rate and the stock price. They also found that the effect of the exchange rate volatility on stock

price volatility was less significant than the effect of stock price volatility on exchange rate volatility. Arora Srinivasan, P. (2012) examined the price discovery process and volatility spillovers in Indian spot-futures commodity markets by using Johansen cointegration, vector error correction model and EGARCH model. The four futures and spot indices of MCX representing agriculture, energy, metal and the composite index were taken. The study confirmed the presence of long-term equilibrium relationships between the futures price and its underlying spot price of the commodity markets and there is a flow of information from spot to futures commodity markets. Louzis (2013) examined the return and volatility spillovers among the money, foreign exchange, stock and bond markets of the euro area. They utilized the forecast-error variance decomposition framework of a generalized VAR model to estimate the predictive directional measurement of volatility spillovers. They found the presence of high level of total return and volatility spillover effects throughout the sample. They also identified stock market as the main transmitter of both return and volatility spillovers. Bonds of the periphery countries that were under financial support mechanisms were receivers of return spillovers. Natarajan, Singh & Nagarajan (2014) used a time series generalized auto regressive conditional heteroscedasticity in the Mean GARCH (1,1)-Mean model to examine mean-volatility spillovers across national stock markets. They found statistically significant mean spillovers from the markets of USA to the Australian market and Germany market. They also found that the past USA returns had a greater effect on current returns in Germany as compared to Australia. Zhang & Jaffry (2015)

explored the influence of the global financial crisis on the volatility spillover between China stock market and Hong Kong stock market. They broke the data into two sub-periods: pre-crisis from January 04, 2002 to June 30, 2007 and crisis period from July 01, 2007 to December 31, 2013. They applied asymmetric BEKK-GARCH and adopted the vector autoregressive approach as a robustness test. They concluded that there was no volatility spillover in the pre-crisis period and strong bi-directional volatility spillover in the crisis period. Larisa, Janusz & Chi (2016) provided empirical evidence on the patterns of intra-regional and inter-regional transmission of information across emerging and developed markets. They examined data of ten developed markets and eleven emerging markets in America, Asia, Europe and Africa. They used stock indices and stock index futures to examine the main transmission channels from 2005 to 2014. They applied the generalized vector autoregressive framework and found that these markets are more susceptible to region-specific and domestic volatility shocks than to inter-regional contagion. They also found difference in patterns of international signals transmission between models that were employed on indices and futures data. The futures data provided more efficient channels of information transmission due to the magnitude of return and volatility spillovers across them.

Studies of inter-linkages between financial markets have focused primarily on return correlations and volatility spillovers of developed countries with other developed nations or few emerging economies. But there is lack of exploration of inter-linkages among emerging economies. The present treatise is an attempt to fill this lacuna by studying the inter-linkages

between Indian stock market and Bangladesh stock market.

2. OBJECTIVES OF THE STUDY

The present treatise attempts to explore the stock market inter-linkages between Indian equity market and Bangladesh equity market. The main objective of the present treatise can be further delineated into following points:

i) To examine the cointegration of Indian stock market and Bangladesh stock market.

ii) To study the causality among Indian stock market and Bangladesh stock market.

iii) To study the spillovers between Indian and Bangladesh stock market.

3. RESEARCH METHODOLOGY

The daily stock price data for the period of September 2014 to September 2016 on BSE Sensex and DSE 30 have been taken from the online database maintained by the Bombay Stock Exchange and the Dhaka Stock Exchange respectively. BSE Sensex is considered as pulse of the domestic stock markets in India and DSE 30 is considered as pulse of the domestic stock markets in Bangladesh. BSE Sensex is also-called as BSE 30 or S&P Bombay Stock Exchange Sensitive Index. It is a free-float market-weighted index of thirty well-established and financially sound companies which are listed on the Bombay Stock Exchange. The component companies are some of the largest and most actively traded stocks in India which represents various industrial sectors of the Indian economy. DSE 30 index is also called as DS30. This index is a float-adjusted market weighted index of thirty leading companies which are listed on the Dhaka Stock Exchange. The component companies are the largest and most actively traded stocks

in Bangladesh representing various industrial sectors of the Bangladesh economy. The series of 373 returns has been analyzed to explore the stock market inter-linkages.

4. ECONOMETRIC METHODOLOGY

The data of two indices was studied for stationarity, serial correlation, cross correlation, integration, causality and spillovers through following statistical tests.

The data were initially studied for stationarity with the help of **Augmented Dickey–Fuller test.** This test is important as the vector error correction model, vector autoregression model and Granger causality tests can be applied to stationary time series only. In case the series are non-stationary then only Johansen cointegartion test can be applied to the series. The series needed to be transformed into stationary series by appropriate method so that vector error correction model, vector autoregression model and Granger causality test can be used for estimation. It is a test for a unit root in a time series sample. It examines whether a time series variable is non-stationary using an autoregressive model. It tests the existence of a unit root as the null hypothesis. The testing procedure for the ADF test consists of estimation of the following regression:

$$\Delta y_t = \propto + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

The unit root test is carried out under the null hypothesis $\gamma = 0$ against the alternative hypothesis of $\gamma < 0$. Once a value for the test statistic is computed, it is compared to the relevant critical value for the Dickey–Fuller test. If the test statistic is less than the critical value, then the null hypothesis is rejected implying no unit root is present.

Autocorrelation function (ACF) and Partial Auto-correlation Function (PACF): Tintner (1953) defined autocorrelation as "lag correlation of a given series with itself, lagged by a number of time units". The autocorrelation at lag t by r_t is given by

$$r_t = \frac{\sum_{i=k+1}^{n}(X_i - \bar{X})(X_{i-k} - \bar{X})}{\sum_{i=1}^{n}(X_i - \bar{X})^2}$$

All autocorrelations at lags 1, 2,….n together make up the autocorrelation function. Partial auto correlation function measure the relationship between X_t and $X_{(t-k)}$ in time series after removing the effects of other time lags 1, 2,...,k − 1. The return is white noise in case the ACF and PACF coefficient lie within the critical values i.e. ±1.96(1/N).

Ljung-Box Q-statistics: The Ljung–Box Q statistics test the randomness on the basis of number of lags. It is also known as portmanteau test that indicates whether any group of autocorrelations of a time series are different from zero. The Q-statistic at lag is a test statistic for the null hypothesis that there is no autocorrelation up to order and is computed as:

$$Q = n(n+2) \sum_{k=1}^{h} \frac{p_k^2}{n-k}$$

Note that in case the series is not based upon the results of autoregressive integrated moving average estimation, then as per the null hypothesis, Q is asymptotically distributed as a chi-squared distribution with degrees of freedom equal to the number of autocorrelations. The critical region for rejection for significance level (α) is $Q > \chi_{1-\alpha,h}^2$ (it is the α-quantile of the chi-squared distribution with h degrees of freedom).

Cross correlation: It is also known as cross correlogram. It is a measure of similarity of two time series as a function of the lag of one series relative to the other series. The correlations are asymptotically consistent approximations. This analysis does not confirm the causality but rather determines the time lag between two variables. So, this analysis helps in determining the cross correlation in the following forms:

RSensex, RDSE30(-1)

RSensex, RDSE30(+1)

The first cross correlogram relates BSE Sensex returns to the past value of DSE30 returns and the second cross correlogram relates BSE Sensex returns to subsequent DSE30 returns.

Johansen Cointegration Test: It tests the cointergration of several I(1) time series. It permits more than one cointegrating relationship. This test evaluates the long run or equilibrium relationship. If the residual from the regression equation of the series (which are non stationary in level but are stationary after first differencing) is stationary then it confirms that the series are cointegrated. Note that the vector error correction mechanism can be applied to co-integrated series only and if series found to be non co-integrated then vector autoregression models are applied. **Vector Error Correction Mechanism** examines the long run causality and short run causality between variables. There may be disequilibrium in the short run in the cointegrated series having long run relationship. The error generated from such cointegrated series is termed as equilibrium error. The error correction mechanism equation, stating the dependence of ΔY_t ton ΔX_t tand equilibrium error, is:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 (Y_{t-1} - \beta_1 - \beta_2 X_{t-1}) + \varepsilon_t$$

Where $\Delta Y_t = Y_t - Y_{t-1}$

$$\Delta X_t = X_t - X_{t-1}$$

ε_t = Random error term

Vector Autoregressive Models: Sims (1980) suggested the vector autoregression models (VAR) as a substitute of dynamic simultaneous equation models involving too many arbitrary decisions. In these models, each variable is a function of its own past and the past values of other variables. The vector autoregression model used in the present treatise is based on the following equations:

$$RSENSEX_t = \lambda_{10} + \lambda^1_{11} RSENSEX_{t-1} + \lambda^1_{12} RDSE30_{t-1}$$

$$+ \cdots \ldots \ldots \ldots + \lambda^p_{11} RSENSEX_{t-p} + \lambda^p_{12} RDSE30_{t-p} + \varepsilon_{1t}$$

$$RDSE30_t = \lambda_{20} + \lambda^1_{21} RSENSEX_{t-1} + \lambda^1_{22} RDSE30_{t-1}$$

$$+ \cdots \ldots \ldots \ldots + \lambda^p_{21} RSENSEX_{t-p} + \lambda^p_{22} RDSE30_{t-p} + \varepsilon_{2t}$$

These equations can also be presented in the matrix form. The matrix form is as follows:

$$\begin{bmatrix} RSENSEX_t \\ RDSE30_t \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \end{bmatrix} + \begin{bmatrix} \lambda^1_{11} & \lambda^1_{12} \\ \lambda^1_{21} & \lambda^1_{22} \end{bmatrix} \begin{bmatrix} RSENSEX_{t-1} \\ RDSE30_{t-1} \end{bmatrix}$$

$$+ \ldots \ldots \ldots + \begin{bmatrix} \lambda^p_{11} & \lambda^p_{12} \\ \lambda^p_{21} & \lambda^p_{22} \end{bmatrix} \begin{bmatrix} RSENSEX_{t-p} \\ RDSE30_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

The compact form of above equation is as follows:

$$\acute{y}_t = a_0 + A_1 \acute{y}_{t-1} \ldots \ldots \ldots \ldots \ldots A_p \acute{y}_{t-p} + \varepsilon_t$$

Where, $_t$ = vector of all the k variables that are included in the system

a_0 = k×1 vector of intercepts

$A_1 \ldots \ldots A_p$ = k×k matrix of coefficients

ε_t = vector of error terms

ε_t = is assumed to follow multivariate normal distribution and with zero autocorrelation.

The lag-order p is decided with the help of an individual or/and collective information criteria encompassing sequential modified likelihood ratio test statistic, Akaiki Information Criterian (AIC), Schwarz Bayesian Criterion (SBC) and Hannan-Quinn information criterion (HQ). The interpretation of individual coefficients from vector autoregression model is done directly as well as with the help of following summary statistics:

a) **Block significance:** The causality in a vector autoregression model is estimated with the help of **block significance test.** It examines the joint significance of lagged coefficients of one variable in the equation of another variable. In the present context of bivariate case, the causality is examined with the help of the Granger causality test. This test in vector autoregression model framework is also known as **"Block Exogenity Test".**

b) **Innovation response:** It is also known as **impulse response analysis** used to explore the volatility transmission or spill between the markets. The impulse response function requires a representation of a stable vector autoregression model of order k as an infinitive order vector moving average process. This representation traces the time path of the impact of a shock in one variable on all the variables included in the vector autoregression model. This analysis assumes that at a time the shock occurs in one variable. So, this assumption is valid only if the shocks in different variables are not contemporaneously correlated. In case of the presence of significant contemporaneous correlation the results of innovation response analysis depends on the method of decomposition used. The **Cholesky decomposition method** is used to study the impulse response. This method is based on the assumption that all the contemporaneous correlation between two variables are accounted as caused by the

first variable. Therefore the order of the variables in the VAR system is very crucial to determine the impulse response.

c) **Variance decomposition:** Cholesky decomposition method involves a sequential decomposition of the variance covariance matrix that converts the variance covariance matrix of contemporaneously correlated error terms into variance-covariance matrix of the non-correlated error terms. The first variable is considered as contemporaneously independent. The second variable is considered as contemporaneously dependent on the first variable and the third variable is dependent on the first variable and the second variable and so on.

5. PROPERTIES OF BSE SENSEX RETURNS AND DSE30 RETURNS SERIES

The series of indices on BSE Sensex and DSE 30 have been converted into return series by applying the following formula:

$$R_t = (In\ P_t - In\ P_{t-1}) * 100$$

where R_t is the return for day t, P_t is indices for day t, P_{t-1} is the indices of previous trading day and In is natural log. The basic statistics of return indices are portrayed in following table:

**Table 1: Basic statistics of BSE sensex returns and DSE30 returns**

Descriptive Statistics	BSE Sensex	DSE 30
Mean	0.000198	-0.00013
Median	0.000285	-0.00043
Maximum	0.033574	0.041801
Minimum	-0.06999	-0.0353
Std. Dev.	0.01158	0.009516
Skewness	-0.6895	0.07924
Kurtosis	6.514284	5.26678
Jarque-Bera	221.4969	80.24798
Probability	0.000000	0.000000
Observations	373	373

The average statistics of BSE Sensex returns is positive implying the fact that this indices has increased over the period whereas the average statistics of DSE30 returns is negative implying the decrease in the indices over the period. The returns are negatively skewed in BSE Sensex that indicate the high probability of earning negative returns. The DSE 30 returns are positively skewed that indicates the high probability of earning positive returns. The value of kurtosis statistics is more than three in both indices. It means that the data is leptokurtic. BSE Sensex and DSE 30 returns series have a heavier tail as compared to the standard normal distribution. Jarque-Bera test confirms the non-normality of return series of Indian and Bangladesh main market indices as the value of probability is zero i.e. the null hypothesis of normal distribution cannot be accepted by the Jarque-Bera test.

The time series of BSE Sensex and DSE 30 are first tested for stationarity by graphical method and then by applying Augmented Dickey–Fuller test. The graphical presentation in exhibit 1 for BSE Sensex and DSE 30 indicates that both time series are non stationary.

Figure 1: Time series of BSE Bankex and DSE30
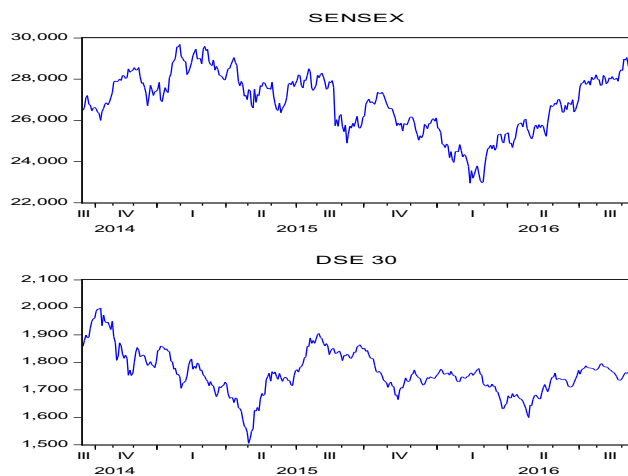
The augmented Dickey–Fuller test is further applied to test the null hypothesis of unit root. Table 2 indicates the results of augmented Dickey–Fuller test for indices series of BSE Sensex and DSE 30.

Table 2: Results of augmented Dickey–Fuller test on BSE sensex and DSE 30 indices

Null Hypothesis: BSE SENSEX has a unit root					
			t-Statistic	Prob.*	Durbin-Watson stat
Augmented Dickey-Fuller test statistic			-1.909153	0.3280	1.978725

Null Hypothesis: DSE30 has a unit root					
			t-Statistic	Prob.*	Durbin-Watson stat
Augmented Dickey-Fuller test statistic			-2.211237	0.2027	1.826851

The null hypothesis that indices series of BSE Sensex and DSE 30 have unit root cannot be rejected as the probability value is greater than 0.05. A peculiar point to note here is that value of Durbin–Watson statistic i.e. d in BSE Sensex indices is almost equal to 2 indicating no autocorrelation whereas the same statistic is less in DSE30 indicating the chances of autocorrelation.

Transformation of non-stationary time series to stationary time series: The series of BSE Sensex and DSE30 are non-stationary time series as confirmed by the results of augmented Dickey–Fuller test. These non-stationary time series are transformed to stationary time series by estimating differentiated log of BSE Sensex and by estimating differentiated log of DSE 30. Again the augmented Dickey–Fuller test is applied on differentiated log of BSE Sensex {dlog(Sensex)} and on differentiated log of DSE30 {dlog(DSE30)} to test the null hypothesis of unit root. Table 3 indicates the results of augmented Dickey–Fuller test for differentiated log of BSE Sensex and DSE30.

Table 3: Results of augmented Dickvey–Fuller test on BSE sensex returns and DSE 30 returns

Null Hypothesis: RSENSEX has a unit root					
			t-Statistic	Prob.*	Durbin-Watson stat
Augmented Dickey-Fuller test statistic			-19.33606	0.0000	1.996984

Null Hypothesis: RDSE30 has a unit root					
			t-Statistic	Prob.*	Durbin-Watson stat
Augmented Dickey-Fuller test statistic			-17.69191	0.0000	2.017458

The null hypotheses that BSE Sensex returns and DSE 30 returns have unit root are rejected as the probability value is 0 i.e less than 0.05. The graphical presentation of BSE Sensex returns and DSE 30 returns in exhibit 2 indicates transformation of non-stationary time series to stationary time series.

Figer 2: Plot of daily returns of BSE Bankex and DSE30
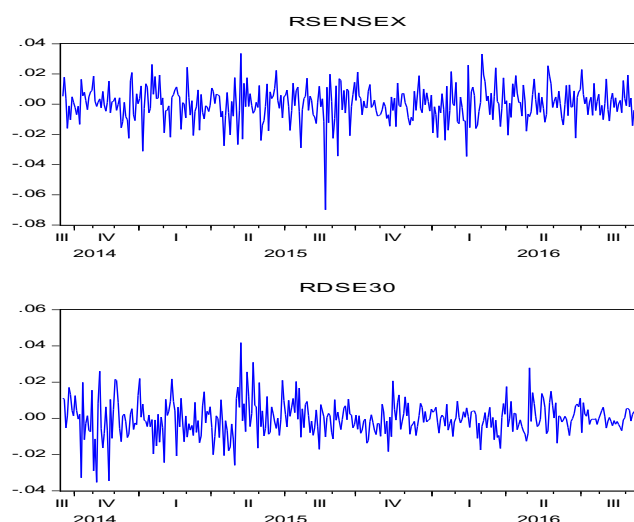
Cointegration between BSE Sensex and DSE30 indices series: The time series of BSE Sensex indices and DSE30 indices are non-stationary at level form and stationary at the first difference. So it can be concluded that both series are I(1) series and these series may be cointegrated. Johansen cointegration test is first applied to determine either the BSE Sensex indices series and DSE30 indices series are cointegrated or not. Table 4 portrays the result of Johansen cointegration test on BSE Sensex indices series and DSE30 indices series encompassing the Eigen value and Trace statistics.

The results clearly indicate that the null hypothesis of no-cointegration cannot be rejected even at the 10%. So, the time series of BSE Sensex indices series and DSE30 indices are not cointegrated as confirmed by the result of Johansen cointegration test. The vector error correction mechanism cannot be applied to these non-cointegrated series. The vector autoregression models are applied to these series in the present treatise.

Table 4: Result of Johansen cointegration test on BSE sensex indices series and DSE30 indices series

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.023441	11.44134	15.49471	0.1858
At most 1	0.007259	2.688510	3.841466	0.1011
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.023441	8.752828	14.26460	0.3073
At most 1	0.007259	2.688510	3.841466	0.1011
Max-eigenvalue test indicates no cointegration at the 0.05 level				

Autocorrelation: The next stage is to statistically detect the autocorrelation with the help of autocorrelation function (ACF), partial autocorrelation function (PACF) and Q statistics in the BSE Bankex return series and DSE30 returns series. Note that the Durbin statistic is not suitable for autoregressive models that is why Q statistics is used in the present treatise to investigate the autocorrelation. Table 5 portrays the results of ACF, PACF and Q statistics and its associated probabilities values for BSE Sensex return series. The ACF and PACF coefficients are not significant as they do not fall in the rule of thumb range of +0.14 to -0.14. The probability value of Q statistic is also more than 0.05 at each lag in BSE Sensex return series indicating the chances of no autocorrelations in all lags of BSE Sensex returns series. So, null hypothesis of no autocorrelation is not rejected.

Table 5: Results of ACF, PACF and Q statistics for the BSE sensex return series

Autocorrelation	Partial Correlation		AC	PAC	Q - Stat	Prob
.|. |	.|. |	1	-0.005	-0.005	0.0099	0.921
.|. |	.|. |	2	-0.005	-0.005	0.0203	0.990
.|. |	.|. |	3	-0.019	-0.019	0.1556	0.984
*|. |	*|. |	4	-0.122	-0.122	5.7544	0.218
.|. |	.|. |	5	0.028	0.026	6.0472	0.302
.|. |	.|. |	6	0.056	0.055	7.2322	0.300
.|. |	.|. |	7	-0.053	-0.058	8.3048	0.306
.|* |	.|. |	8	0.084	0.072	11.037	0.200
.|. |	.|. |	9	-0.038	-0.029	11.581	0.238
.|. |	.|. |	10	-0.062	-0.053	13.053	0.221
.|. |	.|. |	11	-0.004	-0.017	13.058	0.290
*|. |	*|. |	12	-0.101	-0.087	17.025	0.149
.|. |	.|. |	13	-0.046	-0.057	17.834	0.164
.|* |	.|. |	14	0.076	0.055	20.112	0.127
.|. |	.|. |	15	-0.055	-0.050	21.300	0.128

Table 6 portrays the results of ACF, PACF and Q statistics and its associated probabilities values in case of DSE30 return series. This series may have autocorrelation at one, two and four lag at the 10% level.

Table 6: Results of ACF, PACF and Q statistics for the DSE30 return series

Autocorrelation	Partial Correlation		AC	PAC	Q - Stat	Prob
.|*		.|*		1	0.085	0.085	2.7227	0.099
.|*		.|*		2	0.089	0.082	5.7129	0.057
.|.		.|.		3	-0.011	-0.025	5.7598	0.124
.|*		.|*		4	0.079	0.075	8.1031	0.088
.|.		.|.		5	0.038	0.029	8.6497	0.124
.|.		.|.		6	-0.022	-0.042	8.8418	0.183
.|.		.|.		7	-0.031	-0.029	9.2155	0.238
.|.		.|.		8	0.049	0.056	10.133	0.256
.|.		.|.		9	-0.042	-0.053	10.800	0.290
.|*		.|*		10	0.087	0.090	13.718	0.186
*|.		*|.		11	-0.119	-0.121	19.194	0.058
*|.		*|.		12	-0.118	-0.126	24.602	0.017
*|.		.|.		13	-0.099	-0.056	28.390	0.008
.|.		.|.		14	-0.061	-0.044	29.822	0.008
.|.		.|.		15	0.040	0.070	30.450	0.010

Cross correlation: The cross correlation between BSE Sensex return series and DSE30 returns series is portrayed in table 7. The first cross correlogram in a form of {RSensex, RDSE30(-1)} related BSE Sensex returns to the past value of DSE30 returns. The negative correlations suggest that past growth or lagged growth in DSE30 returns reduces BSE Sensex returns. The second cross correlogram in a form of RSensex, RDSE30(+1) related BSE Sensex returns to subsequent DSE30 returns. It shows that recent BSE Sensex returns tends to be negatively related to subsequent DSE30 returns. Note that this analysis does not confirm the causality between BSE Sensex return series and DSE30 return series but rather it determines the time lag between two variables.

Table 7: Results of cross correlogram of BSE sensex return series and DSE30 return series

Rsensex, Rdse30(-I)	Rsensex, Rdse30(+I)	i	lag	Lead
.|.		.|.		0	0.0412	0.0412
*|.		.|.		1	-0.0563	-0.0059
.|.		.|.		2	-0.0097	-0.0379
.|.		.|.		3	-0.0151	-0.0340
.|*		.|*		4	0.0632	0.0697
.|.		.|.		5	0.0001	0.0451
.|*		*|.		6	0.0500	-0.0641
.|.		.|.		7	0.0163	-0.0300
*|.		*|.		8	-0.0746	-0.0521
.|*		.|.		9	0.0936	-0.0274
.|.		.|.		10	0.0054	-0.0245
.|.		*|.		11	-0.0079	-0.0533
.|.		.|.		12	0.0185	0.0199
.|.		.|.		13	0.0330	0.0324
.|.		.|.		14	-0.0053	-0.0235
.|.		.|.		15	-0.0319	-0.0409

Vector autoregression: The mixed evidences of autocorrelations and cross correlation necessitate the further investigation with the help of vector autoregression models. Table 8 portrays the results of VAR lag order selection criteria.

Table 8: Results of VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
Endogenous variables: RSENSEX RDSE30						
0	2290.845	NA	1.23e08-*	12.54162-*	12.52025-*	12.53312-*
1	2292.678	3.636181	1.24e08-	-12.52974	-12.46564	-12.50427
2	2294.326	3.249848	1.26e08-	-12.51685	-12.41001	-12.47439
3	2294.841	1.010202	1.28e08-	-12.49776	-12.34817	-12.43831
4	2300.255	10.56228*	1.27e08-	-12.50551	-12.31318	-12.42908
5	2300.903	1.256087	1.29e08-	-12.48714	-12.25208	-12.39372
6	2303.595	5.192503	1.30e08-	-12.47997	-12.20217	-12.36957
7	2304.632	1.989698	1.32e08-	-12.46374	-12.14320	-12.33635
8	2307.904	6.239013	1.33e08-	-12.45975	-12.09647	-12.31538
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

The sequential modified likelihood ratio test statistic suggests the selection of four lags in the vector autoregression model whereas all other criteria suggest no selection of any lag of both indices series. So to proceed further and rigorously confirm the results statistically, the four lags are selected to frame the following equations of the vector autoregression models in the present case:

$$\text{RSENSEX} = C(1) * \text{RSENSEX}(-1) + C(2) * \text{RDSE30}(-1) + C(3)$$
$$* \text{RSENSEX}(-2) + C(4) * \text{RDSE30}(-2) + C(5) * \text{RSENSEX}(-3) + C(6)$$
$$* \text{RDSE30}(-3) + C(7) * \text{RSENSEX}(-4) + C(8) * \text{RDSE30}(-4) + C(9)$$
$$\text{RDSE30} = C(10) * \text{RSENSEX}(-1) + C(11) * \text{RDSE30}(-1) + C(12)$$
$$* \text{RSENSEX}(-2) + C(13) * \text{RDSE30}(-2) + C(14) * \text{RSENSEX}(-3) + C(15)$$
$$* \text{RDSE30}(-3) + C(16) * \text{RSENSEX}(-4) + C(17) * \text{RDSE30}(-4) + C(18)$$

The results of vector autoregression estimates are portrayed in table 9 and the significance of individual variable explaining the dependent variable are portrayed in table 10. These results clearly indicate that the p value all coefficients of lag variables is not only more than 0.05 but also more than 0.10 except in case of C(7) which is the coefficient of fourth lag in BSE Sensex return series. So, the results clearly indicate that there is no lagged variable that is significant to explain the dependent variable (BSE Sensex return in equation 12 and DSE30 in equation 13) except for fourth lag of BSE Sensex returns.

Table 9: Results of Vector Autoregression Estimates

Standard errors in ( ) & t-statistics in [ ]	RSENSEX	RDSE30
RSENSEX(-1)	-0.007033	-0.001103
	(0.05208)	(0.04281)
	[-0.13506]	[-0.02577]
RSENSEX(-2)	-0.000577	-0.034831
	(0.05217)	(0.04289)
	[-0.01106]	[-0.81211]
RSENSEX(-3)	-0.016328	-0.020797
	(0.05205)	(0.04279)
	[-0.31368]	[-0.48597]
RSENSEX(-4)	-0.128061	0.059641
	(0.05198)	(0.04274)
	[-2.46368]	[1.39560]
RDSE30(-1)	-0.081131	0.082267
	(0.06383)	(0.05247)
	[-1.27115]	[1.56774]
RDSE30(-2)	-0.014166	0.084710
	(0.06406)	(0.05266)
	[-0.22115]	[1.60847]
RDSE30(-3)	-0.011644	-0.033347
	(0.06395)	(0.05257)
	[-0.18210]	[-0.63429]
RDSE30(-4)	0.083699	0.070064
	(0.06364)	(0.05232)
	[1.31515]	[1.33905]
C	0.000200	-0.000145
	(0.00060)	(0.00050)
	[0.33249]	[-0.29265]

Block exogeneity: Genearlly, the pairwise Granger causality tests cannot be applied in vector autoregression model framework. So, the block exogeneity Wald test is applied in the present treatise to estimate VAR Granger causality between BSE Sensex return series and DSE30 returns series. The causality here means the chronological ordering of movement in the BSE Sensex return series and DSE30 returns series. The results portrayed in table 11 shows that the null hypothesis of non-significant lagged coefficients of one variable in the equation of another variable cannot be rejected as the probability value is greater than 0.05. So, it may be concluded that neither the lags of DSE30 returns explain the current BSE Sensex returns nor the lags of BSE Sensex return explain the current DSE30 returns.

Table10: Results of coefficient wise vector autoregression estimates

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.007033	0.052076	-0.135056	0.8926
C(2)	-0.081131	0.063825	-1.271149	0.2041
C(3)	-0.000577	0.052167	-0.011063	0.9912
C(4)	-0.014166	0.064056	-0.221153	0.8250
C(5)	-0.016328	0.052052	-0.313681	0.7539
C(6)	-0.011644	0.063946	-0.182096	0.8556
C(7)	-0.128061	0.051979	-2.463683	0.0140
C(8)	0.083699	0.063642	1.315150	0.1889
C(9)	0.000200	0.000602	0.332494	0.7396
C(10)	-0.001103	0.042815	-0.025770	0.9794
C(11)	0.082267	0.052475	1.567738	0.1174
C(12)	-0.034831	0.042889	-0.812107	0.4170
C(13)	0.084710	0.052665	1.608469	0.1082
C(14)	-0.020797	0.042795	-0.485971	0.6271
C(15)	-0.033347	0.052574	-0.634286	0.5261
C(16)	0.059641	0.042735	1.395596	0.1633
C(17)	0.070064	0.052324	1.339048	0.1810
C(18)	-0.000145	0.000495	-0.292647	0.7699
Determinant residual covariance	1.14E-08			

Table 11: Results of VAR Granger causality/block exogeneity wald tests

Dependent variable: RSENSEX			
Excluded	Chi-sq	df	Prob.
RDSE30	3.525609	4	0.4740
All	3.525609	4	0.4740
Dependent variable: RDSE30			
Excluded	Chi-sq	df	Prob.
RSENSEX	2.856491	4	0.5821
All	2.856491	4	0.5821

Impulse Response Analysis: The impulse responses identify the responsiveness of BSE Sensex returns and DSE30 returns in the vector autoregression when a shock or impulse is given to their error terms that is C(9) in equation 12 and C(18) in equation 13. The process of giving one positive standard deviation shock or impulse to the residuals of both equations checks how the BSE Sensex returns and DSE30 returns are reacting to each other. Table 12 portrays the results of impulse response function that traces the time path of the impact of a shock in BSE Sensex returns on BSE Sensex as well as on DSE30 returns and the impact of a shock in DSE30 returns on DSE30 as well as on BSE Sensex returns.

Table12: Results of vector autoregression impulse responses

Response of SENSEX:		
Period	RSENSEX	RDSE30
1	0.011552	0.000000
2	-0.000118	-0.000770
3	-1.42E-05	-0.000192
4	-0.000165	-0.000190
5	-0.001411	0.000799
6	-1.88E-05	9.49E05-
7	-3.48E-05	8.79E05-
8	4.80E06-	-1.87E-05
9	0.000236	-4.06E-05
10	6.59E06-	-1.83E-05
Response of RDSE30:		
Period	RSENSEX	RDSE30
1	0.000449	0.009487
2	2.42E05-	0.000780
3	-0.000362	0.000869
4	-0.000279	-0.000152
5	0.000669	0.000723
6	4.58E05-	3.61E05-
7	9.61E05-	9.47E05-
8	-9.84E-06	-5.52E-05
9	-2.99E-05	9.55E05-
10	-4.11E-06	7.08E06-
Cholesky Ordering: RSENSEX RDSE30		

As it was expected given the parameters estimates and the VAR Granger causality results, again few interlinkages between BSE Sensex returns series and DSE30 returns series are established here. The graphical presentation in exhibit 3 indicates that the responses to the one positive standard deviation shock or impulse are very small except for the response of BSE Sensex and DSE30 to their respective own shocks.

Figure 3: Plot vector autoregression impulse responses

Response to Cholesky One S.D. Innovations ± 2 S.E.
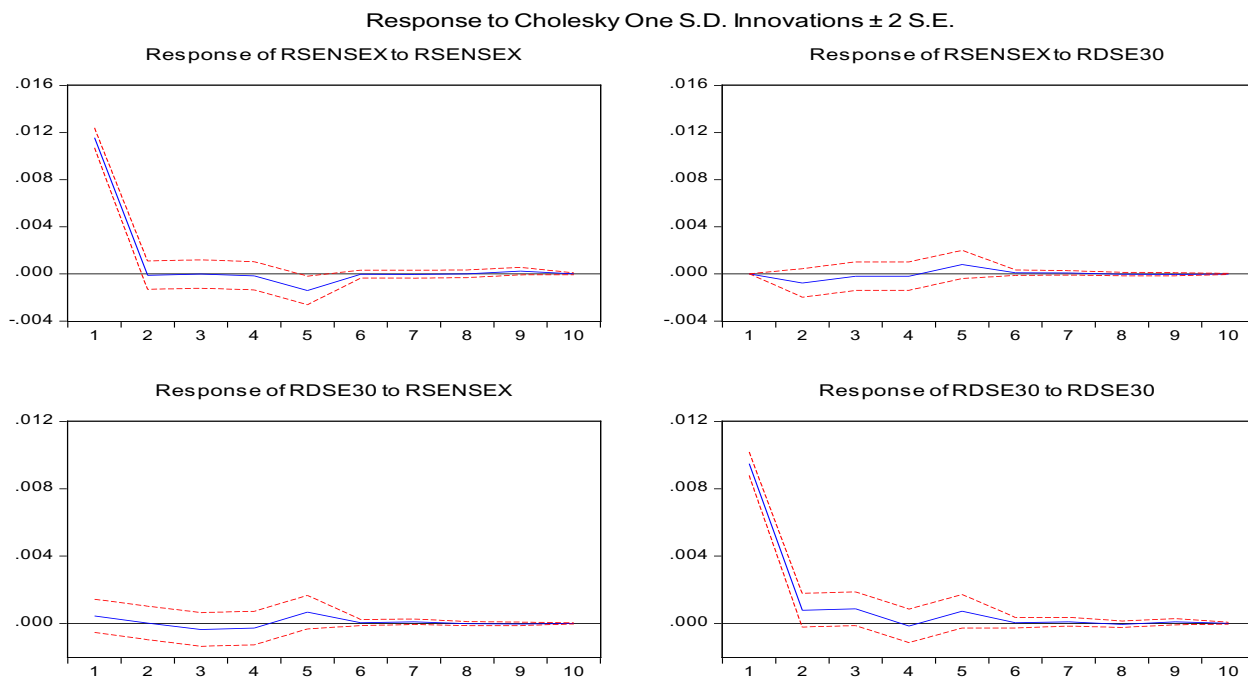
Variance decomposition: The results of variance decomposition of BSE Sensex returns and DSE30 returns using Cholesky decomposition method is portrayed in table 13. In the short run that is on day 1, impulse or shock to BSE Sensex returns account for hundred percent variation of the fluctuation in BSE Sensex returns and the shock to DSE30 returns do not cause any variation of the fluctuation in BSE Sensex returns. On day 2, shock to BSE Sensex returns account for 99.55 percent variation of the fluctuation in BSE Sensex returns and shock to DSE30 returns causes only 0.44 percent variation of the fluctuation in BSE Sensex returns. The variance decomposition of DSE30 returns shows that on day 1, impulse or shock to DSE30 returns account for 99.776 percent variation of the fluctuation in DSE 30 returns and the shock to DSE30 returns causes only 0.223 percent variation of the fluctuation in BSE Sensex returns. On day 2, shock to DSE 30 returns account for 99.777 percent variation of the fluctuation in DSE 30 returns and shock to DSE30 returns causes only 0.222 percent variation of the fluctuation in BSE Sensex returns.

Table13: Results of variance decomposition

Variance Decomposition of RSENSEX:			
Period	S.E.	RSENSEX	RDSE30
1	0.011552	100.0000	0.000000
2	0.011578	99.55807	0.441930
3	0.011580	99.53061	0.469386
4	0.011583	99.50387	0.496132
5	0.011696	99.04671	0.953291
6	0.011696	99.04019	0.959813
7	0.011697	99.03460	0.965399
8	0.011697	99.03435	0.965651
9	0.011699	99.03355	0.966450
10	0.011699	99.03331	0.966693
Variance Decomposition of RDSE30:			
Period	S.E.	RSENSEX	RDSE30
1	0.009498	0.223460	99.77654
2	0.009530	0.222604	99.77740
3	0.009576	0.363527	99.63647
4	0.009581	0.447832	99.55217
5	0.009632	0.925768	99.07423
6	0.009632	0.927992	99.07201
7	0.009633	0.937766	99.06223
8	0.009633	0.937839	99.06216
9	0.009634	0.938700	99.06130
10	0.009634	0.938717	99.06128
Cholesky Ordering: RSENSEX RDSE30			

The graphical presentation of variance decomposition in exhibit 4 portrays the same results. The percentage of the errors that is attributable to own shocks is 100 percent in the case of BSE Sensex returns and 99.77 percent in DSE30 returns. These results clearly indicate that with the increase in lag there is decrease in the percent variation of fluctuation in BSE Sensex returns due to domestic shock (i.e. shock in BSE Sensex) whereas there is increase in the percent variation of fluctuation in BSE Sensex returns due to shock in DSE30 returns. In the same way, with the increase in lag there is decrease in the percent variation of fluctuation in DSE30 due to domestic shock (i.e. shock in DSE30) whereas there is increase in the percent variation of fluctuation in DSE30 returns due to shock in BSE Sensex returns.

Figer 4: Plot of variance decomposition

Variance Decomposition
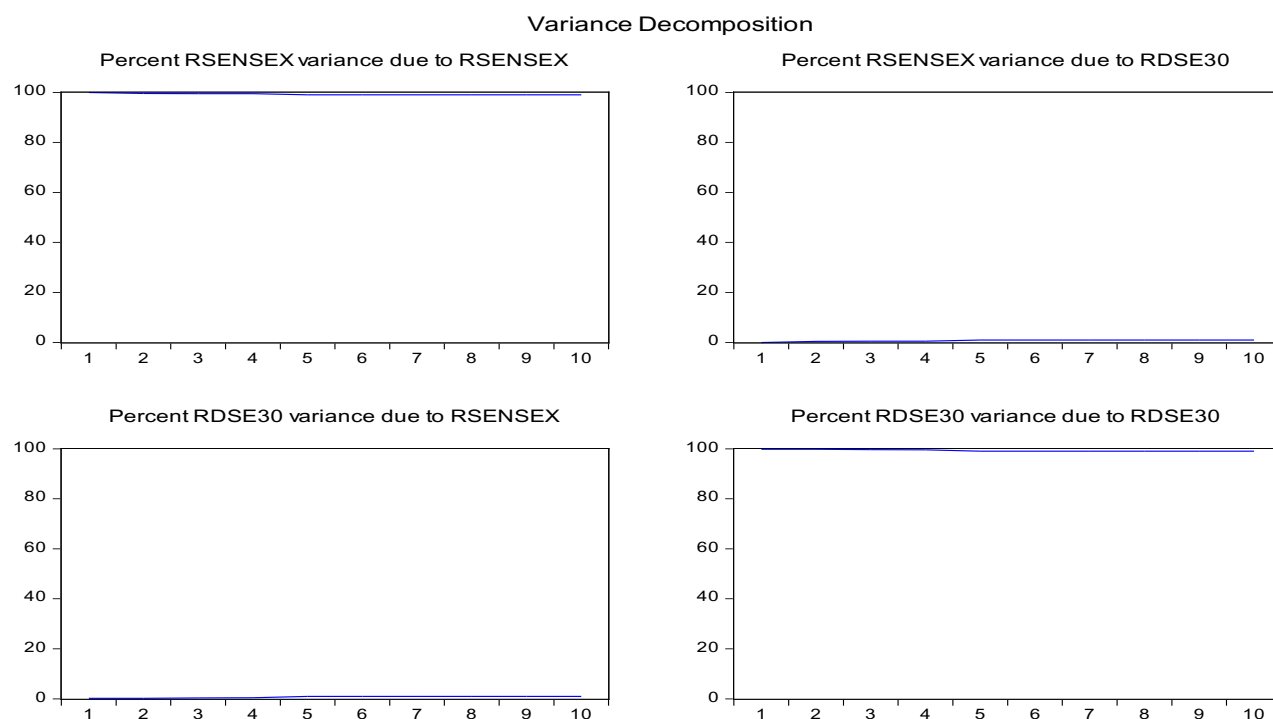
6. DISCUSSION

Eun & Shim (1989), Hamao, Masulis & Ng (1990), Park & Fatemi (1993), Lin, Engle & Ito (1994), Janakiramanan & Lamba (1998), Kanas (2000), Balaa & Premaratneb (2002), Marianne & Nicola (2009), Natarajan, Singh & Nagarajan (2014), Larisa, Janusz & Chi (2016) found the substantial interdependence among the national stock markets with US being the most influential market. Johnson & Soenen (2002), Xinling & Peng (2011), Arora Srinivasan, P. (2012), Louzis (2013) investigated the degree of integration of equity markets in Asia and found that the Asian equity markets were highly integrated and these markets became more integrated over time. Zhang & Jaffry (2015) found no volatility spillover in the pre-crisis period and strong bi-directional volatility spillover in the crisis period between China stock market and Hong Kong stock market. These studies show the presence of inter-linkages between financial markets of developed countries with other developed nations or few emerging economies. The present treatise explores the inter-linkages between Indian stock market and Bangladesh stock market on the basis of returns correlation, cointegration, causality, vector autoregression, block significance, impulse response and variance decomposition. It is found that the Indian stock market and Bangladesh stock market are not significantly cointegrated to each other. The more interlinked are stock markets the less is the scope of exploiting opportunity of diversification to earn benefits. So, the segmentation of these equity markets provides the long-run diversification benefits to investors across these two markets. The results of the present study is based on the daily returns indices of two years only and these results can be further improved by extending the data of larger period and even on high frequency data to explore the interdependence between the equity markets of these two neighbour countries.

7. CONCLUSION

The earlier studies of inter-linkages between stock markets have focused primarily on return correlations and volatility spillovers of developed countries mainly US and UK with other developed nations or few emerging economies. But there is lacuna in the investigation of inter-linkages among emerging economies. The present treatise attempts to study the inter-linkages between equity markets of India and Bangladesh. The daily stock price data for the period of September 2014 to September 2016 on BSE Sensex and DSE 30 have been taken from the online database maintained by the Bombay Stock Exchange and the Dhaka Stock Exchange respectively. The data of these two indices was initially studied for stationarity, serial correlation and cross correlation. The series of BSE Sensex and DSE30 found to be non stationary. The Johansen cointegartion test was applied to both non stationary series and the results showed the absence of significant cointegration. The results are further verified with the help of augmented Dickey–Fuller test, autocorrelation function and partial auto correlation function, Ljung-Box Q-statistics, cross correlogram, vector autoregression Granger causality tests (block exogenity test), impulse response function and variance decomposition. All the results provide evidences on the segmentation of stock markets of India and Bangladesh. There was no significant inter-linkage between these two markets. The responses to shock or impulse are very small except for the response of BSE Sensex returns and DSE30 returns to their respective own shocks. So, it may be concluded that the recent policy changes and bilateral agreements have not significantly reduced the stock market segmentation of Indian equity market from Bangladesh equity market. The findings of this paper have implications for international investors and policy makers. The segmentation of the equity market provides the long-run diversification benefits to investors across these two markets. It also provides signals to policy makers to take appropriate decisions that may attain and sustain the financial stabilisation of their country.

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