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DIAS Technology Review

The International Journal for Business & IT

ARTICLES

From The Editor's Desk

It is our immense pleasure to present to our readers the 29th issue of DIAS Technology Review.

The information technology revolution has served as a catalyst for electronic connectivity. This has transformed the daily life of consumers, producers and business at large. A tech savvy customer today, can purchase any item of his choice just by clicking a button for ordering online. It saves not only the time and effort of buyers, but also enhances customers' loyalty and service quality of the organizations. The article **The Moderating Role of Gender and the Choice of E-Retailer and the Mediating role of E-Customer Satisfaction in E-Loyalty Formation Process** bespeaks such issues wherein the author has studied the moderating effect of gender and choice of e-retailer on relationship dimensions of e-service quality and e-loyalty of young buyers. The study reveals that a strong positive relationship between information quality and privacy factors must exist in the organizations to gain customer loyalty.

Macroeconomic variables keep an economy anchored and committed for growth, but any fluctuation in these indicators creates ripples in all the sectors, especially the stock markets. In the research study **Causal Interactions Between Macroeconomic Variables and Stock Market Returns in India with Special Reference to NSE,** authors have analyzed the modeling of stock market returns and macroeconomic indicators causing risk, to find out how these stock market variations influence the behaviour of market practitioners and investors.

To remain ahead in competition, organizations roll out numerous projects, but there is a looming risk of not finishing the project on time. In the article Monte Carlo Simulation for Understanding Risk in Project Management, authors have developed an algorithm which is an extension of the classical methods-Critical Path Method and Project Evaluation and Review Technique to deliver a deeper understanding of inherent risk in project planning for a business. The simulation gives a range of project completion times as well as the probability for each activity becoming a part of critical path.

Not only technology but human resource development is also very crucial for modern organizations to thrive. Authors in their research study **Impact of Leadership Development on Employee Engagement of Associates Working in National Capital Region in India** have attempted to map the impact of leadership development practices on different parameters of employee engagement and overall engagement scores of employees in the organisation. They have also recommended the identification of leadership potentials among employees and their grooming for various leadership positions in organizations, since Leaders don't create followers, they create more leaders. Similarly, the article **The Level of Job Satisfaction for Managers and Non-Managers in Haryana Roadways: A Factor Analysis Approach** investigates the organizational structure effectiveness, working conditions, perks and compensation factors vital in defining job satisfaction level of drivers. The authors have reiterated that the overall performance of an organization depends upon efficient and effective performance of satisfied employees of the organization.

The article **Intellectual Property Rights versus Tax Incentives** quizzes the intellectual property right glitches namely freeriding and monopoly. The authors have propounded a theoretical model of intellectual property production making a proposal for restricting intellectual property rights accompanied by a self-funded system of value added taxes and intellectual property tax credits.

The Doctoral Abstract **Comparative Credit Risk Assessment Structures in Indian Banking Industry** elaborates the development of bankruptcy prediction models. A performance comparison of bankruptcy prediction models for the listed companies in India has been made by the author, using multiple discriminant analysis, logistic regression and neural network.

In our endeavor of illuminating our valued readers with up to date knowledge, we are hopeful that this new edition of DIAS Technology Review will, as usual, prove captivating and enlightening.

Regards,

Dr. Anju Batra

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The Moderating Role of Gender and the Choice of E-Retailer and the Mediating role of E-Customer Satisfaction in E-Loyalty Formation Process

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ABSTRACT

Current enterprises recognize both service quality and customer loyalty as critical factors to maintain the competency for business development. However, surveys of online customers continue to indicate that many customers remain unsatisfied with their online shopping purchase experience. Therefore, more research is required to better understand about the factors affecting customers' evaluation of their online shopping experiences. The current study proposed that e-service quality dimensions are causally linked with loyalty and customer satisfaction plays a mediating role between the relationship of the two. The study also proposed that there is a moderating effect of the gender and choice of e-retailer on the relationship of dimensions of e-service quality and e-loyalty. For the purpose of the study, a target sample consisted young population i.e. up to the age of 35 years living in National Capital Region (NCR), who had successfully completed at least one online transaction recently from any online retailer was collected. The instrument used for the study consists of three dimensions to evaluate the online service quality. The scale used is based on the previous studies. The convenience cum snowball sampling has been used for the study. The resulting sample comprised of 155 valid questionnaires. The results of the study revealed that there is strong positive relationship between information quality and privcy factors in loyalty. Also at construct level, no significant gender-specific and e-retailer-specific differences are found among online shoppers.

Keywords: e-Service Quality, e-Loyalty, e-Satisfaction, Moderation, Gender, e-Retailer

INTRODUCTION

Superior service quality has been recognized as the point of difference for making a company's offering standout from the crowd of look-a-like products (Parasuraman et al., 1991). Good quality of the product/service can convince clients to repurchase. A number of studies have focused on service quality, customer experience, website quality, and customer satisfaction of online retailing (Aladwani & Palvia, 2002; Dabholkar, 1995; Gremler, 1995). Bai et al. (2008) observed that in virtual world, providing well-perceived service-quality and customer satisfaction, could enable service provider to have long term relationships with customers. Furthermore, Ziaullah et al. (2015) argued that e-tail online quality dimensions are essentials for customers' satisfaction and e-satisfaction is found to have an important role in the establishment of e-loyalty. Aguila-Obra et al. (2013) observed some debate about the relationship among e-sq, online satisfaction and online loyalty. In some studies, service quality is directly linked with loyalty (Swaid & Wigand, 2009 ; Thaichon et al. 2014) while satisfaction mediates the relationship in other studies (Szymanski & Hise, 2000; Massad et al., 2006). Carrillat et al. (2009) also found variances in the results of these studies. Moreover, in these studies focus of researchers was to explore the direct effects of retailer characteristics such as website design, pricing, and customer service on customer satisfaction and loyalty (Luo et al., 2012). Few researches have been carried out to understand the motives behind the choice of online retailer in the mind of the customers (Wolfinbarger & Gilly, 2003; Devaraj et al., 2002; Kotha et al., 2004). Also little attention has been paid to the influence of gender (Mokhils, 2012) and choice of retailer (Liu et al., 2000) on the relationship of perceived service quality dimensions and e-loyalty. Therefore, the present study has twofold objectives: (1) to identify the moderating role of gender and choice of e-retailer on the relationship of dimensions of e-service quality and e-loyalty and (2) to examine the mediating role of customer satisfaction on the relationship of dimensions of e-service quality and e-loyalty

CONCEPTUAL FRAMEWORK AND HYPOTHESES FOR THE STUDY

Online Retailing Service Quality Attributes

E-service quality has been defined as meeting customer expectations regarding a service in the absence of human-to-human interaction (Pearson et al., 2012). Zeithaml et al. (2000) identified 11 attributes of e-service quality namely reliability, responsiveness, access, flexibility, ease of navigation, efficiency, assurance/trust, security/privacy, price knowledge, site aesthetics, customization/personalization. Later on, Parasuraman et al. (2005) used these 11 attributes as the basis for developing E-S-QUAL, a multi-item scale for assessing the perceived e-service quality during an online transaction. With the growing interest of researchers in online service quality, scholars developed different scales to measure dimensions of online service quality. Chen & He (1999) also developed instrument namely "Ast", comprising of three dimensions: entertainment, informativeness, and organization. Similarly, Yoo & Donthu (2001) developed SITEQUAL with four dimensions: ease of use, aesthetic design, processing speed, and security. Bruke (2002), used consumer survey to list 31 websites features into "must have" and "should have" categories. However, no consensus on the drivers of e-service quality was found (Bansal et al. 2004 ; Goel, 2017).

The current study proposed that e-service quality dimensions include information quality, function, and privacy and developed a research model for understanding the perceptions of rational customers regarding online shopping. The model proposed that e-service quality dimensions are causally linked with loyalty and customer satisfaction plays a mediating role between the relationship of the two. Moreover, model also proposed that there is a moderating effect of the gender and choice of e-retailer on the relationship of dimensions of e-service quality and e-loyalty (figure 1).

Wolfinbarger & Gilly (2003) explored that information is one of the important attributes of online service quality. Due to the absence of any kind of human assistance to the online shoppers, adequacy and accuracy of the product information becomes necessary to make a purchase decision by the customers (Kim & Stoel,2005). Lynch & Ariely (2000) empirically proved that if information about the price and quality of the product is given on the website it will positively influence the satisfaction with the online shopping experience and thus patronage intention. Similarly, most researches and industry reports emphasized that easy navigation is a critical factor in online retailing (Trocchia & Janda, 2003). Attributes related to functionality of a website that is fast information retrieval, navigation speed, valid links are important for a customer (Parasuraman et al.,1988; Yang , 2001). Researhers highlighted that functionality of web-based services is significantly related with satisfaction and future purchase intentions (Yang & Jun, 2002; Zhu et al., 2002). In an online retailing context, privacy has received considerable attention. Sharma & Sheth, (2004) established that privacy has been a critical issue in online retailing. Customers still have the perceptions regarding risks related to the misuse of their personal and sensitive information. Therefore many people are still unwilling to buy products online (Kim et al. 2006). Because of this, online retailers have started giving more importance to consumer privacy policies (Ranganathan & Ganapathy, 2002). Research also supports the importance of privacy in online retailing (Barnes & Vidgen, 2000; Szymanski & Hise; 2000; Santos, 2003).

E-Loyalty

Anderson & Srinivasan (2003) defined e-loyalty as customer's positive attitude towards an e-business website which results in revisit and repurchase intention of the buyer. Customer loyalty has been regarded as the key indicator of customer retention (Hu, 2012). However, Valvi & Fragkos (2012) found that e-loyalty is considered similar to other concepts such as

commitment (Ha, 2004), stickiness (Lin, 2007), re-patronize intention (Koo, 2006), word-of mouth (Chung & Shin, 2010). Thus loyalty has many different aspects depending upon the approach of the researcher and the context of the study. For the present study, e-loyalty construct consists of the statements related to repurchase intention and positive word of mouth.

E-Service Quality and E-Loyalty

The web service quality can affect loyalty directly or indirectly (Valvi & Fragkos, 2012). The direct effect of e-service quality on loyalty has been identified by Parasuraman's empirical work on service quality (Parasuraman et al., 1985; Parasuraman et al.,1988). Zeithaml et al. (1996) were of the view that when customer's expectations surpass, he intends to rebuy and thus affect loyalty directly. Whereas, Cronin & Taylor (1992) emphasized on the indirect relationship between service quality and loyalty via satisfaction.

E- Customer Satisfaction as a Mediator

In marketing literature, customer satisfaction is defined as the function of transaction-specific and cummlative transaction-specific satisfaction (Fornell, 1992). Anderson & Srinivasan (2003), defined e-satisfaction as the contentment of the customer with respect to his or her prior purchasing experience with a given website In literature, satisfaction is highly discussed and also considered as an antecedent variable of loyalty (Taylor & Strutton, 2010; Chen S. , 2010). Researches established that satisfied customers have more repurchase intentions and they are more likely to spread positive word of mouth than those who are not satisfied (Ram & Jung, 1991; Zeithaml et al., 1996).

Moderating Role of Gender and Choice of E-Retailer on the Relationship between Dimensions of E-Service Quality and E-Loyalty ?

Based on the previous research this paper includes gender and choice of e-retailer as moderators in the model (figure 1). It has been observed by various researchers that females generally show higher involvement in online shopping rather than their male counterparts (Laroche et al., 2000; Laroche et al., 2003). Kim & Kim (2004) examined the effect of demographic variables on online purchase intention and found that gender, income and family size has direct impact on loyalty. O' Cass & Carlson (2010), noted the positive influence of customer's gender on loyalty. Roman (2010) explored that there were moderating effects of consumer's demographics such as age, gender, and education on loyalty. Moreover, the rapid growth experienced by the Indian e-commerce sector made it necessary for the e-commerce companies to properly evaluate their service quality (Rao & Rao, 2013). With the intense competition among internet shopping sites, the quality of the sites will become important for survival and success (Yoo & Donthu, 2001). Competition between different websites is high not only to attract users' attention but to make them revisit. Pricing alone cannot be helpful in gaining competitive advantage (Park et al. 2011). Moreover, online consumers evaluate the alternatives before making a final purchase decision and web retailers differ in the extent to which they facilitate the comparison of alternatives available (Ranganathan & Ganapathy, 2002). Therefore, it is essential to provide well- perceived service quality for satisfying the customers and building long-term relationship by acquiring the loyalty of the consumers (Bai et al. 2008).
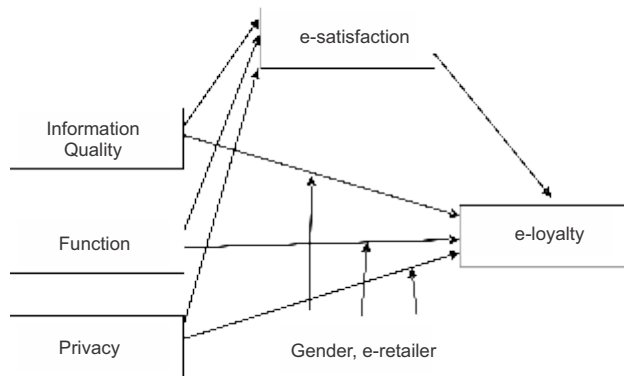

Source: Author's Own work

Figure 1: Proposed Framework of the Study

In the light of previous discussion, the following battery of hypotheses are formulated:

H_{1a}. There is a significant moderating effect of gender between information quality and e-loyalty.

H_{1b}. There is a significant moderating effect of gender between function and e-loyalty.

H_{1c}. There is a significant moderating effect of gender between privacy and e-loyalty in females.

H_{2a}. There is a significant moderating effect of e-retailer between information quality and e-loyalty.

H_{2b}: There is a significant moderating effect of e-retailer between function and e-loyalty.

H_{2c}: There is a significant moderating effect of e-retailer between privacy and e-loyalty.

H_{3a}. There is a significant mediating effect of customer satisfaction between information quality and e-loyalty.

H_{3b}. There is a significant mediating effect of customer satisfaction between function and e-loyalty.

H_{3c}. There is a significant mediating effect of customer satisfaction between privacy and e-loyalty.

MPIRICAL INVESTIGATION

Questionnaire Design

Scales from the extant literature were adapted and further used as the source for measuring dimensions of service quality and loyalty. This measuring

instrument consists 21 items which were used to reproduce four constructs namely information quality (3 statements; adopted from Aladwani & Palvia, 2002), function (5 statements; adopted from Collier & Bienstock, 2006; Parasuraman et al., 2005), privacy (3 statements; adopted from Janda et al., 2002), Customer satisfaction (5 statements borrowed from Janda et al., 2002) and loyalty (5 statements adopted from Parasuraman et al., 2005). The respondents were asked to indicate their level of agreement with each of the original statement on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data Collection and Sample Profile

The survey target sample consisted college going students living in National Capital Region (NCR), who had successfully completed at least one transaction from any of the two online retailing websites operating in India namely Amazon and Flipkart. These websites were chosen for the study as they are top two online retailers operating in India (Top 10 e-commerce companies in India, 2017). The convenience cum snowball sampling has been used for the study. The resulting sample comprised of 155 valid questionnaires, which were considered suitable for the study. Offline method of survey administration has been used for the study. Out of the samples taken, 41 percent were female respondents and 59 percent were male respondents. While 60 percent respondents have given their responses for Amazon and 40 percent of the respondents were Flipkart users.

Reliability and Validity of Measures

Table 1 is depicting the alpha values and composite reliability values of the constructs. Both values are the parameters of checking the reliability of the data. The recommended value of alpha is more than .06 (Ngobo, 2004) and the thumb rule for composite reliability (CR) is > or equal to .70 (Fornell & Larcker, 1981). For the present data, values are fulfilling the recommended criteria hence suggesting the internal consistency and confirming the reliability of data.

function are more than .50 (Sahi et al., 2017). Discriminant validity is established to check the extent to which the construct is distinct from the other construct. In table 1 the values of AVE are greater than MSV and the loadings of AVE are also exceeding the values of average squared variances (ASV). Further, it can be observed that the loadings of MSV and ASV are less than AVE. Thus, all the parameters are fulfilling the necessary conditions for achieving discriminant validity.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a technique to find out how well-measured items represent a latent construct (Demirbag et al., 2006). The model pertaining three constructs: dimensions of e-service quality (function, information quality, privacy), customer satisfaction and loyalty were tested. Besides using CMIN/d.f., additional indices such as goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were also considered for assessing the model fit. The results of the model fit indices CMIN/d.f. = 1.634, GFI = .854, AGFI = .812, CFI = .906 and RMSEA = .064 indicate moderate fit model (Hair et al., 2015).

Analysis of Structural Model

Path analysis is used to examine the pattern of relationships among three or more variables. It provides the quantitative estimates of the causal connections between set of variables (Bryman & Cramer, 1999). The model fit indices were found to have reasonably good fit with the 2/d.f. = 2.493, goodness-of-fit index (GFI) = .987, adjusted goodness-of-fit index (AGFI) = .905, comparative fit index (CFI) = .991 and root mean square error of approximation (RMSEA) = .098. All the indicators have shown improvement in the values after path analysis signaling towards a reasonably good model fit except the value of RMSEA which has been increased from .064 to .098. But this value is under the acceptable range of .10 (Hair et al., 2015).

TABLE 1 Reliability Scores, Convergent, and Discriminant Validity of the Constructs

Latent Variable	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)	Maximum Shared Variance (MSV)	Average Squared Variance (ASV)
Function	.693	.852	.324	.278	.202
Information Quality	.785	.702	.569	.295	.210
Privacy	.784	.797	.562	.058	.048
Satisfaction	.851	.793	.537	.295	.202
Loyalty	.825	.834	.505	.471	.221

Source: Author's Own Work

The convergent and discriminant validity was also assessed to check the validity of the scale. Convergent validity examines whether the respective indicators are measuring the constructs. For establishing the convergent validity, loadings of the average variance extracted (AVE) should be more than .50 and values of maximum shared variance (MSV) should be less than AVE. Table 1 shows that all the constructs except

RESULTS AND DISCUSSION

Choice of e-retailer as a Moderator between the Relationship of Dimensions of e-service Quality and e-Loyalty

Results show that in case of female respondents only information quality dimension has significant positive relationship with e-loyalty. For the male respondents, both

TABLE 2 Results of Hypotheses Developed for Study (Gender as Moderator)

Hypotheses	Estimates (Females)	Estimates (Males)	Estimates (overall)	Z-Scores	Result
H1a. There is a significant moderating effect of gender between information quality and e-loyalty.	.334**	.367***	.320***	0.004	Not Accepted
H2b. There is a significant moderating effect of gender between function and e-loyalty.	.149	.149	.173	0.435	Not Accepted
H2c. There is a significant moderating effect of gender between privacy and e-loyalty.	.065	.110	.091	0.218	Not Accepted
Significance at: .05** and .001 ***					

Source: Author's Own Work

TABLE 3 Results of Hypotheses Developed for Study (Choice of e-retailer as Moderator)

Hypotheses	Estimates (Females)	Estimates (Males)	Estimates (overall)	Z-Scores	Result
H2a. There is a significant moderating effect of e-retailer between information quality and e-loyalty.	.303***	.463***	.320***	1.060	Not Accepted
H2b. There is a significant moderating effect of e-retailer between function and e-loyalty.	.163	.086	.173	-0.389	Not Accepted
H2c. There is a significant moderating effect of e-retailer between privacy and e-loyalty.	.117	.062	.091	-0.541	Not Accepted
Significance at .001 ***					

Source: Author's Own Work

TABLE 4 Results of Hypotheses Developed for the Study

Hypotheses	Estimates (Females)	Estimates (Males)	Estimates (overall)	Z-Scores	Result
H3a. There is a significant moderating effect of customer e-satisfaction between information quality and e-loyalty.	.360***	.353***	.123***	1.060	Significant
H3b. There is a significant mediating effect of customer e-satisfaction between function and e-loyalty.	.141	.475***	-.178	-0.389	Not Significant
H3c. There is a significant mediating effect of customer e-satisfaction between privacy and e-loyalty.	.117	.062	.091	-0.541	Not Accepted
Significance at: .05** and .001 ***					

Source: Author's Own Work

information quality and privacy dimensions found to have significant positive relationship with e-loyalty. However, on the basis of z-score, no moderation effect of gender was found between the relationship of dimensions of e-service quality and e-loyalty (table 2). These results coincide with the results of previous studies (Barrera et al., 2014; Ulbrich et al., 2011). Hence, it leads to non-acceptance of hypotheses H1a, H1b, and H1c framed for the study.

Mediating Effect of Customer E-Satisfaction between E-Service Quality Dimensions and E-Loyalty

For testing the mediating role of customer satisfaction, the direct relationship of e-service quality dimensions with the loyalty was tested. Information quality and privacy were found to have positive relationship with the loyalty. Similarly, the direct relationship of e-service quality dimensions with customer e-satisfaction was also examined. According to the results (table 4), privacy has no significant direct positive relationship with e-satisfaction. Since, function has no direct
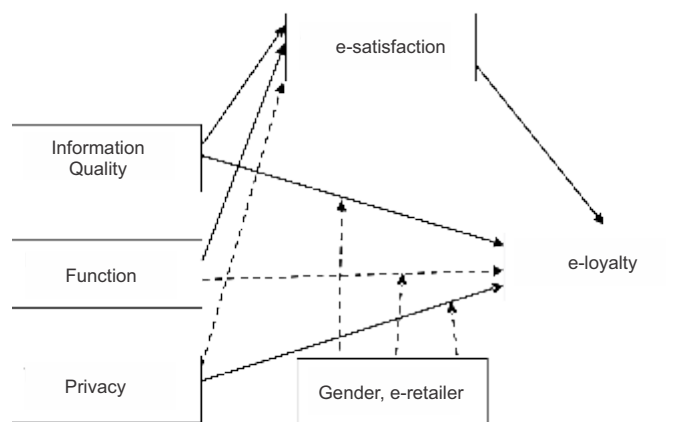

Figure 2: Outcome Framework of the Study

Source: Author's Own Work
Note: Dotted lines show Non Significant relationships

relationship with loyalty, in that case there is no reason that satisfaction is affecting their relationship. The analysis of the table 4 shows that when satisfaction is mediating the

relationship of dimensions of e-service quality and loyalty, the t-value of information quality and privacy changed from .360 and .097 to .123 and .092 respectively. These changes in values imply that there is mediation effect of e-customer satisfaction. However, the strength of mediation is not very strong since both the values (without e-satisfaction and with satisfaction) of information quality and privacy are statistically significant.

CONCLUSION AND IMPLICATION

The challenge in front of modern day organizations is not only to reach at the top but to stay there. To achieve this objective, the focus of any organization should be to attract maximum customers, obtain their loyalty and patronage them for the long-term. The present study can be concluded in following manner.

First, the study analyzed the moderation effect of gender and the choice of e-retailer on the relationship of dimensions of e-service quality and e-loyalty. Figure 2 is depicting the outcome model of the study. Information quality has been identified as an important dimension of e-service quality irrespective of their gender and e-retailer from which they shop. Pitt et al. (1997) also established that information is of dominant concern for the online shoppers. Results show that privacy dimension is also important for the online customers ruling out any possibility of gender difference and e-retailer difference. For any online shopper it is a cause of concern how firms are using their personal information (Phelps et al. 2001). Thus, findings of the study are supported by the literature which suggests that information content and privacy measures taken by e-retailers had a positive impact on purchase intention (Chang et al., 2005). Therefore, at construct level, no gender specific and e-retailer specific differences are found among online shoppers.

The second objective of the study was to examine the mediation effect of e-customer satisfaction between the relationship of dimensions of e-service quality and e-loyalty. The study confirms the role of e-satisfaction in shaping user's loyalty in e-retailing context. The results revealed that there is strong positive relationship between information quality and privacy factors in forming e-loyalty. Information quality has found to be an important dimension for both satisfaction and loyalty of the online buyers. In many ways, information aspects of a website substitute for the important offline shopping experience like touch, feel, appearance etc. Pitt et al. (1997) also found information quality as a primary mechanism for the online retailers website. Previous researches had suggested that 'privacy' might not be a critical factor and its relationship with customer satisfaction might depend on the sector being analyzed (Parasuraman et al. 2005) . Though satisfaction has also strong relationship with the e-service quality dimensions, its presence does not nullify the relationship between e-service quality dimensions and e-loyalty. Hence, the study concludes that there is partial mediation of satisfaction on the relationship of e-loyalty and

e-service dimensions.

The findings of this empirical study have practical implications also. The present study can be helpful to managers in designing a successful online shopping platform. The results show that not all the studied dimensions of e-service quality contribute equally to the loyalty. Therefore it is advised to marketers to perform good on the more important dimensions and continuously make it an unbeatable point for competitors rather than marginally improving on all the dimensions (Hansen & Bush, 1999). Like in this case consumers are more concerned about the information quality and the level of perceived privacy maintained during online shopping. Hence, being able to accommodate the specific needs of the users will help in keeping the existing and attracting the new customers by businesses.

Second, the study shows that gender specific differences are always not obvious. The estimated value of all the dimensions showed no significant difference between males and females. So the marketers can avoid introducing any loyalty programme on the basis of gender.

Lastly, no influence on choice of E-retailer was found which helps in inferencing that online shoppers consider all aspects of service quality important i.e. information quality, function and privacy while shopping through online platform from every e-retailer who-so-ever is offering through this channel. Today building loyalty is not just a way to boost profit but it has become a lifelong survival strategy of a company.

LIMITATIONS AND FUTURE DIRECTION

This research was only conducted in Delhi NCR region and a sample size of 155 respondents participated in the survey. As limitations of this study, the data collected was regional and convenience based. This study could be extended using a web-based survey with more online shoppers and a globally representative sample. Only two leading e-retailers were used in the investigation namely Amazon India and Flipkart, which are well established. Ideally, similar studies should be conducted with a wider range of websites. Moreover, this study was confined to measure the moderation effect of gender and choice of e-retailer on the relationships of dimensions of e-service quality and e-loyalty. Other demographic variables like age, income, marital status, religion, education level etc. could be considered while conducting future research. Additional research is needed to enhance the validity of the current research.

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APPENDIX

Dimension	Items
Function	Fun1: This website is always up and available.
	Fun2: This website has valid links.
	Fun 3: This website loads quickly.
	Fun4: This website enables me to navigate easily.
	Fun5: It makes it easy and fast to get anywhere on the site.
Information Quality	Inf1: Information on the website is clear.I
	nf2: Information on the website is current.
	nf3: Information on the website is complete.
Privacy	Pri1: The website shows symbols and messages that signal the site is secure.
	Pri2: The website assures me that personal information is protected.
	Pri3: The website assures me that personal information will not be shared with other parties.
Satisfaction	Sat1: Based on all my experiences with the online retailer, I feel very satisfied.
	Sat2: My choice to use this online retailer was a wise one.
	Sat3: Overall, I am satisfied with the decision to use the online retailer.
	Sat4: I think I did the right thing when I decided to use this online retailer for making my new purchase.
	Sat5: My overall evaluation of the service provided by his online retailer is very good.
Loyalty	Loy1: You will tell others positive information of this site.
	Loy2: You will recommend this site while others asking for advice.
	Loy3: You will encourage other friends to carry out transactions on this site
	Loy4: You will consider this site as your first choice in case of your future transactions.
	Loy5: You will complete more transactions on this site in the time to come.

Causal Interactions between Macroeconomic Variables and Stock Market Returns in India with Special Reference to NSE

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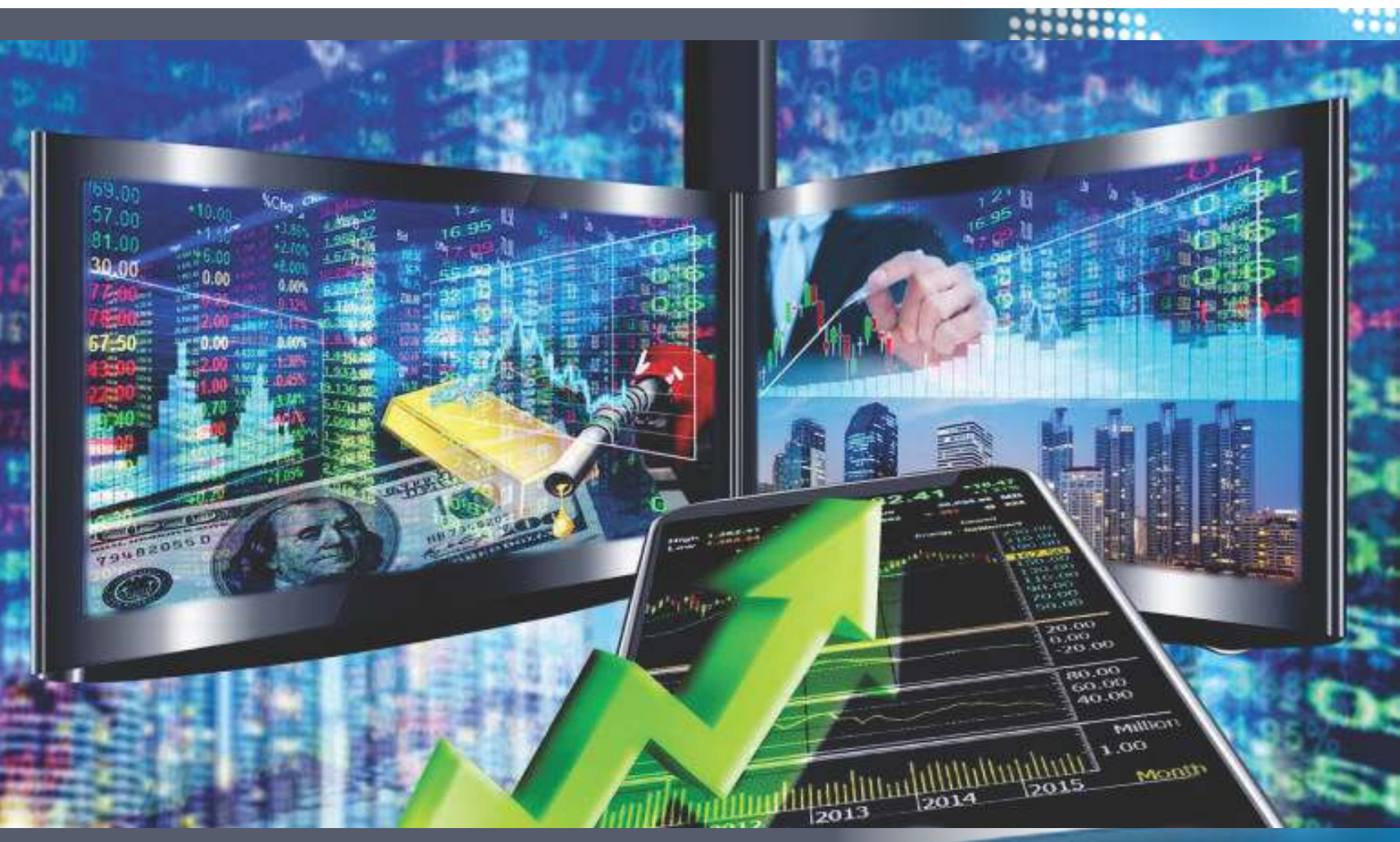
ABSTRACT

Stock market is one of the main variables of economic development of any economy, on the other hand, variations in stock market are also caused by the fluctuations in the various macroeconomic indicators. These stock market variations influence the behaviour of investors; so, the modeling of stock market returns and macroeconomic indicators is one of the key areas of financial researches. The present paper intends at identifying causal interactions between stock market returns and various macroeconomic variables.

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INTRODUCTION

Understanding the stock market dynamics has long been a topic of considerable interest by the market practitioners and investors which is a formidable challenge for them. The volatility of stock market indicators goes beyond anyone's reasonable explanations where the industry performances, economic and political changes are among the major factors that can affect the stock market (Goonatilake and Herath, 2007). The stock price movements are mainly caused by fundamentals and news about company, industry and economy. Fundamentals and news about company and industry e.g. results announcement, industry performance, business cycle, financial leverage, product launch, etc. are micro variables and the performance and news about economy, e.g. national income, interest rates, budget announcement, nuclear power testing, inflation etc. are known as macro variables.

From stock market point of view, the impact of macroeconomic variables is more important because stock performance of a particular company is influenced by micro it was variables but the macro variables drop impact on the whole stock market behavior. On any one day, there would be good stock-specific news for a few companies and bad stock-specific news for others. The news that is common to all stocks is news about macro economy. In this way, stock markets are barometers of the economy. It is expected that the markets and their indicators, in the form of indices, reflect the potential of the corporate listed on them, and, in the process, the direction and health of the economy. If a country's economy is performing well and expected to grow at a healthy rate, the markets usually reflect that. Stock prices reveal the expectations about future corporate performance; these generally reflect the level of economic activities and the underlying fundamentals. Accordingly, the causal relations and dynamic interactions between macroeconomic variables and stock prices are very important for the market practitioner.

LITERATURE REVIEW

The relationship between macroeconomic variables and stock market returns is, by now, well-documented in the literature. Maysami, Howe and Hamzah (2004) examined the long-term equilibrium relationships between selected macroeconomic variables and the Singapore stock market index and concluded that the causal relations and dynamic interactions among macroeconomic determinants of the economy and stock prices are important in the formulation of the nation's macroeconomic policy. Leblebicioglu and Aksoy (2004) successfully implemented a rule based fuzzy logic model to forecast the monthly return of the ISE100 Index by combining technical analysis, financial analysis and macroeconomic analysis.

Chowdhury, Mollik and Akhter (2006) examined how the macroeconomic risk associated with industrial production, inflation, and exchange rate is related and reflected in the stock market returns in the context of Bangladesh. They concluded that there is relation between stock market dynamics and macroeconomic volatility. Engle and Rangel (2006) developed a model that allows long horizon forecasts of volatility to depend on macroeconomic developments, and delivers estimates of the volatility to be anticipated in a newly opened market. Humpe and Macmillan (2007) examined whether selected macroeconomic variables influenced stock prices in the US and Japan.

Adam and Tweneboah (2008) observed that there is co-integration between macroeconomic variables and Stock prices in Ghana indicating long run relationship. Kumar (2009) investigated the relationship between macroeconomic parameters like Exchange rate and foreign institutional investment with stock returns in India, in particular at National Stock Exchange. By using Granger causality test he found that exchange rate and stock returns had no causality from either of the sides whereas stock return was found to be Granger cause of FII series. Ali et al. (2010) also investigated the causal relationship between macroeconomic indicators and stock exchange prices. They found co-integration between industrial production index and stock prices, and no causal relationship between macroeconomic indicators and the stock prices in Pakistan.

Tripathi and Seth (2014) examined the causal relationships between the stock market performances and select macroeconomic variables in India and found a significant correlation between stock market indicators and macroeconomic factors. Gurloveleen and Bhatia (2015) investigated the impact of macro-economic variables on the functioning of Indian Stock Market. Kotha and Sahu (2016) examined long and short run relations between selected macroeconomic indicators and stock market returns with reference to India. Khalid and Khan (2017) investigated the effects of interest rate, exchange rate and inflation rate on stock market performance of Pakistan by using annual time series data covering the 1991-2017 period.

NEED OF THE STUDY

Stock market of any economy provides ample opportunities to investors to earn profits and enhance their investments worth. It plays an important role in the mobilization of capital from the domestic as well as from foreign investors. The importance of this research stems from the crucial role played by the Indian stock market in developing Indian economy. Many academic researchers, financial and industry analysts and practitioners have tried to envisage the relationship between macroeconomic variables and stock market movements from the past decades. They have done several empirical and descriptive studies to check the effect of macroeconomic variables on stock prices or vice-versa using various statistical, mathematical and econometrical models.

In the linkage the present research is contributing to the identification of causal interactions between stock market returns and various macroeconomic variables.

RESEARCH OBJECTIVES AND METHODOLOGY

Research Objectives

This paper is dedicated to the identification of causal interactions between stock market returns and various macroeconomic variables. First of all statistical causal interaction are identified and on the basis statistical interactions and conceptual knowledge causal loop interactions are recognized. Thus, the objectives of the research paper are:

1. To find out statistical causal interactions between macroeconomic variables and stock market returns via Granger Causality Test.

2. To draw causal loop interactions between macroeconomic variables and stock market returns via causal loop diagramming.

The Variables

Keeping above mentioned objectives in mind, the researchers extensively reviewed available literature and identified 14 key macroeconomic variables of stock market vulnerability. These are Gross Domestic Product (GDP), Index of Industrial Production (IIP), Wholesale Price Index (WPI), Balance of Payments (BOP), Foreign Exchange Reserves (FXRE), Foreign Exchange Rate (FXRA), Repo Rate (RPR), Treasury Bills Rate (TBR), Prime Lending Rate (PLR), Foreign Institutional Investments (FII), Trading Volume (TRV), Market Capitalization (MCP), Crude Oil Prices (CRO) and Gold Prices (GLD). The supported research works of the selection of these variables are mentioned in Table 1. Stock market returns (SMR) of National Stock Exchange of India Ltd. is selected as the indicator of the Indian stock market. Monthly Data of twelve financial years from FY 2002-03 to FY 2013-14 has been collected through official government websites. The detailed description of the variables is provided in Table 2.

Research Technique 1: Granger Causality test

Granger Causality test is a test for determining whether one-time series is useful in forecasting another or not. Granger proposed that if causal relationship exists between variables, they can be used to predict each other. In general, it is a F-test on lagged values of a time series X including the lagged values of Y (Madalla, 2001). The mathematical presentation of Granger Causality test for a model of two variables X and Y is:

Where, p is the maximum length of the lagged observations, A is the matrix that contains the coefficients of the model

$$X(t) = \sum_{j=1}^{p} A_{1,j} X(t-j) + \sum_{j=1}^{p} A_{2,j} Y(t-j) + \varepsilon_1(t)$$

$$Y(t) = \sum_{j=1}^{p} A_{21,j} X(t-j) + \sum_{j=1}^{p} A_{22,j} Y(t-j) + \varepsilon_2(t)$$

(containing of each lagged values of both the variables), and ε_1 and ε_2 are the prediction errors. The magnitude of a G-causality interaction can be estimated by the logarithm of the corresponding F-statistic (Geweke, 1982). Granger Causality test can be extended to the n variables. If the hypotheses (X does not Granger cause Y) rejects, it means X has causality impact on Y or (Y does not Granger cause X) rejects, it means Y has causality impact on X, and so the causality inference is unidirectional. If both the hypotheses reject, then it should be interpreted as the bidirectional causality or feedback.

Research Technique 1: Causal Loop Diagram

Causal Loop Diagrams (CLDs) are abstract and simplified representations of relevant factors of any system and the causal relationships between them (Cioni, 2009). The CLDs consist two items, the first are the factors or variables and second are the links connecting the factors. Any link has annotations about its polarity and delay. The polarity tells whether the dependency has positive polarity (if the cause increases, the effect will also increase compared with the situation where the cause did not change) or negative polarity (if the cause increases, the effect will decrease compared with the situation where the cause did not change) (Binder et al., 2004). CLDs represent only the structure; the dynamics of events have been abstracted away. Basically, these indicate what happens between events or variables as cause and effect. The sources of information may be mental (primary information with every human being), written/spoken (previous research works) and numerical (quantitative database). The diagramming is done in Vensim PLE V6.0 software using mental (researchers' conceptual knowledge), written/spoken (reviewed research papers) and numerical information (results of Granger Causality test).

RESULTS AND DISCUSSION

Granger Causality Test

To explore the existence of causality between stock market and selected macroeconomic variables, the Granger Causality Test has been applied and the F-statistics along with their significance values are shown in Table 3.Results of Granger causality test established only three causal relationship (i) SMR Granger cause to BOP, (ii) SMR Granger Cause to RPR and (iii) MCP Granger Cause to SMR. Rest all the hypotheses are not rejected at 5% level of significance. Only the results of Granger causality are not able to develop a comprehensive causal interacted structure between stock market and the selected macroeconomic variables.

Causal Loop Diagramming

Results explored by the Granger Causality test for SMR with all the fifteen explanatory variables do not show much significant outcomes as only few of the Granger cause hypotheses are rejected and rest proved valid. As researcher did not find remarkable results from the Granger Causality test, and has also considered written and published literature available on

stock market interactions with macroeconomic indicators by scrutinized review of researches for diagramming the CLD, the developed causal framework has been presented in the Figure 1. In this figure, the polarity of the causal loops is indicated by blue color at the top of the arrows. The logical description of causal relationships between selected variables is as follows:

SMR has three positive causal links (i.e., positive polarities) to FII, TRV and MCP. As FII, TRV and MCP are the indicators from stock market, they are directly affected by changes in SMR. It indicates that a rise in stock market indices boosts the number of investors, trading volume and the market capitalization. Further, SMR is positively affected by GDP, IIP, FII, TRV, MCP, CRO, and GLD; and negatively by PLR. GDP has a massive positive impact on almost all the sectors of the country. Reduced consumer spending leads to lower demand situation, which results in cutting down the production by the producers. Low industrial production results in lower corporate sales and profits, which directly affects the stock prices. So, there is a direct impact of weak IIP on sudden fall in stock prices. Increased consumer spending leads to higher demand of all products including financial products, thus inflation has positive impact on market behavior. FII, TRV and MCP have bidirectional causal relationship. Rising prices of crude oil and gold indicate sound purchasing power people of of the country.

GDP has six positive causal links to SMR, IIP, WPI, TRV, FII and MCP. It shows that growth in GDP leads to increased production opportunities, investments and also the foreign investments. Higher GDP is a benign factor for the economy; it has overall impact on trade and industry in an economy resulting into increased trade in securities and the market capitalization of the companies. Boom in GDP may also result in the increased money supply and inflation.

IIP shows seven positive causal links to SMR, GDP, BOP, FII, TRV, MCP and CRO; and negative causal links with WPI. Relationships of IIP with stock market (TRV and MCP), and GDP are very clear as these are the outcomes of increased output, higher consumer demand, better corporate performance, increased investment and trade at stock market. Figure shows that IIP is a cause to CRO and BOP. It is due to the fact that when industrial production increases, the demand of crude oil also increases which ultimately results in to higher crude oil prices. Further, increased industrial production may result in increased international trade, favorable BOP and fall in inflation intensity.

Causalities of WPI are observed on the GDP, IIP, CRO and GLD with positive polarities. The relationship of WPI with GDP and IIP can be understood from the discussion in above paragraphs. The prices of crude oil and gold have cause and effect relationship with inflation. Thus, inflation causes an increase in demand for these commodities and the increase in demand of these commodities results into rise in inflation indices.

Increased international trade gives rise to currency flows in the country and improves position of RBI to hold more foreign currency. The increased trade and Forex reserves also attracts foreign investors to invest in the country which again improves Forex reserves position in the country and strengthens the value of domestic currency (i.e. Rupee). Figure displays the positive causal links of BOP with FXRE and FII and negative link with FXRA.

Official Forex reserves in a country are held for transaction and precautionary motives keeping in view the aggregates of national interests. Foreign exchange reserves are important indicators of the ability of a country to repay foreign debt and for currency defence and are also used to determine credit ratings of the nations. Sound Forex reserves position of the nation brings more investments from the foreign investors and is an important instrument to maintain the exchange rate. In the figure, FXRE depicts negative causal relationship with FXRA and a positive causal link to FII.

It is commonly understood that a movement in exchange rate results in changes in relative prices of imports and exports of goods and services; so, the foreign trade and foreign investment. When US dollar appreciates against Indian Rupee, the relative prices of goods and services in the US market fall and the prices of goods and services imported from the US increase. This may result in increase in Indian exports and fall in imports depending on the degree of elasticity of demand of Indian goods and services in the US market. Any ways, the change in exchange rate has impact on production of goods and services, current account balance, BOP and the Forex reserves of the country. In the Causal Loop diagram FXRA shows negative causal link to IIP, BOP and FXRE.

RPR shows two negative causal links to IIP and WPI. It means when RBI increases repo rate, interest rates on deposits and advances also increase. This, on one hand encourages consumers to save more and reduce consumption, on the other, deters people to take loans from banks, leading to a shortage of money or liquidity in the economy. Thus, it controls inflation within limits, but retards industrial production as consumption falls and companies avoid taking new loans at higher interest rates.

Treasury Bills, highly liquid and secured promissory notes, are issued by Central Government for generating funds to finance outstanding obligations. An increase in Treasury bill rate (discount rate) leads to increased interest rates, which in turn adversely affect the industrial production and controls the intensity of inflation. Figure shows negative causal links of TBR with IIP and WPI.

Economic theory states that the interest rate channel affects demand for goods and services. Higher interest rates mean reduction in household consumption, fall in prices of both financial and real assets (e.g., shares, bonds, property etc.) and also in the present value of future returns. A rise in interest rates also makes it more expensive for firms to finance investment. If consumption and investment fall,

aggregate demand falls and lowers resource utilisation. When resource utilisation is low, prices and wages usually rise at a more modest rate. The Causal loop diagram shows negative link of PLR to SMR, GDP and IIP.

- FIIs usually pool large sums of money and invest those in securities, real property and other investment assets. As bulks of their investments are in the stock market, the inflow and outflow of money by FIIs affect stock market movement significantly and also the trading volume and the market capitalization. Since the amount of FII investment is credited in the balance of payments account, it has negative impact on the BOP. Figure 1 shows that FII has three positive causal links to SMR, TRV and MCP, and a negative causal link to BOP.

- Trading volume reflects the intensity of a stock, commodity or index. It reflects quality of a price trend and the liquidity of a security or commodity. High volume indicates greater reliance of investors in the market, positive movements in securities price, growth of the stock exchange, and its market capitalization. The Causal loop diagram indicates positive causal links of TRV to SMR and MCP.

- Market capitalization is the way to use the stock price to determine the value of a company, and to know how likely it is to grow. Investors use the figure of market capitalization to determine size of a company; normally they are attracted to the rising trend of market capitalization in a stock exchange. MCP is found to have two positive causal links with SMR and FII.

- Oil, one of the major inputs in an economy is used in most of the critical activities. When input costs of oil rise, the cost of end products also rises and results into inflation. Further, inflation causes an increase in demand for oil which results into rise in oil prices, profits of oil companies, their market performance and the growth in the stock market Further, the hike in crude oil prices in international market results in rising bill of oil importing countries and also the rising negativity in the balance of payments account. The causal loop diagram shows three positive causal links of CRO to SMR, WPI, and GLD, and a negative link to BOP.

Investors are mostly interested in the assets with low price and high returns. When gold prices increase, investors divert their investments to stock market. This is indicated by positive causal link of GLD with SMR in causal loop Diagram.

CONCLUSION

The causal framework developed in this paper presents a logically structured framework for interrelationship between the stock market returns and the macroeconomic variables in Indian context. Additional researches can be done using this diagram for developing non-linear modeling techniques such as multivariate GARCH, System Dynamics, Fuzzy-Neural Networks, Fuzzy Asymmetric GARCH, ANFIS, Hidden Markov Models, Wavelet Neural Networks etc.

This work would be helpful to the investors at the time of their investment decisions because they can consider all those affecting variables and take suitable actions. India has been showing remarkable interest in stock market investment in last decades. Investment in stock market is a science wherein an investor should carry out a detailed enquiry before investing. Today most young professionals earn good income but face myriad financial challenges and lose good investment opportunities. With changing time, the youngsters take participation in the programs on financial planning, safe investing, financial goal setting, etc. Further, for most of the people, the regular income comes in the form of salary and by the time of retirement, they have their income and spending patterns well established. They need to plan what they are going to do with their retirement savings to ensure that they will continue to earn a satisfying income and enjoy a comfortable lifestyle, even when they are no longer working. Stock market provides various investment avenues for the retired persons to achieve their financial goals. The research could work as an investment guide on stock market investing for them. The historical database for all the selected variables is easily available on the authentic websites any time. The investor can easily correlate the data with causal relations before making any investment decision in stock market.

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TABLE 1: VARIABLES SELECTION CRITERIA

	Dependent Variable: Stock Market Returns (SMR)	
S. No.	**Macroeconomic (Independent) Variables**	**Empirical Evidences (Justification)**
1.	Gross Domestic Product (GDP)	Aksoy and Leblebicioglu (2004), Maysami, Howe and Hamzah (2004), Engle and Rangle (2006), Duca (2007), Diebold and Yilmaz (2008), Oseni and Nwosa (2011), Kumar and Puja (2012), Zakaria (2012).
2.	Index of Industrial Production (IIP)	Aksoy and Leblebicioglu (2004), Maysami, Howe and Hamzah (2004), Bhattacharya and Mukherjee (2006), Chowdhury, Mollik and Akhter (2006), Dopke, Hartmann and Pierdzioch (2006), Humpe and Macmillan (2007), Corradi and Distaso (2009), Engle, Ghysels and Sohn (2009), Ali et al. (2010), Paye (2011), Kumar and Puja (2012), Gurloveleen and Bhatia (2015).
3.	Wholesale Price Index (WPI)	Maysami, Howe and Hamzah (2004), Bhattacharya and Mukherjee (2006), Chowdhury, Mollik and Akhter (2006), Dopke, Hartmann and Pierdzioch (2006), Engle and Rangle (2006), Flad (2006), Humpe and Macmillan (2007), Saryal (2007), Adam and Tweneboah (2008), Diebold and Yilmaz (2008), Corradi and Distaso (2009), Engle, Ghysels and Sohn (2009), Ali et al. (2010), Sharma and Mahendru (2010), Asaolu and Ogunmuyiwa (2011), Oseni and Nwosa (2011), Paye (2011), Zakaria (2012), Gurloveleen and Bhatia (2015), Kotha and Sahu (2016), Khalid and Khan (2017).
4.	Balance of Payments (BOP)	Aksoy and Leblebicioglu (2004).
5.	Foreign Exchange Reserves (FXRE)	Bhattacharya and Mukherjee (2001), Aksoy and Leblebicioglu (2004), Bhattacharya and Mukherjee (2006), Sharma and Mahendru (2010), Gurloveleen and Bhatia (2015), Khalid and Khan (2017).
6.	Foreign Exchange Rate (FXRA)	Bhattacharya and Mukherjee (2001), Aksoy and Leblebicioglu (2004), Maysami, Howe and Hamzah (2004), Bhattacharya and Mukherjee (2006), Chowdhury, Mollik and Akhter (2006), Engle and Rangle (2006), Adam and Tweneboah (2008), Kumar (2009), Ali et al. (2010), Sharma and Mahendru (2010), Asaolu and Ogunmuyiwa (2011), Kumar and Puja (2012), Zakaria (2012), Gurloveleen and Bhatia (2015), Kotha and Sahu (2016).
7.	Repo Rate (RPR)	Aksoy and Leblebicioglu (2004).
8.	Treasury Bills Rate (TBR)	Aksoy and Leblebicioglu (2004), Maysami, Howe and Hamzah (2004), Dopke, Hartmann and Pierdzioch (2006), Flad (2006), Adam and Tweneboah (2008), Kotha and Sahu (2016).
9.	Prime Lending Rate (PLR)	Maysami, Howe and Hamzah (2004), Humpe and Macmillan (2007), Zafar, Urooj and Durrani (2008), Oseni and Nwosa (2011), Kumar and Puja (2012), Zakaria (2012), Khalid and Khan (2017).
10.	Foreign Institutional Investments (FII)	Kumar (2009), Gurloveleen and Bhatia (2015).
11.	Trading Volume (TRV)	Engle, Ghysels and Sohn (2009).
12.	Market Capitalization (MCP)	Oluwatoyin and Gbadeb (2009), Musebe (2014).
13.	Crude Oil Prices (CRO)	Adam and Tweneboah (2008), Gurloveleen and Bhatia (2015).
14.	Gold Prices (GLD)	Sharma and Mahendru (2010).

TABLE 2: VARIABLES DESCRIPTION WITH THEIR SOURCE

Dependent Variable		**Data Source**
SMR	Aksoy and Leblebicioglu (2004), Maysami, Howe and Hamzah (2004), Engle and Rangle (2006), Duca (2007), Diebold and Yilmaz (2008), Oseni and Nwosa (2011), Kumar and Puja (2012), Zakaria (2012).	dbie.rbi.org.in
Independent Variable		**Data Source**
GDP	Quarterly Estimates of Gross Domestic Product at Factor Cost (At Current Prices) (Base : 2004-05) (Rs.Crore)	dbie.rbi.org.in
IIP	Monthly Index Numbers of Industrial Production (Base : 1993-94 = 100)	dbie.rbi.org.in
WPI	Wholesale Price Index - Monthly Average (Base: 2004-05=100)	dbie.rbi.org.in
BOP	India's Overall Balance of Payments - Quarterly (Rs.Crore)	dbie.rbi.org.in

TABLE 2: VARIABLES DESCRIPTION WITH THEIR SOURCE

Dependent Variable		Data Source
FXRE	Monthly Foreign Exchange Reserves (Rs.Crore)	dbie.rbi.org.in
FXRA	Monthly Average of Exchange Rate of the Indian Rupee (Rs.per unit of USD)	dbie.rbi.org.in
RPR	Repo Rate	dbie.rbi.org.in
TBR	Monthly Average of Implicit Yield at Cut-off Price (Per cent) on 91-Day Treasury Bills	dbie.rbi.org.in
PLR	Prime Lending Rate relates to State Bank of India (SBAR: State Bank Advance Rate)	dbie.rbi.org.in
FII	Monthly Net Investments by Foreign Institutional Investors in the Indian Capital Market (Rs.Crore)	dbie.rbi.org.in
TRV	Monthly Traded Volume in Corporate Debt at NSE (Amount Traded in Rs.Crore)	dbie.rbi.org.in
MCP	Monthly Market Capitalization-NSE (Rs.Crore)	dbie.rbi.org.in
CRO	Monthly Cushing, OK WTI Spot Price FOB (Dollars per Barrel)	dbie.rbi.org.in
GLD	Monthly Average Price of Gold in Domestic Market (Mumbai) (Rs.per 10gms.)	dbie.rbi.org.in

TABLE 3: RESULTS OF GRANGER CAUSALITY TEST

S. No.	Null Hypothesis	F-Statistics	P-Value	HO Not Rejected	Causality Inference
1.	SMR does not Granger Cause GDP	1.019	0.399	H_o Not Rejected	No Causality
2.	GDP does not Granger Cause SMR	0.912	0.458	H_o Not Rejected	
3.	SMR does not Granger Cause IIP	0.968	0.427	H_o Not Rejected	No Causality
4.	IIP does not Granger Cause SMR	0.046	0.046	H_o Not Rejected	
5.	SMR does not Granger Cause WPI	1.637	0.168	H_o Not Rejected	No Causality
6.	WPI does not Granger Cause SMR	1.521	0.199	H_o Not Rejected	
7.	SMR does not Granger Cause BOP	2.932	0.023*	H_o Rejected	Unidirectional Causality
8.	BOP does not Granger Cause SMR	2.372	0.050	H_o Not Rejected	SMR BOP
9.	SMR does not Granger Cause FXRE	1.823	0.128	H_o Not Rejected	No Causality
10.	FXRE does not Granger Cause SMR	1.316	0.267	H_o Not Rejected	
11.	SMR does not Granger Cause FXRA	1.207	0.310	H_o Not Rejected	No Causality
12.	FXRA does not Granger Cause SMR	1.110	0.354	H_o Not Rejected	
13.	SMR does not Granger Cause RPR	3.702	0.006*	H_o Rejected	Unidirectional Causality
14.	RPR does not Granger Cause SMR	1.846	0.123	H_o Not Rejected	SMR BOP
15.	SMR does not Granger Cause TBR	1.444	0.223	H_o Not Rejected	No Causality
16.	TBR does not Granger Cause SMR	2.045	0.091	H_o Not Rejected	
17.	SMR does not Granger Cause PLR	0.498	0.736	H_o Not Rejected	No Causality
18.	PLR does not Granger Cause SMR	1.128	0.345	H_o Not Rejected	

TABLE 3: RESULTS OF GRANGER CAUSALITY TEST

S. No.	Null Hypothesis	F-Statistics	P-Value	HO Not Rejected	Causality Inference
19.	SMR does not Granger Cause FII	0.649	0.628	H_0 Not Rejected	No Causality
20.	FII does not Granger Cause SMR	2.096	0.084	H_0 Not Rejected	
21.	SMR does not Granger Cause TRV	0.292	0.882	H_0 Not Rejected	No Causality
22.	TRV does not Granger Cause SMR	0.674	0.610	H_0 Not Rejected	
23.	SMR does not Granger Cause MCP	0.729	0.573	H_0 Not Rejected	Unidirectional Causality
24.	MCP does not Granger Cause SMR	9.236	0.000*	H_0 Rejected	SMR BOP
25.	SMR does not Granger Cause CRO	1.387	0.241	H_0 Rejected	No Causality
26.	CRO does not Granger Cause SMR	1.596	0.179	H_0 Not Rejected	
27.	SMR does not Granger Cause GLD	0.459	0.765	H_0 Not Rejected	No Causality
28.	GLD does not Granger Cause SMR	0.851	0.494	H_0 Not Rejected	
Note:[*] denotes rejection of null hypothesis at 95% confidence level.					
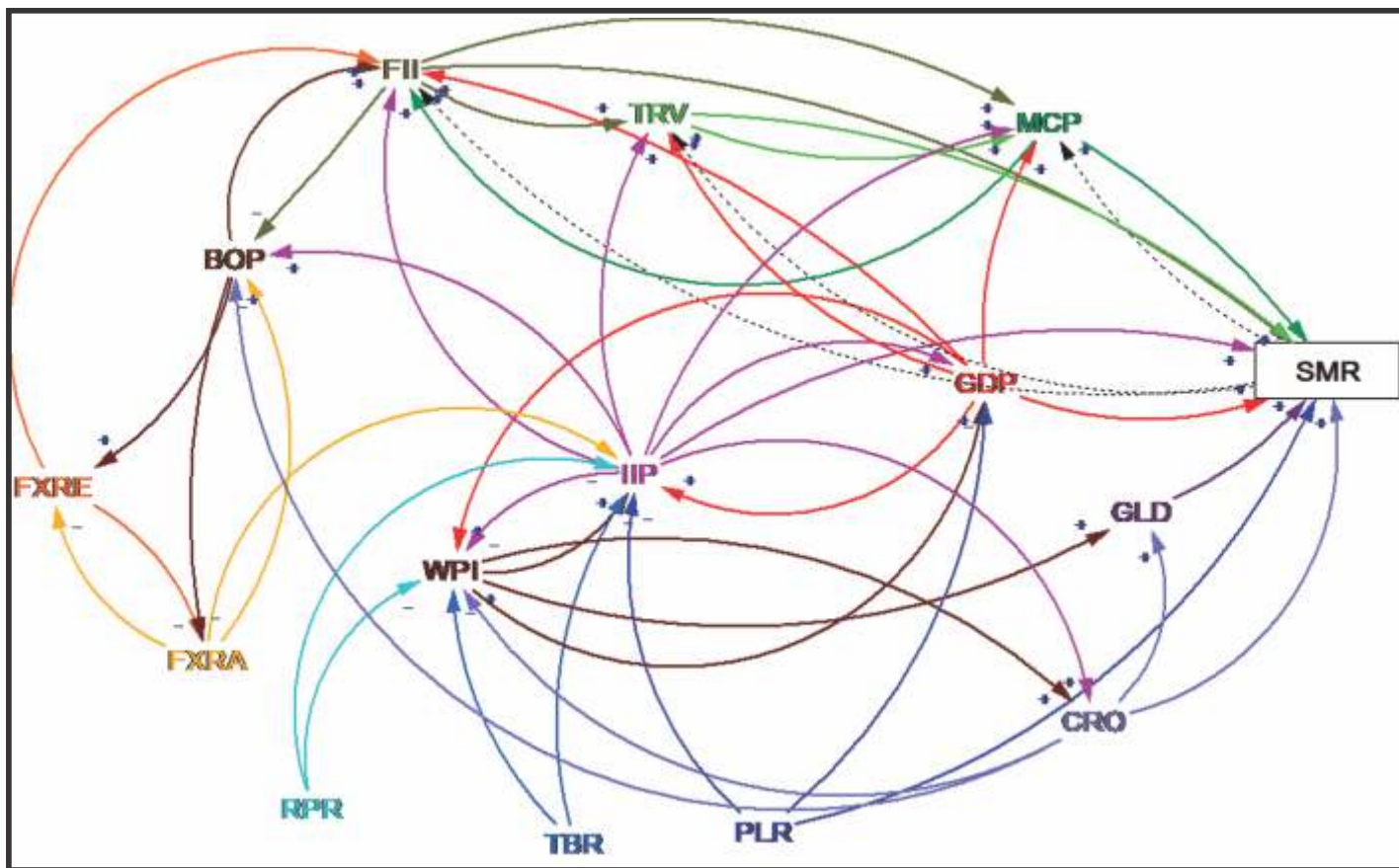
Figure 2 : Causal Loop Diagram of Macroeconomic Determinants of Stock Market Volatility

Monte Carlo Simulation for Understanding Risk in Project Management

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RISK

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ABSTRACT

This article develops an algorithm for assessing the risk in project management. The main risk considered here is the risk of a project not finishing on time. This algorithm can be considered as an extension of the classical methods like Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT). This extension can provide a richer understanding of risk inherent in any project planning.

Specifically, the present article discusses the classical project management tools such as CPM and PERT by pointing out to their applications as well as shortcomings in the context of risk management. It then shows the steps to conduct a Monte Carlo simulation of CPM using EXCEL spreadsheet. To conduct the simulation, first CPM is recast as a couple of optimization (linear programming) problems. And then the scripts written in Visual Basic for Applications (VBA) in Excel is used to run the CPM for one hundred times. The simulation gives a range of project completion times as well as the probability for each activity becoming a part of critical path.

Keywords: Project Management, Critical Path Method, Linear Programming, Risk, Simulation

INTRODUCTION

A project can be defined as a set of connected activities, which has definite beginning and ending. However, finishing any project on time and within the budget limits has always been a challenge. Hence, many organizations (e.g., DuPont) and government agencies (e.g., U. S. Department of Defense)? early on developed and refined algorithms to schedule activities in a CPM project (Lawrence et al., 1998, pp 272-283 and Pich et al., 2002).

Critical Path Method (CPM), developed by Dupont, computes the time required to complete a project, including the starting and ending time for each of the activities. It also focuses on the order in which the activities can be started as inputs for the calculation. For example, an excavation must be completed before laying a foundation, or wiring must be completed before any inspection. Then, based on this information, a network diagram is developed. This diagram is used to find the critical path. The critical path is the longest path in the network. The project completion time is equal to the sum of durations of all the activities in the critical path (Critical Path Method, Lawrence et al., 1998, pp 272-283).

In any project, there is always a risk that a project may not complete on time (Jamshadia et al., 2017; Galli, 2017, Pich et al., 2002, Pritsker, 1966). This contrasts with the assumption of CPM, which requires that the duration for each of the activities is deterministic. Therefore, CPM as such cannot evaluate risk inherent in a project. To overcome or mitigate this deficiency, PERT was developed. Here the completion time of each of the activities is taken as stochastic. Hence the project completion time is stochastic as well (Lawrence et al., 1998, pp 293-299).

However, PERT has its own limitation. When the time required to complete each of the activities is stochastic, the critical path itself can change. However, PERT takes a critical path determined by CPM as given. A Monte Carlo simulation of CPM can be a better solution in such situations. The simulation can be used not only to find a range of project completion times, but also to see the probabilities of each of the activities falling on the critical path (Pich et al., 2002).

The purpose of this article is to develop an algorithm to understand and assess the risks embedded in a project management endeavor. Importantly, the article provides a deeper understanding of risk assessment in any project planning and demonstrates the ease of programming and user-friendliness as the notable features of the algorithm developed in this article.

Following, Lawrence et al., this article utilizes Linear Programming to find the critical path as well as project completion time (1998, pp 299-300). I used, SOLVER which is an add-in tool in EXCEL (2001, pp 171-182; https://www.solver.com/excel-solver-linear-programming) to run the Linear programming. Then, following Albright (2001) I developed VBA scripts for the Monte Carlo Simulation.
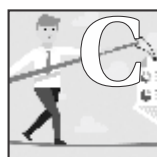
ONCEPTUAL FRAMEWORK

This section explains CPM and PERT with an example and elaborates on the logic behind the simulation. The following example illustrates the CPM/PERT concepts as well the simulation run. The example is shown in Table 1. This example-the part of Table 1 and the corresponding CPM-is mostly based on Wikipedia page on Critical Path Method (https://en.wikipedia.org/wiki/Critical_path_method). However, it should be noted that the author has extended the original one to present an argument on PERT and simulation. The conceptual parts of CPM and PERT can be found in the works of Lawrence et al. (1998, pp 272-283 and pp 293-299).

According to Table 1, there are eight activities in the project. The amount of time taken by each of the activities is given. In CPM only the average time is considered. For example, time to complete activity 'A' is 10. It is considered deterministic. The units of time can be anything (e.g., minutes, hours, etc.). This article defines the unit as day. Furthermore, "predecessors" are the tasks that must be completed before starting a specific activity. For example, Activity A should be completed before staring B. Similarly, both predecessors D and H must be completed before starting E, and so on.

RITICAL PATH METHOD

As stated previously, the purpose of CPM is to find the start and end time for each of the activities and the minimum time required to complete the project. The project completion time is the sum of the time required by the activities in the critical path (Lawrence et al., 1998, pp 272-283).

The network diagram in Figure 1 shows the critical path method. Each of the nodes (circles) represent an activity. For

TABLE 1: ACTIVITIES AND DURATION

Activity	Predecessor	Duration					
		Mean	Min	Max	Median	Standard	Variance
A	-	10	4	20	9	2.67	7.11
B	A	20	10	30	20	3.33	11.11
C	B	5	1	9	5	1.33	1.78
D	C	10	3	21	9	3.0	9
E	D, H	20	10	30	20	3.33	11.11
F	A	15	5	25	15	3.33	11.11
G	F, C	5	2	10	4.5	1.33	1.78
H	A	15	4	30	14	4.33	18.78
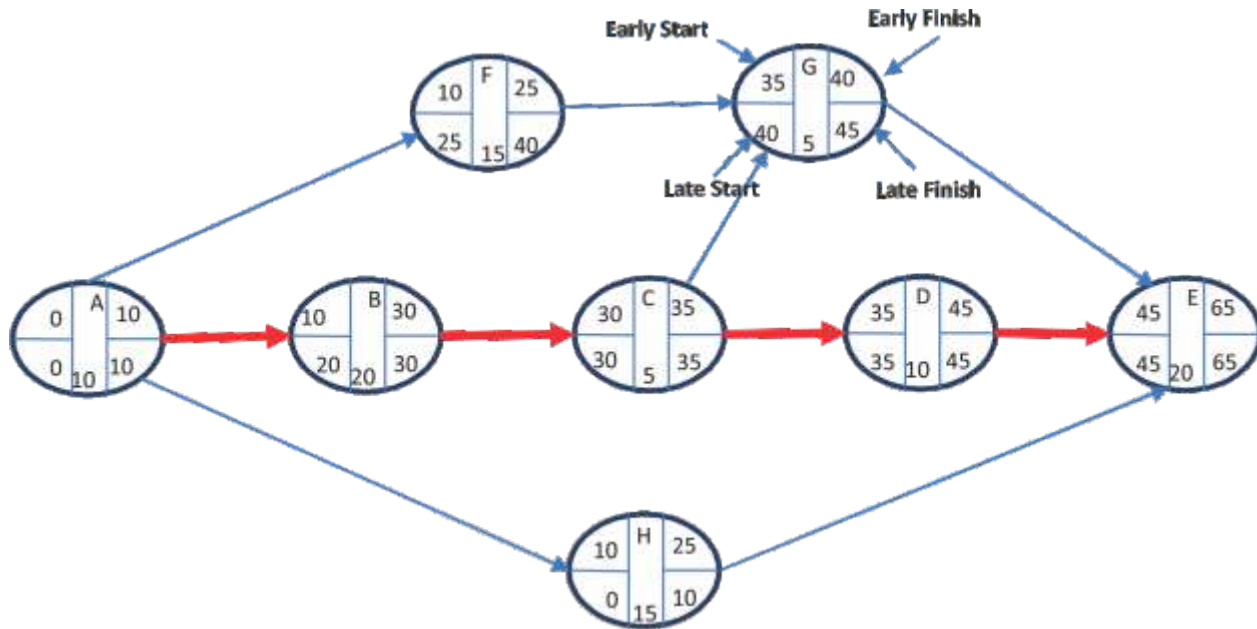
FIGURE 1: FINDING THE PROJECT COMPLETION TIME WITH CPM

example, Activity G is represented by the node that is designated as G. It takes 5 days to complete. Therefore, if this activity starts on day 35, it can finish on day 40. The reason it can only start on day 35 is dictated by the completion time of its two predecessor activities. Activity C ends on day 35 and F at 25. Since both preceding activities must be completed before G starts, it can only start on day 35.

Moreover, the late finish time is related to the late start time of the succeeding activity. E is the succeeding activity of G, and it can start as late day 45. Therefore, G can have a late finish time of 45, leading to a late start time of 45-5 = 40. Hence, there is a 5 day slack between late start and early start (or late finish and early finish).

Activities on the critical path do not have slack. That is, any delay in any of these activities can lead to a delay in project completion time. The critical path consists of activities A, B, C, D and E. The number of days required to finish the project is 65 (10+20+5+10+20) (Lawrence et al., 1998, pp 272-283).

PROJECT EVALUATION AND REVIEW TECHNIQUE

One must recognize that a completion time for each of the activities cannot be deterministic. At best, it is the average time drawn from a wide range of possibilities. Generally, completion time for each of the activities is considered as having a triangular distribution. This is illustrated in Figure 3. In this distribution, data for three sets of times (minimum, maximum and most likely) are collected. Mean and standard deviation of each of the time periods can be calculated as following: - The above figure needs some work in its display and role.

$$Mean = \frac{Min + Max + 4 \cdot Most\ Likely}{6}, \quad Standard\ deviation = \frac{Max - Min}{6}.$$
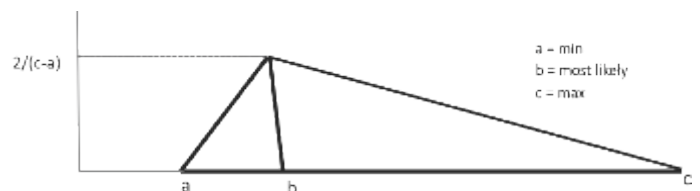
Recall that the time estimates of each of the activities in Table 1 are the means calculated with the formula given above. Table 1 also gives the standard deviations and variances of each of the activities. Variances are the square of their respective standard deviation. The estimate of the project completion time (65 days) calculated above can be considered as the mean, with 50% chance that it can be longer and another 50% chance to be shorter. Like averages, a variance of the completion time is the sum of variances of each of the activities in the critical path. To find the standard deviation of the path, we should find its variance first and take its square root [Lawrence et al., 1998, pp 293-299]. The value of standard deviation turns out to be 6.33. Based on the mean and standard deviation, the range of 99% confidence interval of the project completion time can be calculated in the range of 50 to 80.

LIMITATIONS OF PERT

Like CPM, PERT has its own limitations. For example, it assumes that the critical path as originally identified from CPM remains unchanged. However, the completion time of each of the activities, not just those in original critical path, are stochastic (and not deterministic). Two alternative solutions of CPM are shown in Figures 2 and 3. They are calculated using the same data from Table 1. Here, the completion time of each of the activities is randomly drawn from the triangular distribution of the activity times. These figures show that, not just the project completion time, but the critical path is also different from that shown in Figure 1. In Figure 2, the critical path is ABCGE and the project completion time is 57.3 days,
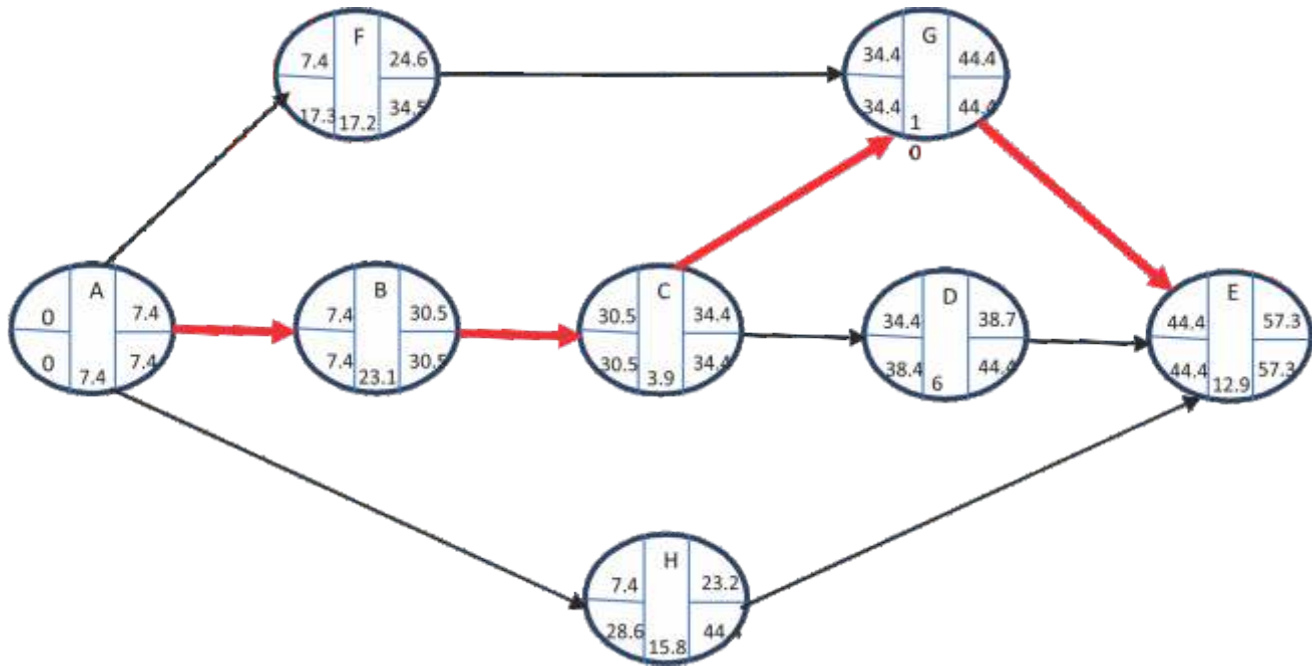
FIGURE 2: FINDING THE PROJECT COMPLETION TIME WITH CPM-ALTERNATIVE ACTIVITY TIMES

whereas in Figure 3 the critical path is AFGE and the project completion time is 61.9 days. Therefore, there is a need for finding, not just one critical path, but evaluating the probability of each of the activities falling in the critical path.

To overcome the above limitations, one can use a Monte Carlo simulation (Pich et al, 2002). To achieve this, MS Excel 2016 along with its SOLVER option, can be used to conduct the simulation. This process generates CPM one hundred times in succession. For each iteration, the duration of each of the activity is drawn randomly. It not only gives the range of project completion times, but also the probabilities of each of the activities falling in the critical path, thus, giving a more complete picture of project completion resulting in a better understanding and analysis of project risk management.

ONTE CARLO SIMULATION

To conduct the Monte Carlo simulation, an example with 22 activities is used (Gido and Clements, 2013, pp 177). However, the present author has added a set of minimum, maximum and median durations which are required for the Monte Carlo simulation. This approach has resulted in a more realistic example. Table 2 shows the results from the example.

This Simulation consists of the following steps.

Step 1. Find the project completion time and the critical path for using estimated durations. Conceptually, one can draw CPM diagram like the one shown in Figure 1, but for practical purpose, the details are given in a table-format only. Table 3
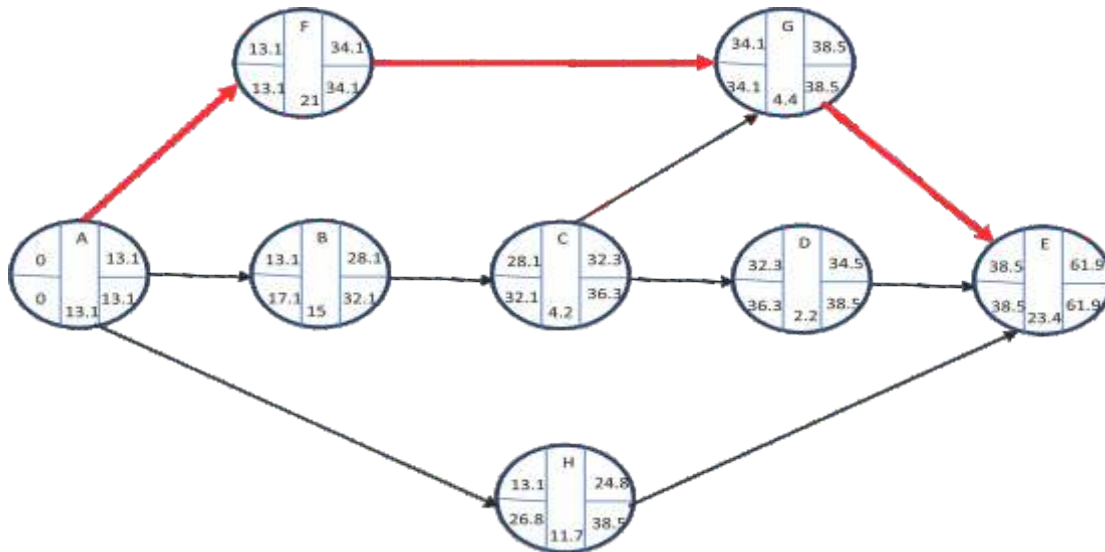
FIGURE 3: FINDING THE PROJECT COMPLETION TIME WITH CPM -ALTERNATIVE ACTIVITY TIMES

has the details.

Step 2. Randomly draw the duration for each of the activity. The numbers are drawn based on the triangular distribution, and within the range of maximum, minimum and median as given in Table 2.

Step 3. Repeat Steps 1 and 2 one hundred times.

Step 4. Calculate the range of project completion times, and the probability that each of the activities falls in the critical path. The details of the outcome of these steps are shown in Tables 4 and 5.

Following paragraphs elaborate on the above steps.

CPM USING EXCEL SOLVER

Finding the critical path and the project completion time is the most crucial step in this algorithm. Making a network diagram like Figure 1 is not viable here, because a diagram with 22 activities can be very burdensome.

The current article used Liner Programming (LP), aided by EXCEL SOLVER to get the critical path and the project completion time. Two Linear Programs are formulated following Lawrence et al. (1998, pp 299-300). The first one finds the minimum completion time of the project (this number is called "FINISH" here) and the early start time of each of the activities. In general form, it is shown below:

$$Min \sum_{i}^{n} x_i^e + x_{fin} \quad \text{Where, } x_i^e \text{ is the early starting time of } i^{th} \text{ activity, and } x_{fin} \text{ is the time when project ends.}$$

$$S.1. \quad x_i^e - x_{i-1}^e - d_{i-1}, \quad \forall x_i^e \text{ Where, } d_i \text{ is the duration of the } i^{th} \text{ activity}$$

$$x_i^e > 0 \quad \forall x_i^e$$

The output of the above formula is the minimum project completion time x_{fin}. The value of x_{fin} is a constant "FINISH."

TABLE 2: ACTIVITIES AND DURATION OF LONGER EXAMPLE

#	Activity	Immediate Predecessors	Estimated	Durations				
				Minimum	Maximum	Median	Standard Deviation	Variance
1	A		3	1.000	6.000	2.750	2.041	4.167
2	B		4	2.000	7.000	3.750	2.041	4.167
3	C	A, B	1	0.500	1.500	1.000	0.408	0.167
4	D	C	5	3.000	8.000	4.750	2.041	4.167
5	E	C	8	6.000	10.000	8.000	1.633	2.667
6	F	D	5	3.000	7.000	5.000	1.633	2.667
7	G	E, F	1	0.500	2.000	0.875	0.612	0.375
8	H	G	8	4.000	12.000	8.000	3.266	10.667
9	I	G	10	6.000	12.000	10.500	2.449	6.000
10	J	H, I	2	1.000	4.000	1.750	1.225	1.500
11	K	J	2	1.000	4.000	1.750	1.225	1.500
12	L	I	15	8.000	19.000	15.750	4.491	20.167
13	M	J	10	4.000	12.000	11.000	3.266	10.667
14	N	I	6	4.000	8.000	6.000	1.633	2.667
15	O	L, M, N	2	0.500	6.000	1.375	2.245	5.042
16	P	O	6	3.000	10.000	5.750	2.858	8.167
17	Q	O	4	2.000	8.000	3.500	2.449	6.000
18	R	O	4	2.000	8.000	3.500	2.449	6.000
19	S	P, Q, R	1	0.500	5.000	0.125	1.837	3.375
20	T	S	4	1.000	9.000	3.500	3.266	10.667
21	U	S	2	1.000	4.000	1.750	1.225	1.500
22	V	T, U	1	0.500	3.000	0.625	1.021	1.042

For the problem given in table 2, the value of "FINISH" is 57. Early start of each of the activities are given by x_i^e. In the case of the problem given in table 2, x_i^e changes from x_A^e to x_V^e. The output x_A^e to x_V^e are the early start times of each of the activities. The EXCEL spreadsheet and the related SOLVER inputs are shown in Appendices 2a and 2b.

$$Max \sum_{i=1}^{n} x_i^l + x_{fin} \quad \text{Where, } x_i^l \text{ is the late starting time of } i^{th} \text{ activity, and } x_{fin} \text{ is the time when project ends.}$$

$$S.T. \quad x_r^l - x_i^l \geq d_{r-i} \quad \forall x_i^l \text{ Where, } d_i \text{ is the duration of the } i^{th} \text{ activity}$$

$$x_{fin} \leq FINISH$$

$$x_i^l \geq 0 \quad \forall x_i^l$$

In the second LP, the main issue is to find the late start time for each of the activities. Therefore, the objective here is to maximize the time. But, when it is maximized without constraint, it may go to an infinite level and this problem cannot be solved. To control this problem, one extra constraint $x_{fin} \leq FINISH$ is added. The Excel spreadsheet and the related SOLVER inputs are shown in Appendix 3a.

To be able to automatically run the simulation, SOLVER is run using VBA codes (Albright, 2001, pp 173-183). These codes are given in Appendices 2c and 3b respectively.

Finally, the time slacks of each of the activities are calculated. The formula for the slack is $x_i^l - x_i^e$. Slacks are zero for activities on the critical path. The output of this exercise is shown in Table 3. According to it, the activities with 0 slack are in critical path. The Critical Path is B-C-D-F-G-I-J-L-O-P-S-T-V. The project completion time thus calculated is 57. For PERT the standard deviation thus calculated is 8.216, with a 99% confidence interval of the project completion time as 43.49 to 78.16.

RANDOMLY DRAWN DURATION OF ACTIVITIES

The first step of the simulation is to randomly draw a duration for each activity. Since there is no built-in function for a triangular distribution in EXCEL, a special code was developed for this function. First, a random number must be drawn. To do this, one can use built-in functions in Excel or VBA. Specifically, these functions draw a randomly generated number, ranging from 0 to 1 from the uniform distribution. This number is called "U."

The value of a randomly drawn duration depends on U. Besides; it also depends upon the ratio of $\frac{b-a}{c-a}$, which is called "d" here. If d is greater than U, then the duration of the activity is equal to $(a + (c - a) * \sqrt{dU})$; otherwise it is equal to $(a + (c - a) * [1 - \sqrt{(1 - d)(1 - U)}])$ (Albright, 2001, pp 160-161 and pp 169; Triangular Distribution). The code of the function developed in the article to randomly draw the duration of each activity is given in Appendix 1.

SIMULATION AND THE RESULT

Referring to the Monte Carlo Simulation steps, Step 3 runs Steps 1 and 2 one hundred times (Albright, 2001, pp 173-183). The result is the hundred different instances where the project

TABLE 3: CRITICAL PATH AND PROJECT COMPLETION TIME

#	Activity	Immediate Predecessors	Time		
			Early Start	Late Start	Slack
1	A		0	1	1
2	B		0	0	0
3	C	A, B	4	4	0
4	D	C	5	5	0
5	E	C	5	7	2
6	F	D	10	10	0
7	G	E, F	15	15	0
8	H	G	16	18	2
9	I	G	16	16	0
10	J	H, I	26	26	0
11	K	J	28	55	27
12	L	J	28	28	0
13	M	J	28	33	5
14	N	J	28	37	9
15	O	L, M, N	43	43	0
16	P	O	45	45	0
17	Q	O	45	47	2
18	R	O	45	47	2
19	S	P, Q, R	51	51	0
20	T	S	52	52	0
21	U	S	52	54	2
22	V	T, U	56	56	0
23	Finish	V	57	57	0

completion times are calculated; the result also shows the critical paths for each of the instances. Table 4 summarizes the statistics from this simulation based on Step 3. It demonstrates that the average completion time is different from what was calculated with CPM and the standard deviation is different from what was calculated with PERT. In this case, average is higher and that is because the critical path itself can change. However, the standard deviation is smaller because many variables can cancel each other's volatility.

TABLE 4: SUMMARY STATISTICS

Mean	59.94789
Standard Deviation	3.96609
Maximum	69.86159
Minimum	51.75411
Median	59.97126

Further, Table 5 shows the percentage of time each of the activities can be in the critical path. It shows about 30% of the time Activity A can be in the critical path. Similarly, 25% of the time Activity H can be on the critical path as well, whereas, Activity P is on the critical path for 65% of the time. In fact, except for Activities K and N, each of the activities can be in the critical path. The original critical path, B-C-D-F-G-I-J-L-O-P-S-T-V as calculated by CPM, remained the critical path for only

TABLE 5: % OF TIME EACH ACTIVITY IS IN CRITICAL PATH

#	Activity	Immediate	% of time
1	A		30
2	B		70
3	C	A, B	100
4	D	C	94
5	E	C	6
6	F	D	94
7	G	E, F	100
8	H	G	25
9	I	G	75
10	J	H, I	100
11	K	J	0
12	L	J	94
13	M	J	6
14	N	J	0
15	O	L, M, N	100
16	P	O	65
17	Q	O	18
18	R	O	17
19	S	P, Q, R	100
20	T	S	91
21	U	S	9
22	V	T, U	100

on the average about 30% of the time in the simulations run.
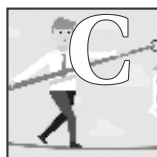
CONCLUSION

The purpose of this exercise was to understand the risk, especially the probabilities of delays, in project management. There are two main benefits of

this method. First, as part of project management, CPM and PERT are described as the problem-solving tools for managers. The Monte Carlo Simulation, by providing additional insights beyond CPM and PERT, can provide and enhance managers' understanding of the risk pertaining to project completion times. Furthermore, EXCEL spreadsheets and SOLVER are widely available. These are tools used extensively by academicians and practitioners of many disciplines with ease. Therefore, the algorithm that is demonstrated in this article can be a useful tool for both students as well as practitioners.

Indeed, there are other methods and procedures available to assess risks in project management (Jamshidia et al., 2017; Pritsker, 1966). But these other methods require sophisticated software and complicated calculations. On the other hand, the algorithm discussed here can be easily applied to understand risk in project management. However, there is a caveat: focussing on one kind of risk (time), while not considering other risks in project management (Galli, 2007), can be considered as the main limitation of the algorithm developed in this article. Future research effort is needed to extend the present algorithm to address other types of risk as well.

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APPENDICES

APPENDIX 1

'This is a function to randomly generate the activity times
'based on triangular distribution

Function ActTime(Maximum As Single, Minimum As Single, MostLikely As Single) As Single

Dim d As Single, x As Single

d = (MostLikely - Minimum) / (Maximum - Minimum)

x = Rnd()

If x < d Then

  ActTime = Minimum + (Maximum - Minimum) * Sqr(d * x)

Else

  ActTime = Minimum + (Maximum - Minimum) * (1 - Sqr((1 - d) * (1 - x)))

End If

End Function

APPENDIX 2 A

This shows the first LP formulation in Excel spreadsheet and Solver.

The numbers shown in the INPUT range are the early start time for each of the activities. The number under FINISH is the time required to complete the project.
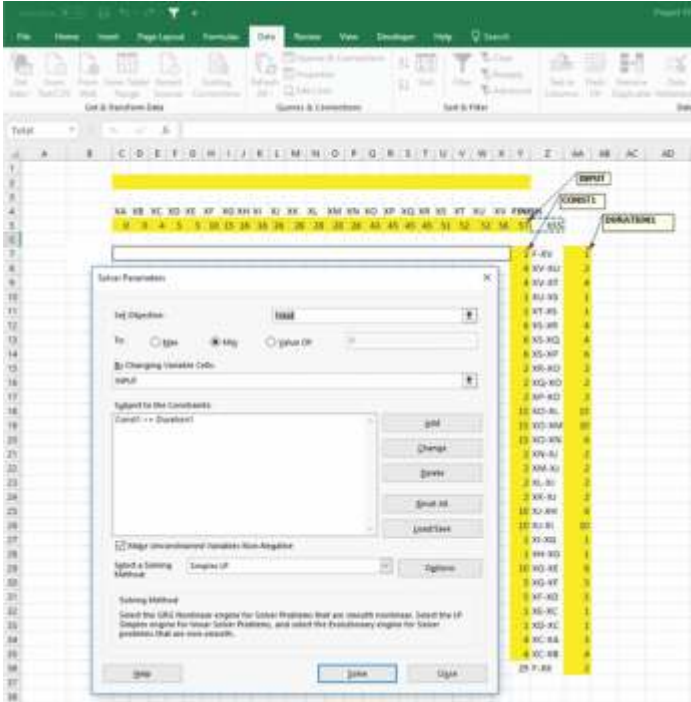
APPENDIX 2 B

This shows the first LP formulation in Excel spreadsheet and Solver. Here instead of the formulas in the cells are displayed.
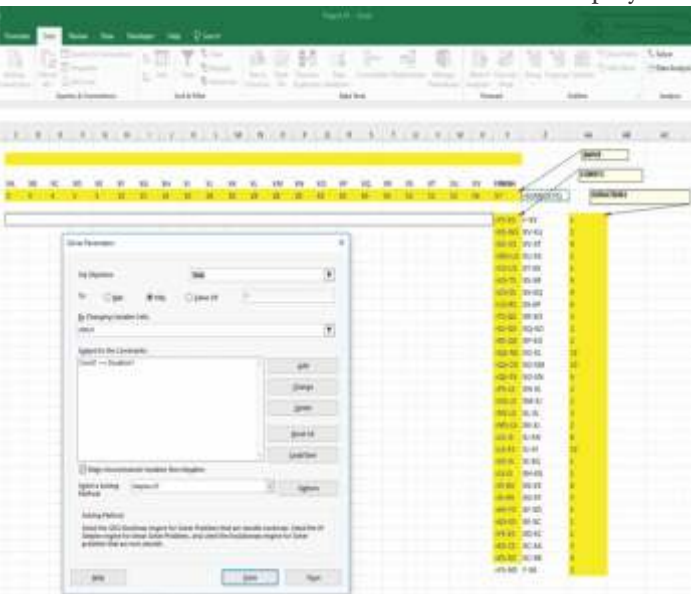
APPENDIX 2 C

'There are two outcomes of this sub

'to find the minimum time required to complete the project

'to find the early start time of each of the activities

Sub Minimize()

SolverReset

SolverOk SetCell:=Range("Total"), MaxMinVal:=2, ByChange:=Range("INPUT")

SolverAdd CellRef:=Range("CONST1"), Relation:=3, FormulaText:="Duration1"

SolverOptions AssumeLinear:=True, AssumeNonNeg:=True

SolverSolve UserFinish:=True

'Transfer the values of early start time in the next row

'This is clear the current row for the next run of LP

Range("INPUT").Copy Destination:=Range("C2:Y2")

'Copy the project completion time in another cell

Appendix 3 A

This shows the second LP formulation in Excel spreadsheet and Solver.

The numbers shown in the INPUT range are the late start time for each of the activities. The number under FINISH is the time required to complete the project.
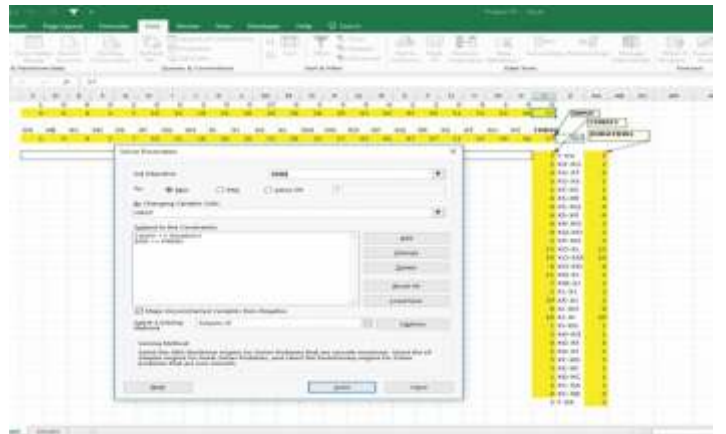
APPENDIX 3 B

'This sub finds the late start time of each of the activities

Sub Maximize()

  SolverReset

      SolverOk SetCell:=Range("Total"), MaxMinVal:=1, ByChange:=Range("INPUT")

      SolverAdd CellRef:=Range("CONST1"), Relation:=3, FormulaText:="Duration1"

      'One constraint is added to make sure that project completion time remains the same

      SolverAdd CellRef:=Range("INPUT"), Relation:=1, FormulaText:="FINISH"

      SolverOptions AssumeLinear:=True, AssumeNonNeg:=True

  SolverSolve UserFinish:=True

End Sub

Impact of Leadership Development on Employee Engagement of Associates Working in National Capital Region in India

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ABSTRACT

Today's globalised organisations focus on leadership development practices wherein leaders are developed at all levels in the organisation. It is a systematic approach to expand the performance capability of individuals in leadership roles in the organisation. In this light the present study aimed to map the impact of leadership development practices on different parameters of employee engagement and overall engagement scores of employees in the organisation. A self administered questionnaire was used to collect primary data of 300 respondents from 20 organisations. The data collected was analyzed using SPSS and Smart PLS software. The results reveal correlation between leadership development and employee engagement (r = 0.71). Regression analysis revealed that leadership development contributes 50% to the overall employee engagement score. It is evident that organisation which invests in developing leaders at each level in the organisation structure are able to facilitate collaborative partnerships, adaptability, agility, communication, feedback, technology absorption, process innovation, productivity, financial performance and employee engagement. Senior Managers in the organisation can enhance employee engagement by identifying leadership potentials among employees and providing them with appropriate opportunities to take up leadership positions.

Keywords : *Employee Engagement, Leadership Development, Job Satisfaction, Organisational Commitment, Intention to stay.*

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INTRODUCTION

"Winning Companies win because they have good leaders who nurture the development of other leaders at all levels of the organisation."   – Noel Tichy

"Leaders don't create followers, they create more leaders."

– Tom Peters

In today's globalised economy where organizations are facing complex and challenging work dynamics, a striking shift from an industrialized model of work to more knowledge intensive communities of practice (Adler, 2001; Cho, Cho, & McLean, 2009); employees have higher anticipations about engaging in organizational decision making. Employee actively seeks work situations where they are dealt with respect and fairness in pursuance of dynamic association in organizational activities (Burke & Ng, 2006). The traditional legitimate and hierarchical models pertaining to power practices are challenged as the new Gen Y workers are entering into the workplace (Beck, 2003; Burke & Ng, 2006; Pink, 2001). Modern styles of leadership are required to practice, keeping into consideration the different and complex business environments.

Leadership development is one such practice, wherein leaders are developed at all levels in the organisation. It is a systematic approach to expand the performance capability of individuals in leadership roles in the organisation. It gives autonomy to employees working at different levels in the organisation to make decisions on their own keeping into consideration the overall goals and objectives of the organisation. Yates (2017) argued that the driving force of a successful organisation is its skilled leaders. These leaders motivate employees by setting and communicating the vision and tone for the organisational culture to flourish. The term leadership does not only refer to the top management rather a new approach is practiced these days, wherein each employee in the organisation is a leader. Every employee in the organisation should be able to communicate, innovate, plan, and work effectively with other employees. The skills of a leader should flow throughout modern business, so they need to be developed at every level. Thus, the workforce feels empowered to contribute to the success of the organisation and in turn feel engaged.

An effective leader should ensure that employees are engaged. According to Witt (2011), leadership practices have a strong impact on employee engagement, well being and productivity. Thus, it is rightly said that leadership and employee engagement are two sides of the same coin. Organisations may not be able to successfully achieve their goals and objectives without effective leaders and none of the employee engagement efforts are successful without leadership development.

Employee Engagement is the commitment of an employee to his or her organization and the eagerness to perform beyond expectations. Engagement is not just job satisfaction; it is much more than that. Highly engaged employees are more dedicated and motivated in making the organization a success. Engagement is "A feeling of psychological connect with the organization emerging out of pleasurable or positive emotional state leading to job satisfaction, commitment, sense of pride towards the organization, wanting to stay with the organization, forming emotional connect and recommending others also to work with the organization (Lather & Jain, 2014)". The world's top-performing organizations understand that employee engagement is an effort that stimulates business outcomes. Employee Engagement is arguably the most integral metric for organizations in the 21st Century.

Precisely, engagement is connected with the active collaboration and investment of a person, not solely parts in role performance. In the context of organizations, engagement has a more explicit meaning. Within the workplace these synergies clearly reveal themselves in the contract of employment wherein employees take a pledge to serve their employer, show responsibility towards their job, and assume the accountability of employment. Employees of the organization invest their energies to comprehend and embark these roles. And thus, they feel associated and involved in the roles and responsibilities they perform. It is precisely evident that whenever employees of the organization are mentally and emotionally engaged, they push the organization to unmatchable heights.

The progressively aggressive business environment has propelled the organizations to focus on the vital issue of employee engagement in an attempt to explain the underlying factors of employee motivation and performance. According to Gallup (2005) engagement was considered imminent, especially when the nature of the job is universal and persuasive part of an employee's well-being, which not only alters the life of the employee, but also one's mental and physical health (Wrzesniewski, Rozin, & Bennett, 2002).

Organisations which value the leadership development maintains a culture of rewarding leaders and invest its resources in maturing them. Organisations which are successful in today's turbulent business environment are those which value the need for developing leaders and are striving to systematically and deliberately produce them.

Leadership development at all levels is of utmost importance for any organization. Innovative ideas are the driving forces of an organization's success and understand that effective leaders, are required not just at the top, but all through the organization, from the CEO to the team members in each department, hold the key to the engines of creativity.

Trap (2014) highlighted the need for leaders at all levels in the organisation to become successful. Leaders develop conditions where employees have assurance in exercising their initiative and in grasping opportunities to share knowledge and assume responsibility. They recognize completing forms of leadership leads to job satisfaction and engagement and have a positive impact on the life of organization.

In this light the present study aimed to map the impact of

leadership development on different parameters of employee engagement and overall engagement scores of employees in the organisation.

LITERATURE REVIEW

Many researchers have conducted research across the globe to map employee engagement and to understand its linkages with other factors. Many international research and consulting firms such as Hewitt Associates, Gallup, BI Worldwide, and Tower Watson etc have undertaken research on engagement in Indian firms. Big corporations of private sector and a few public sector corporations are conducting this type of study with the help of international consulting and research organization.

The most important asset possessed by organizations is its employees. They are considered as the intellectual capital of the organization. Using, this intellectual capital has now become a major source through which organization's gain competitive edge in this dynamic business environment.

According to Lather and Jain (2014) Engagement is "A feeling of psychological connect with the organization emerging out of pleasurable or positive emotional state leading to job satisfaction, commitment, sense of pride towards the organization, wanting to stay with the organization, forming an emotional connect and recommending others also to work with the organization".

Although there is not much research supporting the relationship of leadership development and employee engagement and its parameters, but many researchers have conducted studies which support that leadership behaviour has a strong impact on employee engagement and its dimensions.

Xu and Thomas (2011) conducted a study in New Zealand to investigate linkage between leader's behaviour and follower's engagement. Their research confirmed that there exists a positive relationship between leadership behaviour and follower's engagement in the organisation. Papalexandris and Galanaki (2009) investigated to identify the impact of leadership on employee engagement. The findings of their study suggested that there is a positive impact of leadership on employee engagement. They also underlined the fact that good management and mentoring are essential in any kind of firm, in order to develop an effective, committed and motivated top management team, which will bring corporate success.

Penger and Cerne (2014) developed and tested a multilevel model of cross-level interactions between authentic leadership at the team level and job satisfaction and employee engagement at the individual level with the mediating role of perceived supervisor support. They analysed responses collected from 289 team members and 23 team supervisors. The results demonstrated that there exists a positive relationship among authentic leadership, job satisfaction and employee engagement. Also, it was observed that perceived supervisor support fully mediated the relationship between authentic leadership and job satisfaction, whereas partial mediation was observed in the relationship between authentic leadership and employee engagement.

H1: There is a significant relationship between leadership development and employee engagement.

H2: There is a significant impact of leadership development on employee engagement.

Nelson and Daniels (2014) conducted a study of individuals working for managers who were previously peers to highlight the relationship between perception, tenure, turnover intentions and job satisfaction. On analysing the data it was concluded that there is a significant correlation between job satisfaction and employee turnover; manager's perception and job satisfaction, while the other variables assessed depict no correlation amongst each other. Tsai (2011) conducted a study to understand the relationship amongst leadership behaviour, organisation culture and job satisfaction on hospital nurses in Taiwan. Responses collected from 200 respondents were analysed using correlation analysis. The statistical results revealed that there exists a significant positive correlation among culture of the organisation, leadership behaviour and job satisfaction. Also, it was observed that leadership behaviour has a significant positive correlation with job satisfaction. Thus, they concluded that organisation culture and leadership play a very important role in communication and collaboration and thereby improving the job satisfaction of the employees in the organisation. Kim (2002) argued that participative style of leadership enhances job satisfaction irrespective of the sector of employment. To affirm this relationship of participative leadership in strategic planning and job satisfaction this study was conducted in Government agencies. The results of the analysis revealed that managers use of a participative management style and employee's perceptions of participative strategic planning processes are positively related to high levels of job satisfaction. The study also found that effective supervisory communications in the context of the strategic planning process are positively related to high levels of job satisfaction. The study suggested that participative management, which incorporated effective supervisory communications, can enhance employees' job satisfaction. Yahaya and Ebrahim (2016) construed that there is a relationship between different dimensions of leadership, which are transformational, transactional and laissez-faire, and employee effort, employee satisfaction, leader effectiveness and organisational commitment. Mosadeghrad and Ferdosi (2013) also expounded that job satisfaction and organisational commitment are dependent on the style of leadership of managers. They collected responses from 814 employees of public hospitals of Iran to establish this relationship. It was found that the most of the hospital managers used participative style of leadership, but employees in the hospitals were only moderately satisfied with their jobs and commitment towards their organisation was also moderate. It was also observed that salaries, contingent rewards, fringe benefits, working conditions, promotions, and interpersonal

relationship contributed in the prediction of job satisfaction among the hospital employees. The results also revealed that leadership behavior contributed 20 percent and 28 percent of the variance explained in organisational commitment and job satisfaction respectively. They emphasized that there is a causal relationship between leadership behaviour and job satisfaction and organisational commitment. They also argued that participative style of leadership is not always the best way to lead. Managers should select the style of leadership depending upon the culture and employee maturity in the organisation.

Gillet and Vandenberghe (2014) conducted a research to further affirm the relationship of transformational leadership and organisational commitment through the impact of followers' perceptions of job characteristics. They collected and analysed the data from 488 respondents from different organisations in France. They found that the relation of transformational leadership and organisational commitment are partially mediated by followers' perception of task characteristics. Kleine and Weißenberger (2014) construes that the leadership styles practiced by top level managers affect the level of organisational commitment among the lower and middle level managers. This study was conducted to investigate the relationship among leadership styles, management control systems and organisational commitment. Structural Equation Modelling was used to analyse the data collected from 294 German organisations. The results indicate that informal control elements, such as personnel and cultural controls, act as hinges through which top management is able to positively transmit leadership behaviours and affect the development of organizational commitment. Mclaggan, Bezuidenhout and Botha (2013) conducted a research in mining industry to investigate the relationship between transactional and transformational leadership and organisational commitment. Responses were collected from 88 employees of a coal mine in Phola in the Mpumalanga province. On statistical analysis, it was revealed the there is a significant relationship between leadership styles and organisational commitment. They emphasized that line managers should follow transformation style of leadership to enhance commitment, satisfaction and engagement among their employees. Lo, Ramayah and Min (2009) also construed that organisational commitment has an important implication on employees and the organisation. To establish this they conducted a research in Malaysia to study the relationship of leadership styles and organisational commitment. They only focussed on two styles of leadership, that is, transactional and transformational leadership. They collected and analysed a sample of 156 Malaysian executives. The results of their study revealed that although the transactional and transformational leadership, both have a positive relationship with organisational commitment, but the impacts are much stronger for transactional leadership. Steyrer, Schiffinger and Lang (2008) also conducted a study to investigate the effect of leadership behavior on organisational commitment which in turn influences the performance of the organisation. They collected and analysed data from 78

organisations of Germanic cultural areas. The findings of their research concluded that leadership behaviour is positively related to organisational commitment of the subordinates and organisational commitment has a strong impact on the performance of the organisation.

AbuAlRub R.F. & Nasrallah M.A. (2017) conducted a study on Jordanian nurses to investigate the impact of leadership behaviour and organisation culture on intention to stay in private, public and university hospitals. They suggested that leadership behavior and orgaisational culture are prime factors to enhance the intention to stay of the nurses. They collected and analysed a sample of 285 nurses. The results of their study revealed that leadership behavior and organisational culture have significant positive correlation with intention to stay. Also, leadership behavior and organisation culture together contributed to 43 percent of the total variance explained in the intention to stay of the nurses. Cowden, Cummings and Profetto-McGrath (2011) also conducted a research on nurses to examine the relationship between leadership practices followed by managers and the intention to stay. The results of their study revealed that relational leadership, transformational leadership and supportive work environment have a positive relation with the intention to stay of the staff nurses. The managers, leader managers and leaders who practice relational leadership and ensure quality workplace environments are more likely to retain their staff. Ndoye, Imig and Parker (2010) conducted their study in American schools in North Carolina which were facing a challenge of teacher attrition and migration. Their study focused on the relationship of school leadership, teacher empowerment and intention to stay or leave. The findings of the study indicated that the teacher's intention to stay or leave or to migrate is strongly predicted by leadership.

H3: There is a significant relationship between leadership development and parameters of employee engagement, i.e., job satisfaction, organisational commitment, intention to stay, pride, advocacy and emotional connect.

H4: There is a significant impact of leadership development on parameters of employee engagement, i.e., job satisfaction, organisational commitment, intention to stay, pride, advocacy and emotional connect.

RESEARCH METHODOLOGY

Objectives of the Study

The objectives of conducting this study are:

• To study the relationship between leadership development practices and employee engagement.

• To test a model to predict that leadership development practices impacts employee engagement.

Sample

A causal study was conducted on the working professional of different organizations in National Capital Region of India. A self administered questionnaire was used to collect primary

data of 300 respondents, using systematic sampling, from 20 organisations. These organisations were from different sectors of the economy like manufacturing, automobile, hospitality, aviation, banking, etc. The respondents were managers working at different levels in these organisations. The sample was collected and analyzed using Correlation analysis and Partial Least Square Method. There were 208 males and 92 females whose age group range from 23 years to more than 55years. The sample was collected from employees at different levels of management. Hence, the sample included responses from 139 entry level managers, 125 middle level managers and 36 senior level managers (Table 1).

TABLE 1. RESPONDENT PROFILE

Gender	Male	Female	
	208	92	
Marital Status	Single	Married	Divorced
	164	135	1
Age Group	Young adults: (23-35 years)	Mid. Age adults (36-55 years)	Senior adults (55years and above)
	248	45	7
Level of Management	Entry level Manager	Middle level Manager	Senior level Manager
	139	125	36
Sector of Employment	Public	Private	
	80	220	

Tools Used

• Leadership Development: An 11 item questionnaire was constructed to measure the Leadership development practices in the organization. These items are formed on the supporting individual growth through leadership development practices, frequent leadership development sessions, assessment of leadership potential, continuous review of leadership development practices by top management, well defined and documented policies for leadership development, and arranging adequate resources for leadership development. The validity of the questionnaire was established by confirmatory factor analysis. The cronbach alpha reliability score was calculated as 0.917.

• Employee Engagement Scale: A 26 item employee engagement scale developed by Lather and Jain (2015) was used to measure Employee Engagement. The scale had six dimensions of employee engagement, that is, organizational commitment, job satisfaction, advocate, intent to stay, pride and emotional connect.

RESULTS AND DISCUSSIONS

Correlation coefficients were calculated for various factors of Employee Engagement of the overall sample. The results reveal that there is a significant positive correlation between Leadership Development and Job Satisfaction, Organizational Commitment, Advocacy, Pride, Intent to stay and overall employee Engagement (Table 2). It is evident that organisations which follow a culture of leadership development at all levels have more engaged employee. It is also evident that there exists a very strong positive linear correlation between leadership development and job satisfaction. Thus, to increase the level of satisfaction among employees, organisations need to invest in leadership development.

TABLE 2. PEARSON CORRELATION OF LEADERSHIP DEVELOPMENT WITH VARIOUS FACTORS OF EMPLOYEE ENGAGEMENT.

	LD	Sig.
Job Satisfaction	0.950	0.000
Organisational commitment	0.766	0.000
Advocacy	0.716	0.000
Pride	0.636	0.000
Intent to stay	0.670	0.000
Employee Engagement	0.710	0.000

The leadership development score of the respondents was regressed with an employee engagement score using the partial least square method (PLS) in Smart PLS 3 software.

Partial Least Squares is a regression technique that reduces the predictors to a smaller set of uncorrelated components and performs least squares regression on these components, instead of on the original data. PLS regression is especially useful when your predictors are highly collinear, or when you have more predictors than observations and ordinary least-squares regression either produces coefficients with high standard errors or fails completely. Smart PLS software was used to test the model shown below. As the sample size used for the study was small, the researchers were not sure whether the respondent data will be normally distributed. Since Smart PLS is suitable for non-normally distributed data the model testing method was adopted for this study. The model was evaluated through Smart PLS.

The relationship between the constructs are statistically analysed using partial least square path modelling algorithms. Latent variables are used to estimate the path models in PLS Algorithms. The PLS alogorithms does not require normally distributed data.

Partial Least Squares (PLS) model was analyzed to interpret the model. The model estimates the relationship between observed variables and unobserved variables (latent variables). The model was tested through assessment of validity and reliability of the construct measures in the model. This ensured that only reliable and valid constructs' measures were used for assessing the nature of relationships in the overall model (Hulland, 1999).

The quality of the model was assessed by determining the individual item reliability and scale reliability followed by convergent and discriminant validity of constructs. PLS algorithm was applied to the relationships between the leadership development, behavior and employee engagement, coefficients and values of loadings.

In PLS, loadings of the respective factors on their respective latent constructs are examined to assess the reliability of the factors (Hulland, 1999). Since the final model was decided
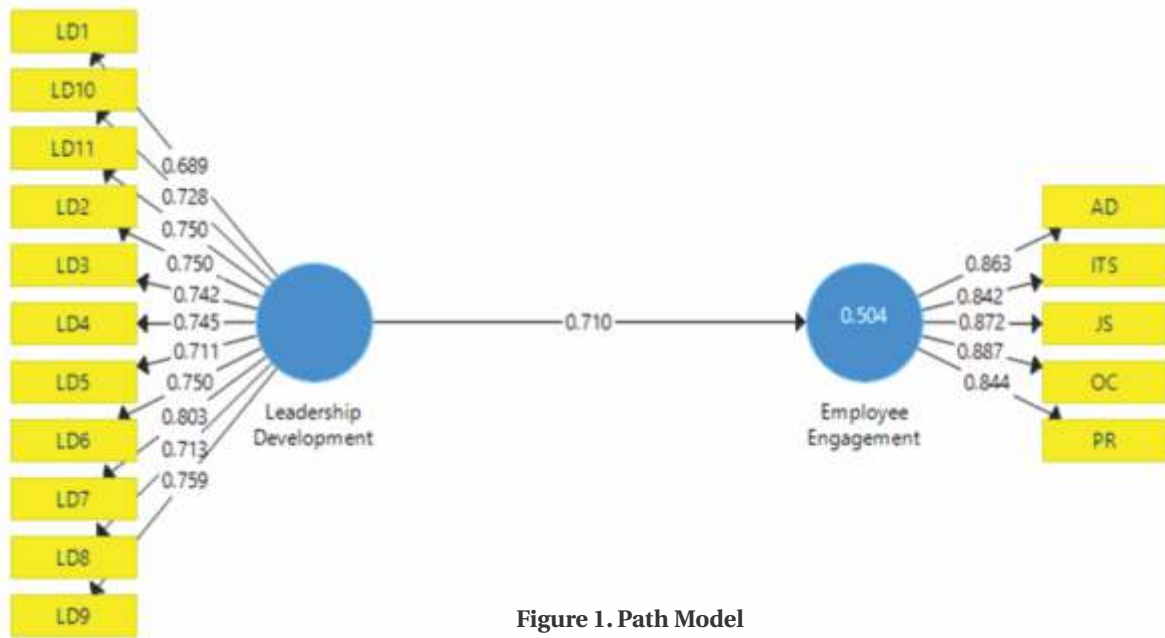
Figure 1. Path Model

after dropping out insignificant factors having factor loadings of less than 0.5, the model was analyzed by using Smart PLS 3.0 software. The loading for Emotional connect was negative, so, it was removed and the final model is displayed below in figure1.

ELIABILITY

In PLS, individual factor reliability was assessed by examining the loadings of the respective factors on their respective latent constructs (Hulland, 1999). A higher shared variance between construct and its measures is implied by higher loadings. In this study the criteria of 0.50 recommended by Hulland (1999) was adopted for the retention of factors.

In addition to Cronbach's (1951) alpha, the reliability of each variable was estimated through Fornell and Larcker's (1981) measure of composite reliability. This measure is adopted over Cronbach's alpha because it attempts to provide a better estimate of variance shared by the respective indicators and because it uses the item loadings obtained within the nomological network (Hair et al., 2006). In this study the composite factor reliability coefficients of the constructs are above 0.90 (see Table 3), which meet the standard of 0.70 as suggested by Fornell and Larcker (1981).

ONVERGENT VALIDITY

Convergent validity refers to the degree of agreement in two or more measures of the same construct (Camines and Zeller, 1979). Evidence of convergent validity was assessed

by inspection of variance extracted for each factor (Fornell and Larcker, 1981). According to Fornell and Larcker (1981), convergent validity is achieved, if the variance-extracted value is greater than 0.50. Results depict that the variance extracted all the variables ranged from 0.689 to 0.887 (Table: 4).

TABLE 4: VARIANCE EXTRACTED FOR EACH VARIABLE OF EMPLOYEE ENGAGEMENT AND LEADERSHIP DEVELOPMENT

	Employee Engagement	Leadership Development
AD	0.863	
ITS	0.842	
JS	0.872	
LD1		0.689
LD10		0.728
LD11		0.750
LD2		0.750
LD3		0.742
LD4		0.745
LD5		0.711
LD6		0.750
LD7		0.803
LD8		0.713
LD9		0.759
OC	0.887	
PR	0.844	

ISCRIMINANT VALIDITY

Discriminate validity is the degree to which any single construct is different from the other constructs in the model (Carmines and Zeller, 1979). Discriminant validity was assessed by the test provided by Fornell and Larcker (1981) in which the

TABLE 3: CRONBACH'S ALPHA, COMPOSITE RELIABILITY AND AVE

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Employee Engagement	0.914	0.922	0.935	0.743
Leadership Development	0.917	0.918	0.930	0.549

TABLE 5: SHOWING THE DISCRIMINANT VALIDITY

	Employee Engagement	Leadership Development
Employee Engagement	0.862	
Leadership Development	0.710	0.741

pairwise correlations between factors obtained were compared with the variance extracted estimates for the constructs making up each possible pair. The Discriminate validity is adequate when constructs have an AVE loading greater than 0.5 meaning that at least 50% of the measurement variance was captured by the construct (Chin, 1998). In addition, discriminate validity is confirmed if the diagonal elements are significantly higher than the off-diagonal values in the corresponding rows and columns. The diagonal elements are the square root of the AVE score for each construct (i.e., Employee Engagement and Leadership development). These values are shown in Table 5. The result revealed that all the constructs possess Discriminant validity.

MODEL EVALUATION

On regressing the leadership development scores with employee engagement, it was evident that leadership development contributes to 50.2% of the variance explained in the employee engagement. This means that managers who invest in developing the leaders at all levels are able to successfully engage the employees in the organisations who in turn can successfully work towards the achievement of goals and objectives of the organisation. (Table 6)

TABLE 6: R SQUARE AND ADJUSTED R SQUARE

	R SQUARE	R SQUARE ADJUSTED
Employee Engagement	0.504	0.502

CONCLUSION

The importance of employee engagement in helping to create resilient organisations that thrive in challenging conditions and are equipped to take advantage of more buoyant circumstances when they present themselves. Todays turbulent business environment calls for bold leadership. The role of managers and leaders continues to be the area of focus. Leadership has always played an important part in building employee engagement, we have observed that their role is even more crucial. The results of the study conclude that organisations which practice leadership is able to engage their employees more in comparison to those who do not follow. It is evident that there is a strong positive relationship between leadership development and employee engagement. Also, the causal model was tested in the paper which represents that leadership development impact employee engagement.

MANAGERIAL IMPLICATIONS

The results of the present study clearly depict that managers can enhance the employee engagement in their organisation by supporting a culture of leadership development at all levels. Organizations shall support individual growth of employees through leadership development practices, every employee must be informed of leadership development programmes in the organization, such sessions should be organized on regular basis. Top management should ensure that continuous leadership development takes place at each level and adequate resources are made available to augment the process. Such activities should be reviewed periodically and should be improved for better results. If organizations practice all this diligently then engagement will never be an issue to them.
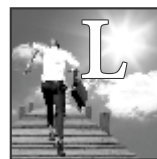
LIMITATIONS OF THE RESEARCH

The study is limited to a sample of 300 employees of Delhi/NCR. The finding of this study, therefore, may not have universal applicability to other organizations. Also, since the study is conducted in India, its applicability is limited to other countries.

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The Level of
Job Satisfaction for Managers and Non-Managers in Haryana Roadways: A Factor Analysis Approach

*Dr. Richa Arora, **Ms. Anjani Gupta

ABSTRACT

Haryana Roadways, a State Government Undertaking, is accountable for providing well-coordinated, cost-effective, safe and competent transport action services to the public of the State. Haryana Roadways is the foremost service provider for passenger transport in the State. It has a fleet of about 4250 buses being operated by 24 depots, each headed by a General Manager, and 13 sub-depots functioning under the depot concerned. This study tries to determine the level of job satisfaction & job performance based on the intrinsic factors and extrinsic factors among employees of Haryana Roadways. The study is based on the empirical investigation of 530 respondents working in Haryana Roadways selected from five districts of Haryana. The study identifies organizational structure effectiveness, working conditions and perks and compensation factors vital in defining job satisfaction level of drivers.

Keywords : *Job Satisfaction, Job Performance, Factor Analysis, Intrinsic Factors, Extrinsic Factors.*

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INTRODUCTION

The overall performance of the organization depends on efficient and effective performance of individual employees of the organization. When an employee feels satisfied with his/her job, he/she is motivated to put in more effort to increase his/her performance. Thus it tends to increase the overall performance of the organization. At its most generic level of conceptualization, job satisfaction is simply how content an individual is with his or her job. At more specific levels of conceptualization used by academic researchers and human resources professionals, job satisfaction has been given various definitions. Affective job satisfaction (Thompson et. al., 2012) is the amount of delightful passionate feelings individuals have about their jobs overall, and is different to cognitive job satisfaction (Moorman, 1993)which is the amount of individuals' satisfaction with certain aspects of their jobs, such as pay, pension arrangements, working hours, and numerous other aspects of their jobs.

Employee satisfaction is understood to be one of the prime requirements of a well-run organization and is considered imperative by all corporate managements. Locke (1970) defined job satisfaction as "a pleasurable or positive emotional state, resulting from the appraisal of one's job experiences." According to Dewhurst et al. (2010) there are other factors to reward employees that not only focus on financial compensation but also include the praise that employees are able to obtain from their managers, the opportunity to take on important projects or tasks, and even management attention. Frederick Herzberg (1987), a behavioral scientist projected a two-factor theory or the motivator-hygiene theory. According to Herzberg, there are certain job features that result in satisfaction while other job features that prevent dissatisfaction. According to Herzberg, the opposite of "Satisfaction" is "No satisfaction" and the opposite of "Dissatisfaction" is "No Dissatisfaction".

ATIONALE OF THE STUDY

Transportation industry in India is very huge and diverse and caters to the needs of billions of folks. Employees of every organization play a vivacious role in its growth and development. There are three major categories of employees that we can consider in any organization: Top level management; they formulate the policies and strategies for an organization, Middle level management; they look after whether these policies and strategies are being executed correctly in the organization. Lower level management consists of those people who work for the accomplishment of the assigned goals and objectives of the organization. Top level management and middle level management get all the comforts as preferred in their jobs. They all are provided with the personal and comfortable working conditions. But the lower level management is the one which is most affected by the culture and climate of the organization; as well as by the physical and behavioral conditions provided to them at their work. There is a lot of dissimilarity in the needs and priorities for job satisfaction of the managers, non-managers and technicians, drivers and conductors. Therefore, in this study we have focused mainly on the top and middle level management, i.e., on the managers and non-managers of Haryana Roadways.

ITERATURE REVIEW

This is known to everyone that transportation industry plays a significant role in the economic, cultural, social and industrial development of the nation. Halder(1967) studied the traffic problems of Calcutta and also evaluated its performance from the year 1964-65 to the year 1972-73. He held the low fleet utilization, higher absenteeism and avoidance of fare factors accountable for lower productivity of Calcutta State Transport Corporation. The public mass transport system is usually considered good for transportation of the poor. But recent studies in the developed countries have proved that it could be equally popular with the rich people. Despite this fact, mass transport is comparatively more essential for the bulk of the people in the developing countries, who have restricted access or no access to a car or personalized vehicle or who cannot afford costly modes.

Khan (1980) presented the broad framework of the transport system network in India and roofed large variety of information on the transport management system. He built a model for comprehensive transport system and transport planning built on the demographic data available and provided the systematic study on the several important areas of the transport management system. The transport sector in India comprises various means of Transport like air, water, road and railways. The rates, fares, low productivity, administration, financing, state regulations are the operating variables for different means of transport. The cheap, efficient and well-coordinated development of the transport system has an effect on the Indian economy (Srivastava, 1987).

Job Satisfaction

Satisfaction at job reflects an individual's emotional response towards the various job facets. A person who is highly satisfied with his job embraces the positive approach towards his job, while the one who has high level of job dissatisfaction embraces the negative approach towards the job. According to Luthans (1985) job satisfaction is influenced by the number of factors; the major ones are pay, the work itself, promotions, supervision, workgroup, and working conditions. When employees are hired, they have a set of needs, wishes and previous experiences which make their job expectations. Job satisfaction of the individual is dependent on the reward program. The main objective of these reward programs is to attract the right kind of people for the organization and to motivate them to work effectively and efficiently to achieve high levels of performance. Although the rewards are provided by the organization, they are evaluated by the individuals. The individual feels the level of satisfaction in accordance to the adequate ability and equitability of the rewards. The rewards can be broadly categorized into: intrinsic rewards and extrinsic rewards. Intrinsic rewards are the part of the job itself

and are experienced directly by the individual. Extrinsic rewards are the rewards external to the job and are provided by the supervisors or the work groups (Gibson, Ivancevih and Donnely, 1991). Stoner and Freeman (1992) referred intrinsic rewards as psychological rewards which are experienced directly by the employees. Pay, promotions, interpersonal relationships, status and fringe benefits are some of the examples for extrinsic rewards. Responsibility, achievement, autonomy, personal growth, challenge, complete work and feedback characteristics of the job are some intrinsic rewards. Saiyaden (1993) defined job satisfaction as the reintegration of affect produced by the individual's perception of fulfillment of his needs in relation to his work and the surrounding.

Performance

Performance very much depends on perception, values and attitudes. There are so many variables influencing the job performance. Performance is defined as a function of individual ability, skill and effort in a given situation (Porter and Lawler, 1974). Job performance is a set of behavior which a person shows in relation to his job. In other words, it is the amount of efficiency gained due to job type (training, producing or servicing). They believe that performance is total expectation of the organization from separate behavior samples of each person during specific period of time (Motowidlo, 2003). It can be defined as the skill of a person in doing his job and tasks. Organizational theorists have divided job performance in two categories: task performance and dispositional performance. Task performance is defined as tasks and responsibilities of each person and related directly to all things that must be done by that person such as monitoring absent or present employee. Proper understanding of this, needs definite standards. The other performance is dispositional which helps organizational and social network to survive (Kwong, 2003). Motowidlo (2003) made differences between task performance and disposition. The first includes parts of formal job and the latter includes behaviors affecting psychological, sociological and organizational aspects. Job performance can be studied by two aspects: job creativity and job role. The performance of the individual is highly relevant for both the organization and the individuals. When the individual shows high performance in accomplishing the tasks assigned to him, it results in satisfaction, self-efficacy and mastery (Bandura, 1997).

ESEARCH OBJECTIVES

Traditionally, human resource was just considered as the means of production, but today human resource is considered to be the most treasured asset for any organization, apart from money and the physical equipment. Human resource possesses the knowledge, skills, attitude, talents, abilities, values and benefits of the individuals working in an organization. The performance of the organization and the subsequent productivity are directly proportional to the quality and quantity of human resources employed. Therefore, building and maintaining effective human resources is major function of human resources

management. In his study, Silva (2006) expounded that studying the attitude of the workers has become important because, by analyzing the reasons that make the employee unhappy in the organization, the company can make appropriate rearrangements to the get to the root of the problem and resolve them. Moreover, varied job tasks, compassionate co-workers and a pleasant working environment have been sensed both as motivational and satisfaction factors (Bjerke, Ind, &Paolli, 2007). People agreed that a pleasant working environment contributes in the foundation of optimistic feelings (Bjerke et. al., 2007).

In this research we have focused on the job satisfaction relating to the performance of Managers and Non-Managers of Haryana Roadways. For the thorough study of the problem we will be determining the impact of the employee job satisfaction on the performance of the employees. This research was apprehended to address this major issue. It targets at identifying the factors determining job satisfaction of the Managers and Non-Managers of Haryana Roadways. It explores the following issues:

1. Which elements affect the job satisfaction of the employees working in Haryana Roadways?

2. Are all the elements of equal relevance for the job satisfaction of the employees working in Haryana Roadways?

3. How job satisfaction can be enhanced in the light of the findings of the research?

ESEARCH METHODOLOGY

The study included both exploratory as well as conclusive phases. Exploratory research was used primarily for back- ground study and questionnaire development, whereas conclusive research dealt with data collection from actual respondents through a structured questionnaire.

Designing of research instrument

Background of the study included exploration into which factors contribute to job satisfaction of the employees working in the organization. Primary data was collected using the questionnaire method; it affords the advantages of speed, cost and versatility. The questionnaire was developed using the review of literature. To avoid any subjectivity bias, questionnaire included the questions and the information based on the various levels of the data measurement. The respondents were instructed to tick an appropriate box for each question. Some close – ended questions were also included. The preliminary survey questionnaire was given independently to three professors from the subject area to obtain feedback regarding the content, layout, wording and ease of understanding the measurement items. They were also asked to offer suggestions for improving the proposed scale and to edit the items if necessary to enhance clarity, readability and content adequacy. In general, the comments were positive with some suggestions which were taken into account while revising the questionnaire. During the next stage, the

questionnaire was administered on a group of 50 respondents. The inputs from this interaction were further used in refinement of the questionnaire. Such interaction also proved to be of great help in finally deciding on the factors to be included in the study.

Sampling and mode of contact

A sample of 280 respondents was used for this study out of which 30 were managers and 250 were Non-Managers. Population for this research was defined as the employees working as drivers in the Haryana Roadways. Multistage Stratified random sampling was used. As a part of multistage sampling Haryana state was selected from the whole of India. Further in Haryana the respondents were selected from five districts namely, Ambala, Hisar, Gurgaon, Charkhidadri and Rohtak to carry out the research. Considering the stratified random sampling, this is a type of Probability sampling technique where the samples are gathered in a process that gives all the individuals in the population equal chances of being selected. In this sampling technique the entire target population is divided into different subgroups, or strata, and then proportionally the sample is selected randomly from the different strata.

ATA ANALYSIS AND EXTRACTION OF FACTORS

Data collected from 280 respondents was subjected to data reduction using exploratory factor analysis (EFA) with the help of statistical package for social sciences (SPSS). This research used principal component analysis. Data was checked and found suitable for factor analysis in terms of vital parameters. Initial un-rotated solution was received and subjected to Varimax rotation for further refinement.

Checking suitability of data for factor analysis

Data set was checked for suitability by examining the output of correlation analysis, variable wise measure of sampling adequacy, KMO test of sampling adequacy and Bartletts test of sphericity. Presence of an underlying structure in the data-set was indicated by significant correlation between many

TABLE 1 - DEMOGRAPHIC PROFILE

Variable	Sub-variable	Percentage (%)
Gender	Male	100
Age	15-25	12.4
	25-35	23.6
	35-45	64.0
	Above 45	11.6
Marital Status	Married	53.4
	Unmarried	46.6
Employment Status	Permanent	100
	Contractual	0
Education Level	Intermediate	13.2
	Graduate	78.5
	Post-Graduate	8.3
Income	15000-30000	4.1
	30000-45000	61.1
	Above 45000	34.8

variables. The observation was corroborated by Anti-image correlation matrix showing adequate variable-wise measure sampling adequacy (diagonal values greater than 0.5). The KMO value is .875 which was higher than the benchmark value of 0.5. These results indicated that it was a fit case for factor analysis.

Examining the initial output

Data was subjected to data reduction using principal component analysis. Initial output was received along with communality values (Annexure A2). All the communality values which were greater than 0.5 data was subsequently subjected to Varimax rotation. Rotation solution explains 90.801% of the variance associated with the problem (Annexure A3) and comprised of five factors (Annexure A4).

Listing and labeling of factors

Exploratory factor analysis condensed 16 statements into a four distinct bunch of statements. Statements within single bunch had something in common as indicated by significantly higher factor loading whereas, statements placed in different bunches were dissimilar to each other in terms of shopper's response. Each bunch represented a factor. For assigning label to each factor, nature and wording of all the statements comprising that factor were examined and considered. The exercise resulted in four distinct names (Table 2).

Factor 1

First factor extracted out of this research explained 33.641% of total variance. It comprised of six factors namely- receiving regular and helpful feedback; supervisor is positive and supportive; supervisor addresses questions and concerns; supervisor keeps well informed about what's going on/ in the organization; receiving appropriate recognition and my efforts at work are appreciated by others. Each of these variables was strongly correlated with the extracted factor 1 as factor management and monitoring to be a potent factor as its average score was 3.80 indicating agreement with statements constituting this factor hence it is labeled as "Management monitoring and recognition". Variable wise average ranges between 3.44 and 4.46. The factor supervisor keeps well informed about what's going on in the organization was considered to be the most significant.

Factor 2

Second factor extracted in this analysis explained 29.230% of the total variance and comprised of five factors of job satisfaction. These were: number of working hours, shift or time of work, nature of work, workload you have and employees have authority to perform their duties effectively. These variables are highly correlated with the extracted factor and the factor loading range between .816 and .913. Each of these factors explained the working conditions of the employees and hence is labeled as "Working conditions" with an average score of 3.41.

Factor 3

TABLE 2- TABULATED FACTOR OUTPUT

Factor No	Factor Title	Variables included	Average	Factor
F1: 33.641	Management monitoring and recognition	Receive regular and helpful feedback	3.80	.816
		Supervisor is positive and supportive		.840
		Supervisor addresses questions and concerns		.854
		Supervisor keeps well informed what's going on in the organization		.913
		Receive appropriate recognition My efforts are appreciated by others		.890
F2: 29.230	Working Conditions	Satisfaction with working hour	3.41	.886
		Satisfaction with shift or time of work		.901
		Satisfaction with nature of work		.904
		Satisfaction with workload you have		.878
		Employees have authority to perform their duties effectively		.826
F3: 18.643	Perks and Compensation	Employees are paid fairly well for the work they do	3.31	.889
		Satisfaction with benefit package pay		.897
		Satisfaction with benefit package promotion		.847
F4: 9.287	Behavior and Logistics	Satisfaction with Physical conditions	3.82	.845
		Satisfaction with behavioral conditions.		.869

Third factor comprising of three factors explained 18.643% of the total variance. Variables comprising this factor were: employees are paid fairly well for the work they do, benefit package pay and benefit package promotion. These variables are highly correlated with the extracted factor and the factor loading range between .847 and .897. Each of these factors explained the monitory and the non-monitory benefits of the employees working in Haryana roadways and hence is labeled as "Perks and compensation" with an average score of 3.31. The factor benefit package pay was considered to be the most significant.

Factor 4

Factor number four comprised of only two variables- physical conditions influencing performance and behavioral conditions influencing performance. These explained 9.287% of the total variance and hence are labeled as "Work Place and People". Factor loading for these two variables were 3.71 and 3.92 respectively. This factor was found to be of great significance with the highest average score of 3.82.

VALIDITY AND RELIABILITY OF FACTOR OUTPUT

TABLE A1 - KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.875
Bartlett's Test of Sphericity Approx. Chi-Square	6.126E3
Df	91
Sig.	.000

Validity and reliability of the factor output was checked statistically. Reliability was established by estimating cronbach's alpha for each of the factors, as given in Table 2. Alpha value for all the above factors was above 0.7 except for one factor which was .623 which can also be accepted

in some cases indicating the output is reliable. Convergent validity for a factor indicates that all variables constituting a single factor are actually coherent, i.e. they share a high proportion of variance in common. Convergent validity was checked with the help of variance extracted (VE).

VE was calculated by adding squared factor loadings for all

TABLE A2 - COMMUNALITIES FOR 16 VARIABLE PROBLEMS

Communalities

	Initial	Extraction
Receive regular and helpful feedback from supervisor	1.000	.834
Supervisor is positive and supportive	1.000	.947
Supervisor addresses questions and concerns	1.000	.930
Supervisor keeps well informed what's going in organization	1.000	.973
Employees paid fairly well for work they do	1.000	.979
Satisfaction with benefit package pay	1.000	.974
satisfaction with benefit package promotions	1.000	.949
Satisfaction with Physical conditions influence performance	1.000	.747
Satisfaction with Behavioral conditions influence performance	1.000	.763
Receive appropriate recognition	1.000	.937
My efforts at work are appreciated by others	1.000	.938
Satisfaction with number of working hours	1.000	.870
Satisfaction with shift or time of work	1.000	.950
Satisfaction with nature of work	1.000	.955
Satisfaction with workload you have	1.000	.890
Employees have authority to perform their duties effectively	1.000	.848

Extraction Method: Principal Component Analysis.

variables constituting a factor and dividing total sum by the number of variables(Table 3). Variance extracted for all four factors was greater than 0.5.Discriminant validity establishes that the factors extracted are truly distinct from each other. It was established by observing factor loading for each variable under all factors. Final factor output showed absence of any cross loading as there was only significant factor loading per variable.

CONCLUSION AND RECOMMENDATIONS

Organizations grow eventually and tend to epitomize a complex network of institutional, material and manpower resources. Since organizations are set up and managed by people, the subject of Human resource development espouses greater significance as the data analysis reveals that job satisfaction is a vital determinant of organizational

TABLE A3 - TOTAL VARIANCE EXPLAINED FOR THE GIVEN PROBLEM
TOTAL VARIANCE EXPLAINED

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative%	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	9.940	62.125	62.125	9.940	62.125	62.125	5.383	33.641	33.641
2	1.844	11.526	73.651	1.844	11.526	73.651	4.677	29.230	62.871
3	1.482	9.262	82.913	1.482	9.262	82.913	2.983	18.643	81.514
4	1.262	7.887	90.801	1.262	7.887	90.801	1.486	9.287	90.801
5	.517	3.228	94.029						
6	.352	2.198	96.227						
7	.294	1.839	98.066						
8	.071	.446	98.512						
9	.067	.419	98.931						
10	.050	.310	99.242						
11	.039	.244	99.242						
12	.031	.191	99.676						
13	.025	.158	99.834						
14	.016	.103	99.937						
15	.010	.063	100.000						
16	1.84 E-15	1.15 E-14	100.000						

Extraction Method: Principal Component Analysis.

TABLE A4 - ROTATED COMPONENT MATRIX FOR 16 VARIABLE PROBLEM
ROTATED COMPONENT MATRIX[a]

	Component			
	1	2	3	4
Receive regular and helpful feedback from supervisor	.816	.311	.264	-.039
Supervisor is positive and supportive	.840	.335	.356	-.053
Supervisor addresses questions and concerns	.854	.313	.310	-.077
Supervisor keeps wellin for med whats going in organization	.913	.306	.212	-.006
Employees paid fairly well for work they do	.340	.267	.889	-.002
Satisfaction with benefit package pay	.323	.254	.897	-.012
Satisfaction with benefit package promotions	.400	.266	.847	.021
Physical condition influence performance	-.075	-.164	-.006	.845
Satisfaction with behavioral conditions influence performance	.001	.090	-.004	.869
Receive appropriate recognition	.890	.290	.236	-.019
My efforts at work are appreciated by others	.891	.288	.242	-.016
Satisfaction with number of working hours	.280	.886	.236	-.033
Satisfaction with shift or time of work	.293	.901	.231	-.039
Satisfaction with nature of work	.291	.904	.225	-.042
Satisfaction with workload you have	.302	.878	.164	-.012
Employees have authority to perform their duties effectively	.370	.826	.171	-.025

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

[a.] Rotation converged in 5 iterations.

TABLE 3 - CRONBACH ALPHA'S VALUE AND VARIANCE EXTRACTED BY EACH FACTOR

S. No.	Factor no and label	Cronbach's alpha	Variance
1.	F1 Management monitoring and recognition	.958	.733
2.	F2 Working conditions	.932	.753
3.	F3 Perks and compensation	.953	.751
4.	F4 Behavior and logistics	.602	.705
Value of Cronbach's alpha for all variables		.921	

performance. Among the factors of job satisfaction, physical working conditions (comprehensive of hygiene factors and behavioral factors) are very important . How do organizations develop strategies and practices to assist positive organizational climate and restrain the behavioral implications of various groups of personnel, relates to existing and potential yardsticks of performance. Further how organizations measure the level of job satisfaction and the level of employee's performance determine futuristic action plans for optimum manpower planning and deployment of non-managerial staff. A higher average score allocated to behavior and logistics specify the higher preference of the employees working in Haryana Roadways. This fetches the fact that the physical and behavioral factors in the environment of

the workplace have both the positive and the negative effects on the productivity, self-esteem, employee loyalty, comfort level, etc. Convenient working conditions at the workplace help to increase the productivity and the quality of results. Inconvenient working conditions may lead to the lower performance of the employees and also results in high turnover and absenteeism among the employees. The subsequent factor in the list of higher preference of the employees working in Haryana Roadways is management monitoring and recognition followed by the working conditions. For a body like transport, there should be a well- formulated and well-planned strategy envisioned to create a happy, favorable working environment. Such a change will not only subsidize the increment of quality service but also the profit margin. This proves that there is a higher linkage between quality service-quality customers, quality work place and quality of life for the employees and of course attractive profits to the organization.

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Intellectual Property Rights versus Tax Incentives

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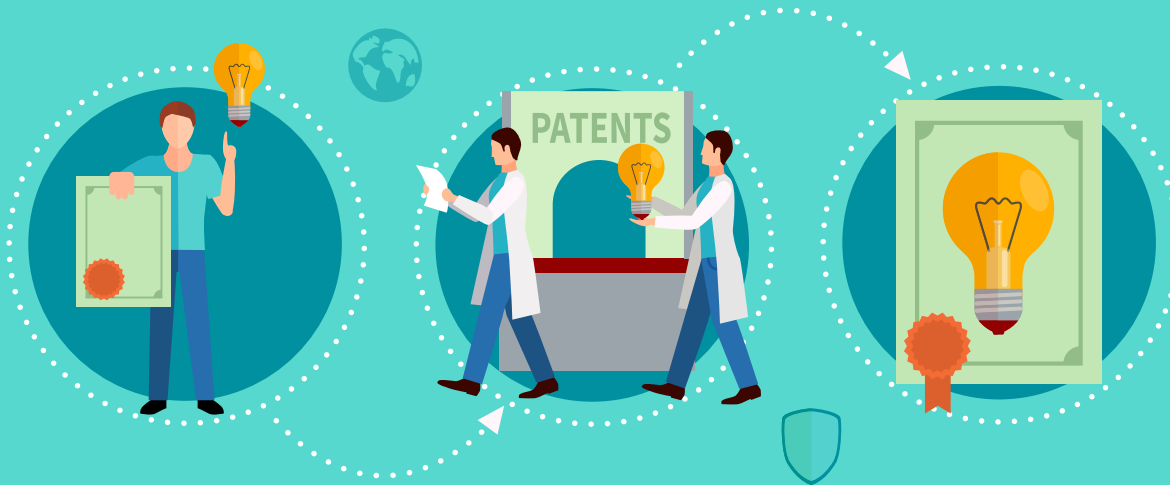
ABSTRACT

This study addresses the alternate problems associated with intellectual property: freeriding and monopoly. With respect to the "anticommons" problems associated with monopoly rights it examines the proposal of Boldrin and Levine (2008, 2015) for the extinguishment of all such intellectual property rights. In this study, a theoretical model of intellectual property production has been presented as a framework for discussion, in which the specific claims of Boldrin and Levine are considered, along with a proposal for the extinguishment of intellectual property rights accompanied by a self-funded system of value added taxes and intellectual property tax credits. Finally, it identifies the conditions under which such a system could encourage the production of intellectual property as well as the conditions under which no such tax incentives are required.

INTRODUCTION

As Boldrin and Levine (2008, 2015) and others have pointed out, creation and innovation builds on existing creations and innovation, so that intellectual property rights, which were originally created in order to encourage innovation, may now be having the opposite effect, and may in fact be discouraging downstream improvements to that innovation.

As Murray and Stern (2007) and others point out, there is an alarming "anticommons" trend, which is especially evident in the biotechnology sector, whereby the privatization of intellectual property threatens to deprive researchers of access to information and technologies necessary for the conduct of meaningful research. Among the examples provided in those studies are the patenting of genes and even the patenting of genetically modified laboratory mice.

The dilemma of course is now, and has always been, how to provide a means for innovators to recoup their research and development costs without restricting access to that technology by others who may be in a position to make incremental improvements to that technology. Clearly, the primary purpose of existing intellectual property rights law is to allow the recoupment of such research and development costs. However, the adversarial nature of patent and copyright litigation and the incentive towards frivolous patent and copyright claims threatens to undermine the production of such property.

Already, by the time of the Thurow (1997) and Heller and Eisenberg (1998) studies, there was a growing consensus that the present regime of intellectual property law in the United States was badly broken. Even if it were not badly broken, the political climate for the elimination of international protection for intellectual property under the TRIPS provisions of the World Trade Organization was all but irreversible, so that the end of intellectual property rights was all but assured. It is worthy to mention that the TRIPS agreement, which came into effect from January 1995, offers protections for copyrights, trademarks, industrial designs and patents among other items.

ARKET DISTORTIONS WITH AND WITHOUT INTELLECTUAL PROPERTY RIGHTS.

So as to avoid any one-sided analysis of the problem of intellectual property, we now present the two sides of the problem: the market distortions which exist without protection of intellectual property (hereinafter referred to as the free rider problem), and the market distortions created by exclusive patents and copyrights (hereinafter referred to as the monopoly problem).

Intellectual property by its very nature is a public good. This is due to the fact that although creators may have ownership rights over their creation, they are intended for public use. For example, millions of viewers may enjoy a show on television, but the creators of that show are entitled to copyright protection.

Without some form of protection for intellectual property, downstream producers would receive a windfall and would be at a competitive advantage in comparison to the creator, since they would be able to make full use of the created technology without being encumbered with the burden of its production cost. While Boldrin and Levine (2008, 2015) and others present, argument minimizing this problem, they nevertheless fail to extinguish it entirely. The bulk of their argument is that there is often a first mover advantage which accrues to the creator of intellectual property. They provide examples of first mover advantages involving short-lived intellectual property, such as software; and while first mover status seems to be advantageous with regard to such property, such first mover status would seem to be far less advantageous with longer lived intellectual property such as pharmaceutical drug formulas. We will provide a theoretical model to address this question and to investigate the degree to which the proposed first mover advantage would be necessary in order to sustain the production of intellectual property.

The second problem of course is the monopoly problem. It is easy to claim, on the basis of equity, that the creator of intellectual property should be allowed to exercise ownership rights over his own work product. Thus we have the creation of property rights over such work product. By definition, property rights are exclusive rights. Of course, it was never expected that the granting of such exclusive rights would lead to the kinds of problems enumerated above. In the Coase (1960) study of private ownership of intellectual property, it was proposed that private property rights would be perfectly compatible with universal access to property by non-owners. Under the reasoning of Coase, such access could still be made available by simple contractual arrangement, accompanied by a reasonable access fee. And thus it was expected that we could extend the reasoning of Coase to include intellectual property, and that we might grant such monopoly rights to the creators of intellectual property and still expect to maintain universal access to a common pool of scientific and technological knowledge. Hardin (1968) carried that logic one step further in his classic study of the "Tragedy of the Commons," which provides the basis for the argument that such a pool of common knowledge would not even exist, without the incentives created by exclusive property rights.

Of course Bessen and Meurer (2009), Depoorter and Vanneste (2006), Heller (1998), Heller and Eisenberg (1998), Paul (2000, 2001, 2003), and Lerner (2009) all provide documented evidence of the distortions and disincentives created by the current system of monopoly rights over intellectual property. Those studies document how the current system of intellectual property rights has led to excessive secrecy, litigation and to the frivolous and preemptive patenting of undeveloped technology and how it has operated to deny information and technology to others who might otherwise be able to make incremental improvements to that technology. Thus, those studies have documented how the granting of monopoly rights over intellectual property has stifled innovation.

ROPOSED MODEL

In order to put all of these arguments into a proper context, we next present a theoretical model to investigate the conditions under which potential intellectual property producers would have the incentive to act as a producer rather than as a free rider, even in the absence of intellectual property monopoly rights.

In this model, we propose a system of value added tax and tax credits. Let k be the cost of production of intellectual property; let c be immediate tax credit, expressed as a percentage of the production cost of intellectual property. Let q be the profitability index, or the ratio of the discounted value of incremental after tax revenues to intellectual property production costs k, where REV is revenue , T is the rate of corporate income tax, and r is the discount rate. Thus:

$$q = \frac{1}{k} \sum_{t=1}^{\infty} \frac{\Delta REV_t(1-T)}{(1+r)^t} \qquad (1)$$

We use the lower case q in order to draw an analogy with Tobin's Q.

Next, we let v be the rate of value added tax, and let be the free rider compensation factor. Both of which may assume values between zero and one. We assume that for each intellectual property producer there are n potential free rider firms ready to free ride on the production of that intellectual property.

We next construct a hypothetical system of value added taxes and tax credits which would satisfy three criteria. The first criterion, which we label incentive compatibility, is the requirement that the expected net present value from intellectual property production should be greater than or equal to the expected net present value from freeriding. The second criterion, which we refer to as the compensation constraint, is the requirement that the system should compensate the intellectual property producer for any value added taxes so as not to diminish the net present value of the typical intellectual property project. Finally, we have the budgetary constraint in which value added taxes collected by the taxing authority must be sufficient to fund the front-end tax credits of the intellectual property producer.

Incentive compatibility $-k + ck + qk(1 - v) \qquad qk(1 - v)$ (2)

Compensation constraint $ck \quad qkv$ (3)

Budgetary constraint $ck \quad qkv + n \quad qkv$ (4)

Assuming that there are n potential free rider firms for each INTELLECTUAL PROPERTY producer, those constraints can be restated in terms of the credit percentage c:

Incentive compatibility $c \quad 1 - q(1 -)(1 - v)$ (5)

Compensation requirement $c \quad qv$ (6)

Budgetary constraint $c \quad qv + n \quad qv$ (7)

The Boldrin-Levine Condition

To put the arguments of Boldrin and Levine (2008, 2015) in proper context, we next investigate the conditions under

$$\lambda \le \frac{q(1-v)-1}{q(1-v)} \qquad (8)$$

which no front-end credits are required in order to provide the incentives for the production of intellectual property.

We call this the Boldrin Levine condition. Under this condition, the firm will always choose to become a producer of intellectual property, rather than a freeloader, even if no front-end tax credits are provided. Thus, the theoretical arguments of Boldrin and Levine can be reduced to a simple factual assertion. Letting q = 3 and v = 0, we see that the firm will choose intellectual property production over freeloading so long as the payoff from freeloading is less that 67 percent of the payoff from intellectual property production. Further, we can see that higher values of the profitability index further raises the threshold which must be met before the firm chooses freeloading over intellectual property production. Is this Boldrin Levine condition met in a significant subset of opportunities? Clearly, the answer is yes. But, does it hold globally? Clearly, the answer is no.

Additional incentives provided by front end credits

Of course, we can raise the threshold required in order for the firm to choose freeloading over intellectual property production by introducing a self-funded system of front end tax credits, funded by a value added tax.

$$\lambda < \frac{c + q(1-v) - 1}{q(1-v)} \qquad (9)$$

Thus, we can increase the likelihood that the firm will choose intellectual property production over free riding by introducing a front-end tax credit; and where * is the critical level of free rider compensation, we can demonstrate that:

$$\frac{\partial \lambda^*}{\partial c} = \frac{1}{q(1-v)} > 0 \qquad (13)$$

$$\frac{\partial \lambda^*}{\partial v} = \frac{c-1}{q(1-v)^2} < 0 \qquad (10)$$

$$\frac{\partial}{\partial c} \frac{\partial \lambda^*}{\partial v} = \frac{1}{q(1-v)^2} > 0 \qquad (11)$$

ISCUSSION

We acknowledge the problems which currently exist in our system of intellectual property rights and have demonstrated that it is possible to achieve the desired levels of intellectual property production without such monopoly rights.

We propose a system of front end tax credits, funded by a value added tax. Such a system of tax incentives would allow the

producers of intellectual property to fully recoup the cost of their creations, while still allowing downstream innovators full access to existing technology. Further, such a system of statutory tax incentives would solve the dilemma of either confining all research and development to the public sector or of asking the state to pick winners and losers.

Such a system would be self-funded. With a system of value added taxes and credits in place, the net cost of the system would be zero. It would be relatively easy to administer such a system of taxes and credits, since it would utilize the right of offset, rather than outright grants.

Such a statutory framework would not place the taxing authority in the position of picking winners and losers, since the same taxes and credits would be applied to all intellectual property producers. Thus, it would relieve the state of the responsibility of determining which innovations are worthy of protection, as well as relieve the state of the responsibility of determining the appropriate scope of the patent protection to be granted. Cockburn et al. (2002) challenges the competence of patent examiners, and Merges and Nelson (1994) addresses the problem of determining the scope of the patent protection. With the proposed system in place, those questions become moot.

Finally, this system of taxes and credits would improve the competitive position of the United States vis a vis its

TABLE I R AND D TAX SUBSIDIES OF OECD NATIONS

Country	Credit	Deduct	Rate	Other	Subsidy
Australia	45%				45%
Brazil		160%	34%		54%
Canada	35%				35%
China		150%	25%		38%
Croatia		250%	20%		50%
China		150%	25%		38%
Czech		200%	19%		38%
France	30%				30%
Germany				*	*
Hungary		200%	19%		38%
India		200%	30%		60%
Ireland	25%				25%
Israel				60%	60%
Italy	50%				50%
Japan	12%				12%
Lithuania		300%	15%		45%
Malaysia	50%				50%
Mexico				*	*
Netherlands				*	*
Poland	50%				50%
Russia		150%	20%		30%
S. Africa		150%	25%		38%
S. Korea	50%				50%
Spain	25%				25%
Turkey		100%	20%		20%
U. K.		225%	24%		54%
U. S. A.		100%	35%		35%
Average					40%

Deduct represents the percentage deductible from taxable income. Rate represents the top marginal tax bracket for that country. *Germany, Mexico and Netherlands have special subsidy arrangements. Source Deloitte (2014)

international trading partners. Imports of copycat films, pharmaceuticals, or other technology would be subject to the full value added tax, without any offsetting credit for research and development costs.

Such a system may already be in effect in other OECD (Organization of Economic Cooperation and Development) countries. Some of these countries offer the type of front end tax credits we have discussed, while others utilize a system of super deductions from taxable income in order to achieve that level of subsidy. On average, these countries offer subsidies of approximately 40 percent of cost for research (R) and development (D) of the type which is capable of producing intellectual property.

From this table, it would appear that the U. S. has tax incentives for the production of intellectual property which are comparable to those of our trading partners. However, there are substantial roadblocks in the way of firms enjoying the full 35 percent subsidy for the production of intellectual property under the U. S. tax system. Fogelberg and Griffith demonstrate that a significant portion of the research and development in the pharmaceutical industry is accomplished by small start-up firms, with the intention that they will later be purchased, merged or consolidated with the major pharma firms. Unfortunately, these small start-up firms have no way of utilizing their net operating loss deductions or intellectual property credits, since they have not yet introduced their products to the market. Further, we know that there are substantial limitations under the Internal Revenue Code and Treasury Regulations for the offsetting of these net operating loss carryforwards and credit carryforwards against the subsequent taxable income of the acquiring firm. (We here cite Internal Revenue Code sections 269, 382, and the separate return limitation year, or SRLY rules of Treasury Regulation 1.1502-21.)

For this reason, it may be appropriate to increase the credit rate as compensation for the delay and potential loss of benefit. Conceivably, the rate of credit could even exceed 100 percent. Alternatively, those credits could be made refundable, in which case they would not be limited to the amount of federal income tax which would otherwise be due.

Continuation of property rights for trademarks and brand names

This analysis comes with two caveats. The first caveat has to do with trademarks. Trademarks and brand names provide a necessary means for producers to develop reputations for quality and fair dealing; and the acquisition and preservation of reputation provides the incentive structure underlying most repeated game models. This is explained in Fudenberg and Tirole (1991), and Fundenberg and Levine (1998). Without property rights, protection for trademarks and brand names, producers would be operating under the condition of anonymity; high quality producers may be unable to distinguish themselves from low quality producers and the result could be the kind of market breakdown described in the Akerlof (1970) "market for lemons," or in the Fogelberg and Krishnamoorthy (2014) "market for tomatoes," the latter study

being a study of the sale of perishable goods with random observation.

HE PROBLEM OF SECRECY

The second caveat to this study has to do with secrecy. The present proposal offers no solution to the problem of secrecy, or of the withholding of valuable information which might otherwise be of benefit to other innovators. In fact, the extinguishment of intellectual property rights might even exacerbate the problem of secrecy. This scenario is quite likely, and even probable, due to the fact that creators of goods and services that might be beneficial to the public at large would be much more reluctant to share their innovations with the public if they do not receive some protection for its creation.

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Comparative Credit Risk Assessment Structures in Indian Banking Industry

Dr. Sandeepa Kaur

ABSTRACT

Bankruptcy is a state of insolvency wherein the company or the person is not able to repay the creditors the debt amount. The purpose of this research is to develop and compare the performance of bankruptcy prediction models using multiple discriminant analysis, logistic regression and neural network for listed companies in India. These bankruptcy prediction models were tested, over the three years prior to bankruptcy using financial ratios. The sample consists of 72 bankrupt and 72 non-bankrupt companies over the period 1991-2016. The results indicate that as compared to multiple discriminant analysis and logistic regression, neural network has the highest classification accuracy for all the three years prior to bankruptcy.

Keywords: Bankruptcy prediction, Multiple discriminant analysis, Logistic regression, Neural network

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INTRODUCTION

The Indian Insolvency and Bankruptcy Code 2016 describes Bankruptcy as "a legal status usually imposed by court, on a firm or an individual who is unable to meet his debt obligations. Upon successful completion of the bankruptcy proceedings, the debtor is relieved of the debt obligations incurred prior to filing for bankruptcy."[1] However, the Insolvency is described in the code as "a situation where individuals or organizations are unable to meet their financial obligations."[2] This code has created an institutional mechanism and insolvency resolution process for business operated by companies, individual or any other entities, either by coming up with a viable survival mechanism or by ensuring their prompt liquidation.

Bankruptcy is defined as the inability of the company to continue its current operations due to high debt obligations (Pongsatat et.al., 2004). Typically, bankruptcy occurs "when either (i) the firm's operating cash flow is insufficient to meet current obligations which means, the inability to service its debts or (ii) when the firm's net worth is negative that means, the value of the assets is less than the value of its external liabilities" (Knox et. al., 2008).

Bankruptcy is a position where a company is not capable of repaying its liabilities. There can be numerous other reasons for bankruptcy of a company such as assets falling short of liabilities, scarcity of cash, inefficient management or even declining trend in sales. Predicting bankruptcy turns out to be very crucial in taking preventive measures regarding liquidity, solvency and profitability position of the company. Predicting bankruptcy involves collecting relevant financial information of the firm, place it in a credible model to verify and predict the future bankruptcy to take required precautions well in advance.

Bankruptcy prediction is among the most well researched topics in the finance and strategic management literature (Polemis & Gounopoulos, 2012). The early researchers (Ramser & Foster, 1931; Fitzpatrick, 1932; Winakor & smith, 1935) focused on the comparison of the values of financial ratios in bankrupt and non-bankrupt companies and concluded that the ratios of the bankrupt companies were poor (Ugurlu & Aksoy, 2006). Altman (1968) used multivariate discriminant analysis for prediction of corporate bankruptcy. In the 1970s, multiple discriminant analysis was the primary method for prediction of corporate bankruptcy. During the 1980s, use of logistic regression analysis method was emphasized, (Virag & Kristof, 2005). However, Ohlson (1980) applied logistic regression analysis for the first time for prediction of bankruptcy. In recent years, a number of researchers have begun to apply the neural network approach to the prediction of bankruptcy as they have produced promising results in prediction of bankruptcy (Ugurlu & Aksoy, 2006). Odom and Sharda (1990) were first to use Neural networks for bankruptcy prediction.

The objective of this study is to develop a bankruptcy prediction model by taking data of Indian listed companies using multiple discriminant analysis, logistic regression and neural network and compare the performance of the three models.

LITERATURE REVIEW

Vasantha, Dhanraj & Thiayalnayaki (2013) studied selected Indian airline companies. The sample of the study consisted of Kingfisher airlines, Spice Jet airways and Jet airways. Authors also studied financial and operational performance of these companies. The financial soundness of these airline companies was evaluated using Altman's original Z score, Revised Z score model and revised four models. The study also compared the above-mentioned models to suggest strategies for making the right moves.

Muthukumar & Sekar (2014) used Altman Z score and Springate models to study the financial health of automobile sector in India. The study was conducted for the period of 2003 to 2012, to check how the global financial crisis affected the automobile sector, which indicates the economic growth of the country. The authors took scores of all companies to calculate an average to create a benchmark for comparison. It has been concluded that none of the companies are in a distressed state.

There have been various methods developed and used across the industries. Some of the more common methods are the Altman Z score and the Merton's distance to default model. Each model has its own limitations and financial institutions are always on the look-out for finding the best method to evaluate credit worthiness.

There have been many related studies in the past which assessed the efficiency of the prediction models. Attempts to find out the best prediction model have been umpteen but none of them have been very successful. Moreover, most of these studies have been on a global scale and concentrate more on firms that are huge multinationals. The purpose of our research is to study the suitability of major bankruptcy prediction models by applying them to companies in the Indian manufacturing sector that have been declared sick and by doing so find out which models are more suitable for firms in this sector.

Most studies conducted in the past, lacked validity and were deficient in a number of ways. A review of statistical and theoretic prediction models was presented by Scott (1981), but it was very limited in coverage and can be considered out of date in the current context. Zavgren (1983) describes only the statistical models without any mention of the theoretical models. The first ever study was by Altman (1984), which was done taking ten countries and is an interesting study but limits itself to only one type of statistical model. However, Jones (1987) tried to give a comprehensive view of all the prediction models and focused on research done in the corporate

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[1] https://www.quora.com/What-is-the-difference-between-insolvency-bankruptcy-and-liquidation.
[2] http://finmin.nic.in/reports/BLRCReportVol1_04112015.pdf.

bankruptcy prediction area, but did not discuss theoretical methods or models.

Zhang et. al., (1999), tries to understand the role of neural networks to predict bankruptcy. They have also discussed the empirical applications of the networks for predicting bankruptcy but have left out all other types of models that are generally used by various firms.

From the review of various studies, it can be concluded that the business failure research can be categorized into following three broad statistical techniques:

1. Accounting Based Bankruptcy Predicting Model

2. Market Based Bankruptcy Predicting Model

3. Artificial Intelligence Based Bankruptcy Predicting Model

The above three techniques have been frequently applied in numerous studies for predicting bankruptcy. A review of these studies is presented in detail as follows.

Accounting Based Bankruptcy Predicting Model

This takes into consideration firm's previous performance as a base for predicting its future likelihood of survival (Xu and Zhang, 2008). Several studies that include accounting variables for corporate bankruptcy prediction are Beaver (1966), Altman (1968), Ohlson (1980), Dichev (1998), Shumway (2001) etc.

Market Based Bankruptcy Predicting Model

This model uses the information derived from the market, i.e., market prices. Since such information is inherently forward looking, market based approach depicts a firm's future performance considering market variables (Xu and Zhang, 2008). In the literature, this new methodology that uses market based variables for bankruptcy prediction usually follows Black and Sholes (1973) and Merton (1974) option pricing theory that expresses probability of bankruptcy occurring, this in turn depends on the volatility between the market value of the assets and the strike price (value of debt obligations). The critical level where firm will default is that when the worth of the firm's assets moves down below a certain level (i.e., debt obligations). However, these theories provide no incremental information when the market is in semi-strong form (Hillegeist et. al., 2004). Several recent studies that have used market-based variables for predicting default probability of a firm include Crosbie and Bohn (2002), Brockman and Turtle (2003), Vassalou and Xing (2004), and Reisz and Perlich (2007).

Hillegeist et.al., (2004), compare the market based approach (i.e., Black Sholes and Merton) with some accounting based approaches (i.e., MDA and Logit) and conclude that the market-based approach provides significantly more information about the default probability of a firm vis-a-vis accounting-based approach. Contrary to Hillegeist, a study conducted by Reisz and Perlich (2007) examine default probability of 5,784 industrial firms by employing both market and accounting based approaches. This study provides that

the accounting-based measures outperform Black-Sholes-Merton measure and recommends them for achieving an optimal default prediction.

Artificial Intelligence Based Bankruptcy Predicting Model

The technological advancement in informatics has evolved artificial intelligence techniques/methods that provided researchers to employ computer databases to estimate failure prediction (Charitou et.al., 2004). Artificial Intelligence (AI) methods that include decision tree, fuzzy set theory, genetic algorithm, support vector machine, data envelopment analysis, case-based reasoning, rough sets theory, and various types of neural networks such as PNN (Probabilistic Neural Networks), BPNN (Back Propagation Trained Neural Network), SOM (Self-Organizing Map), Cascor (Cascade Correlation Neural Network), and many more (see, for more on this, Min and Jeong, 2008).

Artificial intelligence technique has been applied in various countries such as Iran, Greece etc. Etemadi et.al., (2008) and has employed both MDA and Genetic Programming (GP) techniques for forecasting the default probability in Iranian firms. The study notes GP with a high accuracy of default prediction for Iranian firms. Moreover, Zanakisand Zopounidis (1997) employs a case study technique to distinguish between the financial variables of acquired and non-acquired Greek firms. The mixed results were found because of using similar financial ratios profiles between acquired and non-acquired firms. Furthermore, researchers have used different artificial intelligence techniques and propose alternative bankruptcy prediction model. Min and Jeong (2009) suggest a new binary classification technique for forecasting the default probability of firm by validating its prediction power through empirical analysis. Jo and Han (1996) employ both the discriminant technique and two artificial intelligence models (i.e, case-based forecasting and neural network) and suggest integrated approach for attaining high classification accuracy in predicting default characteristics of firms.

All the above three broadly categorized approaches (proposed by different researches) have essential advantages and limitations as well. Therefore, lacking standardized theory has led studies to employ different techniques according to their unique structure of corporate environment and country (Etemadi et.al., 2009).

Numerous researchers have compared the performance of different models of bankruptcy prediction. However, not much research has been conducted using the data of Indian companies.

Charitou, Neophytou and Charalambous (2004) developed bankruptcy prediction models for UK industrial firms using Neural Networks and Logistic Regression models. The results indicated that the neural network model achieved the highest overall classification rates for all three years prior to insolvency. Virang and Kristof (2005) conducted a comparative study of bankruptcy prediction models on the database of

Hungarian companies. They provided that bankruptcy models built using neural networks have higher classification accuracy than models based on MDA and logistic regression.

However, in case of some other studies the results were unsettled. Altman, Marco and Varetto (1994) applied neural network and MDA to large database of 1000 Italian firms for one year prior to their bankruptcy. The comparison yielded no decisive winner. Thus, based on international experience a comparative study is necessary to identify whether international trends can be applied to Indian firms' bankruptcy prediction as well.

METHODOLOGY AND DATA

The Sample and Variable Definition

For the present study, the bankrupt company is considered to be a company that is delisted from the stock market. The company that is delisted from Bombay Stock Exchange or National Stock Exchange and whose latest net worth and the net worth prior to the year of delisting is negative. And for the bankrupt companies, the year of bankruptcy will be the year in which its net worth became negative. For example: if a company is delisted in the year 2002 because its net worth has become negative in the year 1995, then the year 1995 has been considered as the year of bankruptcy. Financial institutions delisted companies merged with other companies and companies for which at least three years' full financial statements prior to the year of bankruptcy were not available are excluded from this research.

From 1991 with the start of economic liberalization in India, major structural changes took place in the Indian economy. Thus, the period considered for this study spans from 1991 to 2016. Application of the above stated definition of bankruptcy in this duration resulted in a sample of 72 companies as bankrupt. Similar to Altman's (1968) study's procedure, a twin company was chosen up that did not bankrupt from the same industry and approximately matched for asset size prior to the year of bankruptcy. This process has also been applied in majority of previous bankruptcy prediction studies. In order to develop bankruptcy models the companies are matched or made pairs so as to isolate key factors which distinguish otherwise similar firms (Morris, 1997). Thus, the total sample consists of 138 companies.

The bankrupt and non-bankrupt companies are randomly split to create distinct analysis and holdout samples. The analysis sample contains 50 bankrupt and 50 non-bankrupt companies and the holdout sample contains 22 bankrupt and 22 non-bankrupt companies.

Predictor Variable Selection

Similar to the previous studies that have used financial accounting ratios in their empirical studies of bankruptcy prediction, this study also employs financial ratios for development of bankruptcy prediction models. Previous studies revealed many significant predictions of bankruptcy

TABLE 1: EMPLOYED FINANCIAL RATIOS

Category	Variable Name	Variable Definition
Operating Cash Flow	CF/TA	Cash Flow from Operations/Total Assets
	CF/CL	Cash Flow from Operations/Current Liability and Provisions
	CF/SF	Cash Flow from Operations/ Shareholder's Fund
	CF/SALE	Cash Flow from Operations/Sales
	CF/TL	Cash Flow from Operations/Total Liabilities
Leverage	RE/TA	Retained Earnings/Total Assets
	SF/TA	Shareholder's Fund/Total Assets
	SF/TD	Shareholder's Fund/ Total Debt
	SF/TL	Shareholder's Fund/ Total Liability
	TL/TA	Total Liabilities/ Total Assets
Profitability	WC/TA	Working Capital/ Total Assets
	EBIT/TA	Earnings before Interest and Tax/ Total Assets
	EBIT/CL	Earnings before Interest and Tax/ Current Liabilities
	EBIT/FA	Earnings before Interest and Tax/ Fixed Assets
	EBIT/SF	Earnings before Interest and Tax/ Shareholder's Fund
	EBIT/TL	Earnings before Interest and Tax/ Total Liabilities
	NI/SALE	Net Income/ Sales
	NI/SF	Net Income/ Shareholder's Fund
Liquidity	CA/TA	Current Assets / Total Assets
	CA/CL	Current Assets / Current Liabilities
	CL/TA	Current Liabilities and Provisions/ Total Assets
	CL/SF	Current Liabilities and Provisions/ Shareholder's Fund
	CL/TL	Current Liabilities and Provisions/ Total Liabilities
	QA/TA	Quick Assets/ Total Assets
	QA/CL	Quick Assets/ Current Liabilities and Provisions
Activity	CA/SALE	Current Assets/ Sales
	INV/SALE	Inventory/ Sales
	SF/SALE	Shareholder's Fund/ Sales
	QA/SALE	Quick Assets/ Sales
	SALE/CA	Sales/ Current Assets
	SALE/TA	Sales/ Total Assets
	SALE/FA	Sales/ Fixed Assets
Market	MV/TD	Market Value of Equity/ Total Debt
	MV/SF	Market Value of Equity/ Shareholder's Fund

that can be used for developing bankruptcy prediction models for Indian companies. So this study employs 35 financial ratios, which were proved to be successful in prior studies.

Table I shows the list of ratios considered in research. This study uses financial data from the Prowess database of Centre for Management Studies, Jamia Millia Islamia University. The data sample consists of financial ratios of company's one year (Year-1), two year (Year-2) and three year (Year-3) prior to the year in which they became bankrupt. In case of non-bankrupt company, data for the same year has been considered as is considered for its matched bankrupt company.

DATA ANALYTICAL TOOLS AND TECHNIQUES

Discriminant Model

Discriminant analysis is used to classify objects/records into two or more groups based on the knowledge of some variables related to them. Discriminant function analysis or Discriminant Analysis is used to classify cases into the values of a categorical dependent, usually a dichotomy. If discriminant function analysis is effective for a set of data, the classification table of correct and incorrect estimates will yield a high percentage. Multiple discriminant analysis (MDA) is an extension of discriminant analysis and an extension of multiple analysis of variance (MANOVA), sharing many of the same assumptions and tests. MDA is used to classify a categorical dependent, which has more than two categories, using as predictors several interval or dummy independent variables. The Discriminant analysis equation is defined as-

$$Y = a + k_1 x_1 + k_2 x_2 + ... + k_n x_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Eq. 1)}$$

Where Y is dependent variable; a is a constant; x_1, x_2, ... x_n are independent variables; k_1, k_2, ... k_n are coefficients of the independent variables.

This model is used to classify or make predictions in problems where the dependent variable appears in qualitative form e.g., male or female, bankrupt or non-bankrupt etc. It represents the best way of classifying observations into one of several defined groupings – frequently known as priori groups. These groups are dependent upon the observation's individual characteristics. In this research, when classifying companies, the financial ratios are to be put into the discriminant function making up the liner combination. By comparing the discriminant values that separate bankrupt and non-bankrupt companies, one can determine which group a certain company is falling into.

Logistic Regression

It is a specialized form of regression that is formulated to predict and explain a binary (two-group) categorical variable rather than a metric-dependent measurement (Ong et.al., 2011). Logistic regression utilizes the coefficients of the independent variables to predict the probability of occurrence of a dichotomous dependent variable (Dielman, 1996). In the context of bankruptcy prediction, this technique weighs the financial ratios and creates a score for each company in order to be classified as bankrupt or non-bankrupt. The function in logistic regression is called the logistic function and can be written as follows:

$$p_i = 1 / (1 + e^{-zi}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Eq. 2)}$$

Where

p_i = the probability of the ith case experiences of the event of interest

z_i = the value of the unobserved continuous variable for the ith case.

Neural Network

Neural networks are inspired by neurobiological systems. Robert Hecht-Nielsen, inventor of one of the earliest neurocomputers, defines a neural network as a computing system made up of several simple, highly interconnected processing elements that process information by their dynamic state responses to external inputs (Caudill, 1989). It is a function of predictors (also called inputs or independent variables) that minimizes the prediction error of target variables (also called outputs). An artificial neural network is layered; each of these layers has several neurons that are connected to other neurons belonging to the preceding and following layer (Bredart, 2014).

EMPIRICAL RESULTS

In order to identify any difference between bankrupt and non-bankrupt companies descriptive statistics are calculated based on financial ratios one year prior to bankruptcy. Table 2 presents a summary of the descriptive statistics.

Discriminant Analysis

In order to develop the discriminant analysis in this study a stepwise selection technique was employed. The stepwise process involves introducing the ratios into the discriminant function one at a time based on their discriminating power. The bankruptcy prediction models are presented below:

Year-1:

$$Z = 4.999 \text{xSF/TA} + 0.963 \text{xEBIT/FA} + 0.731 \text{xSALE/T} - .271 ....\text{(Eq.3)}$$

Year -2:

$$Z = 5.057 \text{xEBIT/TL} + 1.053 \text{xSALE/TA} - 1.743 \ldots\ldots\ldots\ldots.\text{(Eq. 4)}$$

Year -3:

$$Z = -0.246 \text{xCL/SF} + 3.862 \text{xEBIT/TL} + 0.882 \text{x SALE/TA} - 1.196 \ldots\ldots\ldots\text{(Eq.5)}$$

In the above function the cut-off point is 0. The cut-off point indicates that the company with Z score greater than 0 are predicted as non-bankrupt and the company with Z score less than 0 are predicted as bankrupt. The Model performance is evaluated using the overall accuracy rate. Overall accuracy is based on the total number of correct classifications.

TABLE 1: EMPLOYED FINANCIAL RATIOS

	Non-Bankrupt		Bankrupt		Total		F	Sig.
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation		
RE/TA	0.150	0.199	-0.100	0.341	0.025	0.305	28.885	0.000**
SF/TA	0.367	0.152	0.212	0.144	0.289	0.167	39.549	0.000**
SF/TD	1.998	3.553	0.485	0.445	1.241	2.635	12.847	0.000**
SF/TL	0.876	1.090	0.343	0.310	0.610	0.842	15.925	0.000**
TL/TA	0.575	0.165	0.730	0.146	0.653	0.174	35.468	0.000**
CF/TA	0.091	0.080	0.042	0.088	0.066	0.087	12.405	0.001**
CF/CL	0.527	0.547	0.167	0.894	0.347	0.760	8.478	0.004**
CF/SF	0.283	0.288	0.343	1.741	0.313	1.244	0.083	0.773
CF/SALE	0.105	0.142	-0.002	0.312	0.052	0.248	6.936	0.009**
CF/TL	0.156	0.201	0.060	0.129	0.108	0.175	11.712	0.001**
AR/CF	3.433	22.810	-1.269	16.730	1.082	20.072	1.990	0.161
CA/TA	0.440	0.163	0.348	0.210	0.394	0.193	8.492	0.004**
CA/CL	2.441	1.365	2.461	3.199	2.451	2.451	0.002	0.961
CL/TA	0.233	0.153	0.196	0.128	0.215	0.142	2.409	0.123
CL/SF	0.846	1.077	2.170	3.481	1.508	2.652	9.512	0.002**
CL/TL	0.443	0.350	0.270	0.166	0.356	0.286	14.320	0.000**
QA/TA	0.234	0.122	0.204	0.162	0.219	0.143	1.586	0.210
QA/CL	1.254	0.753	1.355	1.609	1.304	1.253	0.234	0.629
WC/TA	0.207	0.154	0.152	0.184	0.180	0.171	3.730	0.055
EBIT/TA	0.106	0.060	-0.012	0.176	0.047	0.144	28.946	0.000**
EBIT/CL	0.611	0.539	-0.032	1.195	0.290	0.978	17.299	0.000**
EBIT/FA	0.356	0.327	-0.006	0.429	0.175	0.421	32.291	0.000**
EBIT/SF	0.334	0.242	-0.270	2.000	0.032	1.451	6.470	0.012*
EBIT/TL	0.199	0.129	-0.007	0.219	0.096	0.207	47.231	0.000**
NI/SALE	0.029	0.138	-0.567	2.494	-0.269	1.785	4.101	0.045*
NI/SF	0.099	0.186	-1.415	2.899	-0.658	2.184	19.557	0.000**
CA/SALE	0.659	1.470	0.667	0.431	0.663	1.079	0.002	0.967
INV/SALE	0.399	1.426	0.281	0.254	0.340	1.022	0.478	0.490
SF/SALE	0.515	0.600	0.629	0.914	0.572	0.773	0.786	0.377
QA/SALE	0.260	0.194	0.385	0.331	0.323	0.278	7.712	0.006**
SALE/CA	3.047	2.319	1.907	1.266	2.477	1.947	13.399	0.000**
SALE/TA	1.256	0.880	0.607	0.479	0.931	0.777	30.187	0.000**
SALE/FA	4.177	3.886	2.048	2.388	3.113	3.387	15.687	0.000**
MV/TD	2.042	3.122	0.345	0.400	1.194	2.375	20.943	0.000**
MV/SF	1.311	1.979	1.396	1.863	1.354	1.916	0.071	0.791

*5% significant level   ** 1% significant level

The results obtained by using multi discriminant analysis on the holdout sample are presented in Table 3 above. In one year prior to bankruptcy that is Year-1, observed non-bankrupt cases are 14 banks which were predicted as non-bankrupt but 7 banks that were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, the 7 were predicted as non-bankrupt which further observed as non-bankrupt and 16 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage is 70.45.

However, in Year-2, observed non-bankrupt are 13 banks which were predicted as non-bankrupt banks but 10 which were wrongly predicted as bankrupt, turned out to be non-

TABLE 3: CLASSIFICATION RESULTS – MULTIPLE DISCRIMINANT ANALYSIS

			Predicted		
			Non-Bankrupt	Bankrupt	Correct Percent
Year -1	Observed	Non-Bankrupt	14	7	68.18
		Bankrupt	7	16	72.73
	Overall Percent Correct				70.45
Year-2	Observed	Non-Bankrupt	13	10	59.09
		Bankrupt	8	13	63.64
	Overall Percent Correct				61.36
Year-3	Observed	Non-Bankrupt	14	7	68.18
		Bankrupt	11	12	54.55
	Overall Percent Correct				61.36

bankrupt. Whereas, the 8 were predicted as non-bankrupt which further observed as non bankrupt and 13 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out in two years prior to bankruptcy is 61.36.

The situation in three year prior to bankruptcy that is Year-3 shows that the observed non-bankrupt cases are 14 banks, which were predicted as non-bankrupt but 7 banks which were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 11 were predicted as non-bankrupt which further were observed as non bankrupt and 12 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out to be 61.36 in two years prior to bankruptcy.

It has been observed that the accuracy rate shows a declining trend from 70.45 % one year prior to bankruptcy to 61.36 % for years two and three prior to bankruptcy.

4.2 Logistic Regression

Stepwise logistic regression analysis is used to develop models for predicting corporate bankruptcy. The bankruptcy prediction models have been presented in the form of equations below:

Year-1:

$Z = -6.578 \times SF/TA – 7.716 \times EBIT/TL -1.643 \times SALE/TA + 4.081$ …….(Eq. 6)

Year-2:

$Z = -9.039 \times EBIT/TL - 1.065 \times SALE/CA + 3.661$ ………….(Eq. 7)

Year-3:

$Z = 25.181 \times EBIT/TA – 19.847 \times EBIT/TL – 1.178 \times SALE/TA + 1.189$ …(Eq. 8)

The Z score obtained from the model can be transformed into a probability using the logistic transformation $P = 1/(1+e^{-z})$. The cut-off value is 0.5. It means that if the estimated probability calculated as above is greater than 0.5, the company would be predicted as bankrupt.

The results obtained by using logistic regression on the holdout sample are presented in Table 4. In one year prior to bankruptcy by applying Logistic regression is shown as Year-1, which observed non-bankrupt cases as 16 banks which were predicted as non-bankrupt but 6 banks were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 5 were predicted as non-bankrupt which further observed as non bankrupt and 17 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage is 75.00.

However, in Year-2, observed non-bankrupt are 13 banks which were predicted as non-bankrupt banks but 9 which were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 9 were predicted as non-bankrupt which further observed as non bankrupt and 13 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out to be 59.09 in two years prior to bankruptcy.

The situation in three year prior to bankruptcy that is Year-3 shows that the observed non-bankrupt cases are 14 banks, which were predicted as non-bankrupt but 8 banks were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 9 cases were predicted as non-bankrupt which further observed as non bankrupt and 13 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out to be 61.36 in two years prior to bankruptcy.

The results indicate that the accuracy rate fall from 75.00% one year prior to bankruptcy to 59.09% two years prior to bankruptcy. For the third year prior to bankruptcy the accuracy rate slightly increases to 61.36%.

Neural Network

To develop the neural network bankruptcy prediction model, the sample of 72 bankrupt and 72 non-bankrupt companies is portioned into training, testing and holdout samples. The training sample comprises the data records used to train the neural network. 40 bankrupt and 40 non-bankrupt companies were assigned to the training sample in order to obtain a model. The testing sample is an independent set of data records used to track errors during training in order to prevent overtraining. 10 bankrupted and 10 non-bankrupted companies were assigned to the testing sample. The holdout sample is another independent data set used to access the final neural network. Remaining 22 bankrupted and 22 non-bankrupted companies were assigned to the holdout sample.

The results so obtained by applying neural networks on the holdout sample are presented in the table above.

TABLE 4: CLASSIFICATION RESULTS – LOGISTIC REGRESSION

			Predicted		
			Non-Bankrupt	Bankrupt	Correct Percent
Year -1	Observed	Non-Bankrupt	16	6	72.73
		Bankrupt	5	17	77.27
	Overall Percent Correct				75.00
Year-2	Observed	Non-Bankrupt	13	9	59.09
		Bankrupt	9	13	59.09
	Overall Percent Correct				59.09
Year-3	Observed	Non-Bankrupt	14	8	63.64
		Bankrupt	9	13	59.09
	Overall Percent Correct				61.36

TABLE 5: CLASSIFICATION RESULTS – NEURAL NETWORK

			Predicted		
			Non-Bankrupt	Bankrupt	Correct Percent
Year -1	Observed	Non-Bankrupt	20	2	90.91
		Bankrupt	8	14	63.64
	Overall Percent Correct				77.27
Year-2	Observed	Non-Bankrupt	13	9	68.18
		Bankrupt	9	13	59.09
	Overall Percent Correct				63.64
Year-3	Observed	Non-Bankrupt	14	8	81.82
		Bankrupt	9	13	50.00
	Overall Percent Correct				65.91

However, in Year-2, observed non-bankrupt are 13 banks but 9 which were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 9 were predicted as non-bankrupt which further observed that 13 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out to be 63.64 in two years prior to bankruptcy..

The situation in three year prior to bankruptcy that is Year-3 shows that the observed non-bankrupt cases are 14 banks, which were predicted that 8 banks were wrongly predicted as bankrupt, turned out to be non-bankrupt. Whereas, 9 cases were predicted as non-bankrupt which further observed as non bankrupt and 13 were predicted correctly as bankrupt. Thus, the overall correct prediction percentage turned out to be 65.91 in two years prior to bankruptcy.

It has been observed that the model's accuracy rate falls from 77.27% one year prior to bankruptcy. However, the rate fell down to 63.64% two years prior to bankruptcy and then rises to 65.91% for the third year to bankruptcy.

Comparison of Results

This section compares the results of the three different methods used in this research and that is shown in the table below.

These results presented in table above indicate that neural network achieved the highest overall classification accuracy for all the three years prior to bankruptcy. Multiple discriminant analysis and logistic regression produce comparable results. This is so because neural networks have highly interconnected processing elements which process information by their dynamic state responses to external inputs.

TABLE 6: COMPARATIVE RESULTS OF THE BANKRUPTCY TECHNIQUES TESTED

	Multiple Discriminant Analysis	Logistic Regression	Neural Network
Overall Percent Correct			
Year-1	70.45	75.00	77.27
Year-2	61.36	59.09	63.64
Year-3	61.36	61.36	65.91

CONCLUSION

In this study the companies that were delisted from Bombay Stock Exchange or National Stock Exchange and who's latest net worth and the net worth prior to the year of delisting is negative were taken. And for the bankrupt companies the year of bankruptcy was the year in which its net worth became negative. Financial institutions delisted companies merged with other companies and companies for whom at least three years full financial statements prior to the year of bankruptcy were not available are excluded from this research.

Due to major structural changes that took place in the Indian economy from 1991, the study period considered is from 1991 to 2016. With the application of bankruptcy as mentioned above in this duration, 72 companies resulted in a sample as bankrupt. Similar to Altman's (1968) study's procedure, a twin company was chosen up that was not bankrupt from the same industry and approximately matched for asset size prior to the year of bankruptcy. This process has also been applied in majority of previous bankruptcy prediction studies. In order to develop bankruptcy models the companies are matched or made pairs so as to isolate key factors which distinguish

otherwise similar firms (Morris, 1997). Thus, the total sample consisted of 138 companies.

The bankrupt and non-bankrupt companies are randomly divided to create distinct analysis and holdout samples. The analysis sample contains 50 bankrupt and 50 non-bankrupt companies and the holdout sample contains 22 bankrupt and 22 non-bankrupt companies.

This research attempts to develop and compare the performance of bankruptcy prediction models using multiple discriminant analysis, logistic regression and neural network for Indian listed companies. The dataset consists of 72 matched pairs of bankrupt and non-bankrupt companies. The bankrupt companies had failed between the periods of 1991 and 2016. Accuracy rates for one, two and three years prior to

bankruptcy for neural network are 77.27, 63.64 and 65.91 percent respectively, and for logistic regression the values are 75.00, 59.09 and 61.36 percent. However, the accuracy rates for the multiple discriminant analysis are 70.45, 61.36 and 61.36 percent.

The results have shown that compared to multiple discriminant analysis and logistic regression, the neural network has the highest prediction accuracy for all the three years prior to bankruptcy. This is so because neural networks have highly interconnected processing elements which process information by their dynamic state responses to external inputs. Thus being so, it is suggested that neural network modeling should be used as successful bankruptcy predictor in case of Indian companies.

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- *Dr. S. K. Pandey, Assistant Professor, Indian Institute of Management, Rohtak, India.*
- *Dr. S.K. Tuteja, Former Professor, Faculty of Management Studies, University of Delhi, India*
- *Dr. Suneel Maheshwari, Professor of Accounting, Indiana University of Pennsylvania, USA.*
- *Dr. S. S. Agarwal, Director, KIIT College, Gurugram, India*
- *Dr. T.N. Kapoor, Ex Vice Chancellor, Panjab University, Chandigarh, India.*
- *Prof. Tanuja Agarwala, Professor, FMS, Delhi University, India*
- *Dr. Uday Tate, Professor of Marketing, Marshall University, USA.*
- *Dr. Vasudha Bhatnagar, Professor, Dept. of Computer Science, University of Delhi, India.*
- *Dr. Vibha Jain, Associate Professor, Janaki Devi Memorial College, University of Delhi, India.*
- *Dr. Vibhakar Shrimali, Professor & Dean, G. B. Pant Engineering College, Okhla, India*
- *Dr. Vinod K Gupta, Professor, Human Resource Department, Management Development Institute, India*
- *Dr. Vikas Nath, Director, BVIMR, India*

We would like to have many more academicians and professionals in our team in our efforts to maintain the quality and content of the journal. Hopefully, you might like to be one of them. If so, please mail your details to us.

DELHI INSTITUTE OF ADVANCED STUDIES

VISION

We strive to provide a dynamic learning environment for imparting holistic education that inculcates professional excellence, induces competitive spirit, instils leadership quality to carve a niche in the changing global scenario

THE INSTITUTE

DELHI INSTITUTE OF ADVANCED STUDIES is 'A' grade NAAC accredited Institution, affiliated to G.G.S. Indraprastha University. Established by Shri Laxman Das Sachdeva Memorial Educational Society, the Institute is providing dynamic learning environment that is changing in response to changing needs of society. At DIAS, pursuit of Excellence is a way of life. The guiding philosophy behind all the academic activities of the Institute is to inculcate professionalism in management and to enhance the effectiveness of organization. The Institute seeks professional excellence through ethics, passion and perseverance.

Shri S.K. Sachdeva, a well- known name in the educational world, is the Chairman of the Institute. Dr. S. N. Maheshwari, former Principal of Hindu College, Delhi University is its Professor Emeritus & Academic Advisor while Dr. N. Malati is its Director.

The Institute runs the following programmes affiliated with Guru Gobind Singh Indraprastha University.

Programme	Duration	No. of Seats
MBA (Full Time)	2 Years	120
MCA (Full Time)	3 Years	60
BBA (Full Time)	3 Years	60
B.Com.(H) (Full Time)	3 Years	60

The success of a professional educational Institution is evaluated and judged both on its academic performance and the placement of its students. DIAS has been successful on both these fronts.

ACADEMIC PERFORMANCE
The students of DIAS have excelled in the University by securing top positions in MBA and MCA programmes and have been conferred 23 Gold Medals. The following students of DIAS were awarded Gold Medals at Annual University Convocation for standing 1st at the University Final Examinations:

MBA: Ms. Pratibha Manchanda (Batch 2000-2002), Ms. Manpreet Kaur (Batch 2001-2003), Ms. Silky Mahajan (Batch 2002-2004), Ms. Kavita Sharma (Batch 2003-2005), Mr. Rahul Gupta (Batch 2004-2006), Ms. Priyanka Rastogi (Batch 2008- 2010), Ms. Ruchika (Batch 2009-2011), Ms. Swati Jain (Batch 2012-2014), Ms. Niti Chopra (2013-2015)

MCA: Ms. Lovelina Massand (Batch 1999-2002, Mr. Pratham Kailash (Batch 2002-2005), Ms. Neha Garg (Batch 2003-2006), Ms. Neha Chaudhary (Batch 2004-2007), Ms. Shruti Gupta (Batch 2005-2008), Ms. Kanchan Agarwal (Batch 2007-2010), Ms. Richa Gupta (Batch 2008-2011), Ms. Sandhya Soman (Batch 2009-2012), Ms. Sakshi Tyagi (Batch 2010-2013)

PLACEMENT
DIAS provides excellent placement opportunities for its students in prestigious organizations. Some of the companies where our students have been placed include: Tata Consulantacy Services, IBM, Nucleus Software Ltd. , Accenture, Intersolutions, American Express , Standard Chartered, ICICI Prudential, Infosys, Adobe , Hughes, Thomas Cook, MAspar, Quark, Syntel, BEC Foods, Grapecity, NIIT, Safenet , Indus Valley Partners, Capital IQ, Federal Bank, Ernst & Young, Pepsico, Ameriprise Financials, Axis Bank, Newgen software and many.

MISSION

DIAS believes in learning to excel and excelling to serve. The aim of the Institute is to develop a unique culture that seeks to scale heights of glory through ethics, passion and perseverance. The guiding philosophy of the Institute is to enhance team spirit, integrity and commitment to serve the cause of humanity.

DELHI INSTITUTE OF ADVANCED STUDIES

(NAAC Accredited 'A' Grade Institution)

(An ISO 9001:2008 certified Institution, AICTE Approved and Affiliated to G.G.S. Indraprastha University, Delhi)
Plot No. – 6, Sector – 25, Rohini, Delhi – 110085, Tel: 27932742, 27934400, 27934011, Fax: 27934200

DIAS maintains a FACULTY DATA BANK for its future requirements as per the following details:

I. QUALIFICATIONS & EXPERIENCE

MBA PROGRAMME

1. Assistant Professor:
(MBA)

First Class or equivalent in Masters Degree in Business Administration or equivalent and two years relevant experience is desirable.

2. Associate Professor:
(All Programmes)

(I) Qualifications as above i.e. for the post of Assistant Professor, as applicable and PhD or equivalent, in appropriate discipline.
(II) Post PhD publications and guiding PhD students is highly desirable.
(III) Min. 5 yrs experience in teaching/research/industry of which at least 2 yrs post PhD is desirable.

3. Professor
(All Programmes)

(I) Qualifications as above i.e. for the post of Associate Professor, as applicable.
(II) Post PhD publications, guiding PhD students, demonstrating leadership in planning and o r g a n i z i n g academic, research, industrial and/or professional activities, and capacity to undertake/lead sponsored R&D consultancy and related activities are highly desirable.
(III) Min. 10 yrs experience in teaching/ research/industry of which at least 5 yrs should be at the level of Associate Professor

Or

Min. 13 yrs experience in teaching/ research/industry.
In case of Research experience, good academic record and books/research paper p u b l i c a t i o n s / I P R / patents record shall be required as deemed fit by the expert members in Selection Committee.

In case of Industry experience, the same should be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books, research paper publications/IPR/ patents, etc. as deemed fit by the expert members in Selection Committee.

BBA/B.COM (H) PROGRAMMES

1. Assistant Professor:l
(BBA/B.Com (H))

(I) Good Academic record with at least 55% marks or equivalent grade at Master's degree level in the relevant subject from Indian University or from Foreign University.
(II) Passing of NET/SLET/SET.

2. Associate Professor:
(All Programmes)

(I) Eminent scholar with Ph.D qualification(s) in the concerned /allied/relevant discipline with high quality published work. Minimum of 10 publications as books and/or research / policy.
(II) Min. 10 yrs of teaching experience in university/ college / research at the University/ National level Institutions/Industries, including guiding Ph.D students.
(III) Contribution to educational innovation, design of new curricula and courses, and technology – mediated teaching learning process.
(IV) A minimum score as stipulated in the Academic performance indicator (API) as per the UGC 2010 Regulations.

OR

An outstanding professional, with established reputation in the relevant field with significant contributions in the concerned/allied/relevant discipline, to be substantiated by credentials.

RESEARCH ASSISTANT

1. Research Assistant

First class or equivalent in Master's Degree in Management or allied subjects from an Indian University or from a Foreign University. Flair for research is highly desirable.

LIBRARIAN

1. Librarian

B.Lib/M.Lib degree(s) preferably with 2 yrs. of working experience in a computerized Library & well versed in English language.

II. EMOLUMENTS

Designation	Pay Scale	Other Admissible Allowances
Assistant Professor	Rs.15,600-39,100 AGP 6,000	Other allowances and benefits as per norms
Associate Professor	Rs.37,400-67,000 AGP 9,000	
Professor	Rs.37,400-67,000 AGP 10,000 (Minimum Basic Rs.43,000)	
Research Assistant/Librarian	As per Norms	

III OTHER REQUIREMENTS

- Candidates who have cleared NET or having Industry experience will be preferred for the position of Assistant Professor in MBA.
- Recently retired persons with Phds may also apply.
- Application has to be in the prescribed form. Applications not in the prescribed form or having incomplete details are likely to be rejected.
- Duly filled in application form can either be submitted online or in person at the Institute's address mentioned above.
- Command over English Language and Computer Skill is essential.

DELHI INSTITUTE OF ADVANCED STUDIES

(NAAC Accredited 'A' Grade Institute, Approved by AICTE and Affiliated to G.G.S. Indraprastha University, Delhi)
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