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ISSN 0972-9658

Rs. 250/- (Single Copy)

DIAS Technology Review

The International Journal for Business & IT

Vol. 12 No. 1 #23 www.dias.ac.in

APRIL 2015 – SEPTEMBER 2015

ARTICLES

Consumer Responses to Brand Image and Purchase Intention.....Pg. 8

DELHI INSTITUTE OF ADVANCED STUDIES

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DIAS Technology Review

The International Journal for Business & IT

Listed In

10th Edition of

CABELL'S DIRECTORY, U.S.A.

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SOCIAL SCIENCE RESEARCH NETWORK

Accessible at : www.ssrn.com

STATEMENT ABOUT OWNERSHIP AND OTHER PARTICULARS OF THE JOURNAL

Printed, Published and Edited by Shri Sanjay Sachdeva, on behalf of Delhi Institute of Advanced Studies, Plot No.6, Sector-25, Rohini, Delhi-110085 and Printed at Swan Press , B-71, Naraina Industrial Area, Phase-II, New Delhi-110028.

The Editorial Board invites original, unpublished contributions in the form of Articles, Case Studies, Research Papers, Book-Reviews and Doctoral Abstracts.

DIAS Technology Review

The International Journal for Business & IT

Editorial Board

A BI-ANNUAL JOURNAL OF DELHI INSTITUTE OF ADVANCED STUDIES

Plot No.6, Sector 25, Rohini, Delhi 110 085, India,
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DIAS Technology Review

The International Journal for Business & IT

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ARTICLES

CASE STUDY

DOCTORAL ABSTRACT

From The Editor's Desk

"Go Green" the buzzword in marketing arena, is catching the attention of agile consumers of modern times. Their sensitivity towards environmental degradation has affected their purchase intentions, and has twirled organizations also towards "green advertising". This catchphrase "green advertising" suggests products and production processes that consume less energy, recycle materials and minimize waste or pollution. The author in present paper **"Consumer Responses to Brand Image and Purchase Intention: The Moderating Role of Green and Non Green Appeals in Advertising"** has examined issues encompassing "green appeal" and "non-green appeal" in advertising and their influence on 'brand image' and 'intention to purchase' of customers.

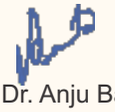
Contemporary marketing survives on physical and virtual network of supply chain management systems, acclimatizing the changing needs of consumers as well as the members of the supply chain. In the research study **"An Analysis of Retail Supply Chains: Time Based Simulation in Neural Networks and Maximum Flow Networks",** the concept of supply chain management has been scrutinized with the approach of network flows applying maximum flow network algorithm of graph theory. The changing count of the supply chain players and its supplying capabilities has been assessed for variability using MATLAB simulation tool.

An organization's website is the mirror reflecting its various facets to the market but is always prone to cyber-attacks. Generally, alphanumeric passwords are used for authenticating users in computer systems, but an attacker makes his way to fiddle with the critical data stored on the database server of the website. Structured Query Language Injection Attack (SQLIA) is one of the most critical cyber-attack on traditional text-based authentication. The authors in research paper **"Prevention of SQL Injection Attacks Using Colour Passwords"** have proposed a secured mechanism of colour code graphical passwords under 'Colour Matrix Map' encryption algorithm. Similarly workplace ethics and spirituality that whittle employees psychological wellness resulting into enhanced efficiency, is also an issue to be contemplated by the organizational practitioners. The authors in the article **"Workplace Spirituality, Organizational Politics and Employee Wellness: A Research Agenda"** have digged out various literature streams to postulate different dimensions and attributes to establish a pragmatic theory on spirituality in management sciences.

In an era of corporate politics where established political parties having gigantic funds and media gimmicks eulogize their stature; a barely three years old party, the Aam Aadmi Party has made a historic win in Delhi Assembly elections 2015. Even after its serious debacle in General Elections 2014, it bounced back with a landslide victory in re-election of Delhi Assembly which made it an exciting case to be studied. The author of the case **"The Phoenix Rises from its Ashes: A Case Study of Aam Aadmi Party"** has scrutinized the amalgamation of applied management theories along with the usage of latest technologies working behind the magnificent success of the party.

In our endeavor of accumulation and proliferation of knowledge in different areas of business and IT, we are incorporating a Doctoral Abstract of research **"Enhanced Data Models For Geographic Information Systems"** along with the latest research studies of distinguished scholars. We are hopeful that the present edition of this journal with all its illuminating features will come up to the expectations of our revered readers.

Regards,



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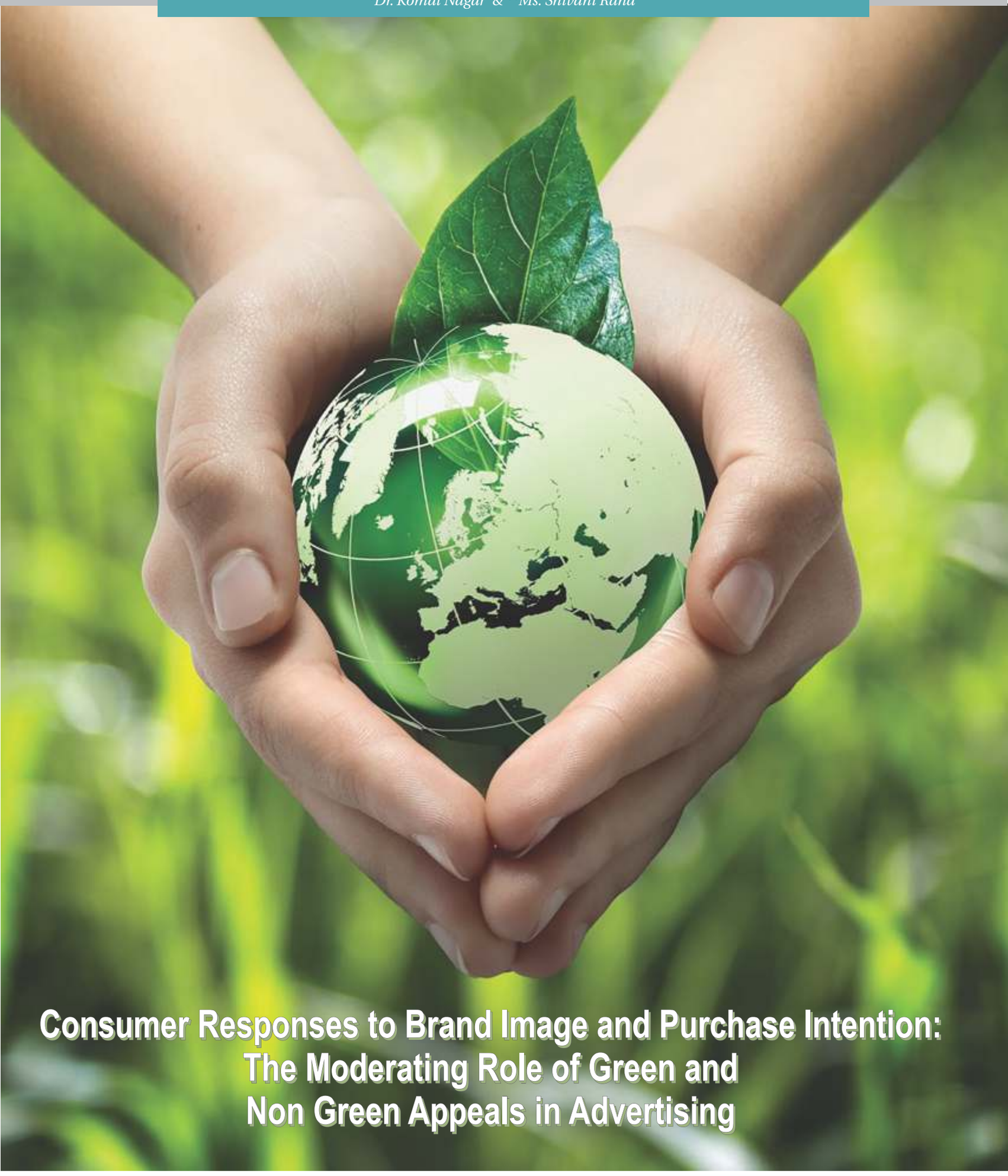

Consumer Responses to Brand Image and Purchase Intention: The Moderating Role of Green and Non Green Appeals in Advertising

ABSTRACT

The concept of green advertising has assumed many synonyms, each suggesting products and production processes that consume less energy, recycle materials and reduce waste or pollution. The present paper examines issues in understanding the role played by green and non-green advertising on brand Image and Intention to purchase. The research examined the relationship between attitude towards the ad and brand image and purchase intention with the moderating effect of type of ads in the context of stationary product. Hypotheses developed on the basis of literature were developed and tested in two different experiments. One group considered a "green" appeal which emphasized the environmental attributes of the product. Another group considered the "non green" appeal for the same product category. We measured each group's attitude toward the ad and brand image. Results from a survey of 150 consumers suggest that type of ad significantly moderates the positive relation between attitude toward the ad and brand image but does not moderate the relation between ad attitude and purchase intention.

Keywords: *Green Advertising, Attitude toward Advertising, Brand Image, Intention to Purchase, Moderation.*

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INTRODUCTION

Over several decades, the issue of environmental preservation has been on top of the agenda at both the national and international levels (MSEA, 2005). At the organizational level, the past two decades have witnessed an explosion of commercial and organizational research activities related to sustainability and green initiatives (Bonini and Oppenheim, 2008). The organizations undertaking the responsibility of positively impacting the environment are ensuring effective communication of green brand features to their top most stakeholders- the consumers. The fact that more and more consumers want to support companies that incorporate sustainability efforts into their product and service offerings (Polonsky, 1994) reflects that green marketing, which not only promotes the environmental benefits of products, but also company's sustainability initiatives, is growing in popularity.

Green marketing, a vital constituent of the holistic marketing concept, is based on the assumption that customers will view a product or service as environment friendly and then implement buying choices accordingly. Charter et al. (2002) put the concept into more sustainable context by strongly linking Green marketing to achieving sustainability through generating and delivering sustainable solutions while continuously satisfying the needs of consumers and other stakeholders. Similarly, Peattie and Charter (2003) define Green marketing as "the holistic management process responsible for identifying, anticipating and satisfying the needs of customers and society, in a profitable and sustainable way".

The "going-green" trend has now extended to the Asian region (Lee, 2008), including India. In India, companies are serious about building environmental sustainability into their business practices. Many people believe that green marketing is a way to promote or advertise a specific product using environmental terms, including a wider range of organizational activities, such as; product modification, changes to the production process, packaging changes, delivery changes, and modifying advertising as well (Polonsky, 2007). New products are positioned on the basis of environmental appeal and green advertising is on the rise as more manufacturers are informing their consumers about the pro-environmental aspects of their products and services. Recent evidence has shown that green advertising has grown exponentially in the last two decades (Futerra, 2008), becoming the driving force behind increasing public awareness of ecological issues and skyrocketing demand for eco-friendly goods (Easterling et al., 1996; Polonsky et al., 1997). Not surprisingly, the emergence of green consumerism signifies that some consumers are even willing to pay a premium price for green products (Sammer and Wustenhagen, 2006; Haytko and Matulich, 2008; Okada and Mais, 2010; Litvine and Wustenhagen, 2011).

Numerous studies have been conducted in the past on green consumerism in Asian market, particularly on the predictor variables, such as consumer's demographic profiles, consumer's environmental attitudes, consumer's environmental threats, perceived consumer effectiveness, and perceived behavioral controls (Tan and Lau, 2010; Punitha and Azmawani Abd, 2011; Teng et al., 2011). However, studies to unveil the relationships between consumer's perception of green products and green purchase intention are still relatively less, especially in the Indian scenario. There is uncertainty among firms on the product dimensions to be considered when developing green products and some of the greatest challenges faced by these firms are changes in consumer preferences, suspicion of green advertising claim, unfavorable consumer perception of green products and the high cost invested in developing green products. As a result, it is vital to explore how consumers view environmental issues, and how they behave, especially in their attitudes towards green or environmental friendly products. Since these relationships are relatively under researched in the Indian context and understanding of these aspects is not supported by empirical evidence, the present study is a follow up on the previous studies and thus finds its significance and motivation. An explanation of such a relationship would provide an operational understanding to marketers who consider it important not only to foresee the reaction of green consumers to green communication, but is also important to find means that would enable to affect them in such a way that the final result of decision making (the buying of an eco-friendly product) would be favorable for a certain company.

The present research paper is therefore vital in filling the current literature gap on green consumerism in the Indian market. The main purpose of this study is to investigate if consumers' perception of green print advertisements influences their attitudes towards the brand and their intention to purchase such brands in contrast to non-green advertisement of the same product. We propose to expand on the existing framework of green ads and present a new scheme analyzing consumers' perception of green and non-green print advertisements by providing an explanation of such a relationship that would enhance the operational understanding of marketers for whom it is of great importance to foresee how green claims of their product are ultimately affecting consumers' attitude and whether such claims tend to be beneficial for the company in terms of improving brand image and consumers' intention to purchase.

EVIEW OF LITERATURE AND HYPOTHESES DEVELOPMENT

Research in the last decade (Lee, 2009, Rahbar and Wahid, 2011, Lee 2008; D Souza 2004) indicates that consumers are aware of and are willing to pay more to "go green". There is limited research which has examined the impact of green marketing on consumers from emerging economies like India (Bhattacharya, 2011; Prakash, 2002), though, there has been extensive growth in interest exhibited by marketing academics as well as practitioners with regard to the impact of marketing on promoting and maintaining ecological balance (Chammaro et al., 2009; Bhattacharya, 2011). Companies now have greater desire to act in a socially responsible manner and cater for socially responsible consumers (Polonsky and

Ottoman, 1998). Research suggests that consumers are willing to support responsible businesses (Pickett-Baker and Ozaki, 2008) and incorporate ethical considerations into their purchasing decisions (Crane, 2000). Carlson, Grove and Kangun (1993), found that consumers are willing to choose companies that they consider to be environmentally friendly in their business and marketing strategies and are responsive to environmental concerns.

Therefore, marketer's interest in green marketing is also growing and companies are increasingly making green marketing a part of their strategies to appear socially responsible to these consumers. Green marketing incorporates a wide range of activities, including product modification; production processes, packaging, as well as advertising of products through messages specifically focusing at promoting environmental benefits of products and services (Prakash, 2002).

Attitude towards Advertising

In recent years, pro-environmental behavior among consumers has risen dramatically as demonstrated by increasing involvement in environmental activities such as saving energy, recycling packages, or using public transportation and a willingness to pay higher prices for environmentally friendly products and to rely on their purchase decision on environmental-related issues (Leonidou et al., 2010). As the issue of environmental deterioration has become prevalent and environmental concerns and awareness among consumers has rapidly grown, a new market segment, environmentally conscious consumers, has been widely acknowledged by both marketing practitioners and academic scholars (Leonidou et al., 2010; Mostafa, 2007; Gardyn, 2003).

It has always been believed by consumer behaviorists that an individual's actions can be predicted by their attitudes. There have been a number of attempts to improve the ability to predict an individual's actions and a variety of factors have also been suggested to involve factors which can be classified as either dispositional or situational. Spruyt (2007) indicate that prediction of behaviour is directly dependent on attitude of the consumer which is found to be associated with knowledge and personal experience they have (Davidson et al., 1985). The impact of beliefs and attitude on consumer buying habits has been studied extensively (Fazio and Zanna 1981; Ajzen 1989).

Previous research into consumer attitudes toward green advertising was very comprehensive and addressed some of the same concepts we look for today. Several authors noted motivations for a firm to produce green advertising (Davis, 1992; Frankel, 1992; Gillespie, 1992; Ottman, 1992, 1998, Zinkhan and Carlson, 1995). Others researched consumer responses to green advertising and products in terms of loyalty (Frankel, 1992), willingness to pay higher prices (Phillips, 1999; Schlossberg, 1992), and perceptions of product safety or harm to the environment (Davis, 1994; Wheeler, 1992). Finally, we included items examining the positive and negative impact of green advertising on society, as noted by Banerjee et al. (1995), Davis (1992), Ottman (1992b), and Schlossberg (1992). In addition to themes used in previous research, we also included three new items. Based on the research conducted by Manrai, Manrai, Lascu and Ryans (1997), we included "Green advertising strengthens company image." Based on the research conducted by Chan (2001), we included "I plan to switch to products and services that were advertised as being green." Finally we included "I prefer products with eco-labeled packages" based on current trends in packaging and labeling to include environmentally friendly messages and/or recycling information. Furthermore research in this area has indicated that if attitudes are to be used in predicting the consumers behavior's then there are a number of methodological issues that have to be sorted out. According to (Ajzen and Fishbein, 1977), behavior and attitudes have to be measured at the same correspondence level. There are a number of theories that have been put forth to explain the process by which attitudes predict behavior.

According to (Ajzen and Fishbein, 1980), theory of reasoned action, "people consider the implications of their actions before they decide to engage or not engage in a given behavior". Thus according to the above theory, people's attitudes play a significant role when it comes to their forming an intention to act in a certain behavior. The model primarily argues that people engage in processing that leads to the formation of attitudes, norms and intentions prior to performing the behavior. Fazio (1986), proposed another theory in which he states that "attitudes guide behavior through an automatic and spontaneous process instead of a deliberate one as argued by the earlier two theories". Thus when an individual forms a favorable (or unfavorable) attitude towards an object then the object will automatically be seen as one that has many favorable (or unfavorable) characteristics to the individual. The attitude is accessed spontaneously by the mere presence of the object

In spite of the presence of theories that aid in prediction of behaviors from an individual's attitude, when it comes to environmental consumerism, the predictive ability of attitude is still being debated by researchers. There have been a number of attempts to provide a valid explanation to the presence of inconsistencies among behavior and attitudes, effects of external variables and lack of measurement reliability and validity (Mainieri et al., 1997), low correlations among environmental behaviors and different levels of specificity in the attitude behavior measures.

YPOTHESES DEVELOPMENT

Green Advertisement and Brand Image

Combining the understanding of attitudes with brand image, Trommbsdorff (2008) defines brand image as "a subjective perception of a brand that is based on verbal and pictorial associations and represents, by the means of attitudes, an overall judgment of a brand based of convictions and feelings". Attitudes, both cognitive and affective, are a relevant aspect of research, because they

determine the consumer's behaviour (Trommbsdorff, 2008).

Researchers support the notion that consumers tend to use beliefs about a product's environmental influence to characterize a brand's image (Rios, Francisco, J.M., Martinez, Teodoro, L., Moreno, Francisca, F., and Soriano, Paloma, C., 2006). Specifically, advertising being a significant medium between the corporations and consumers helps in maintaining a favorable image. The role of advertising in informing consumers, either directly (Grossman and Shapiro, 1984; Stigler, 1964) or indirectly (Milgrom and Roberts, 1986; Nelson, 1974) about brand attributes and/or prices, now includes terms such as recyclable, environmentally friendly, ozone safe, biodegradable etc. popularizing it as green advertisements and often exposing consumers to such messages. As a result, consumers develop feelings and judgments towards such advertisement claims, which affects their attitude and beliefs about the brand (Batra and Ray, 1986) and hence their intention to purchase.

Keller (1993) views brand image as perceptions about the brand as reflected by the brand associations held in consumer memory and suggested that associations that are unique, strong and favorable should create a positive brand image which when processed by consumers will bias consumer brand behavior (Keller, 1993). This implies that if a consumer holds a strong, positive and favorable association of the ad to which he/she is exposed, it is likely to result in a positive image of the advertised brand i.e. a positive brand image. Also it is suggested that an effective brand image construction can cast a strong impression in consumer's mind as it differentiates products and services based on tangible quality features (Mudambi et. al., 1997) including symbolic meanings that associate with specific attributes of the brand, making a mental picture of a brand in the consumer's mind (Cretu and Brodie, 2007; Padgett and Allen, 1997).

In this context, consumer's exposure to green advertisements as opposed to non-green advertising, should lead to differentiated patterns of perceptual and behavioral consequences. Companies, therefore, embody the concept of green advertising in their marketing mix to obtain such a differentiation advantage of their products (Chan et. al., 2006; Peattie, 1992; Porter and ven der Linde, 1995) as well as invest many efforts in improving their brand image as it is an important determinant of customer satisfaction and their consequent intention to purchase. This implies that if consumers link strong, favorable, and unique associations to a brand (Aad), in their memory, they are more likely to favor brand image and are more likely to consider the branded product for purchase (Aajer, 1996; Keller, 1993). Therefore, we propose that:

H01: The effect of Attitude towards the Ad on Brand Image is more for green ads than for non-green ads.

Similar to other universal product trends (e.g. technology, fashion, etc.), the green "industry" has unique properties and consumer relationships that influence purchasing patterns, both negatively and positively. Consumer's willingness to purchase green products has often been contributed to their self-labeled level of environmental enthusiasm, coupled with their skepticism and awareness of green claims.

Leonidas et al., (2011) studied the relationship between consumer's knowledgeof environmental issues and the effectiveness of advertising claims. The advertisements used in these studies featured basic or "shallow" claims, and were perceived by consumers to be lacking in credibility and comprehensiveness. Results also concluded that only low environmentally involved participants found validity in the green appeals (Leonidas et al., 2011). Mitchell & Ramey (2011) suggested that consumer's willingness to purchase green may be rooted in their passionfor the environment. They wrote that those who are considered environmental enthusiasts are more likely to purchase green products than others. Mitchell and Ramey (2011) go on to state that those passionate about the environment will be motivated to purchase any product that is "green".

Research conducted by Basgöze, & Tektas (2012) found various factors that make a difference in consumer's purchasing decision after interviewing both environmental and non-environmental enthusiasts. Their research outlined various elements and barriers that impact consumer's willingness to purchase green products. The elements such as price of the product, confusion regarding its authenticity, product's unavailability and lack of trust among consumers towards the green advertisements were among the few factors that hampered the process of conversion from demand into sales.

Similar research conducted by Leonidas, Palihawadana & Hultman (2011) highlighted that the most challenging aspect of green advertising and consumer purchasing patterns is the gap between the attitudes and buying behavior of consumers. One study conducted by Coleman et al. (2011) suggested that purchasing patterns might follow the foundations of the Competitive Altruism Theory. This theory describes the process in which an individual attempts to out perform others in terms of generosity/status. For example, a green enthusiast would view a green purchase as a means of obtaining long-term gains, such as respect or admiration for their actions. However, research has also documented environmental enthusiasts avoiding green products. Such contradictions have also been interpreted through the Competitive Altruism Theory. In this view, environmental enthusiasts believe that by avoidingfalse claims in green advertising they are in turn paying a betterservice to the environmental community. Ultimately, the disconnect within green advertising lies between what is getting consumers interested, and what is getting them to act on these interests.

According to Mostafa (2007), attitude is an important predictor to the behavior; therefore the understanding on the environmental attitudes of a typical consumer is by means to predict their behavior towards green purchasing. There are many studies being conducted to understand the relationship between environmental attitudes and environmental related issues. Numerous of these studies supported positive relationship between environmental attitudes and green

purchase intention in different cultures, such as Asian, US, and European, and in different product categories, such as organic food, timber-based products, organic products and environmental friendly vehicles (Sinnappan and Rahman, 2011, Kim and Chung, 2011; Yahaya, Nizam and Aman, 2011, Ahmad and Juhdi, 2010; Mostafa, 2007; Tarkiainen and Sundqvist, 2005; Chan and Lau, 2001; Kalafatis, Pollard, East and Tsogas,1999).

Given the range of findings, it seems to be clear that the link of attitude and purchase behavior has to be approached differently and tested deeply. The attitude of consumers toward a green product or service can be a major deciding factor for a positive purchase decision. Interaction between consumers with positive attitude towards green products and high product availability will create a favorable attitude towards purchase behavior, which would result in a stronger intention to purchase leading to a higher purchase of green products (Ahmad and Juhdi, 2010).

Therefore, we hypothesize that:

H02: The effect of Attitude towards the Ad on Intention to Purchase is more for green ads than for non-green ads.

ESEARCH DESIGN AND METHODOLOGY

Data collection form and generation of scale items

The feedback form was developed after a thorough research of secondary data. Various references led to the development of an optimal questionnaire to achieve the research objectives. First part of the questionnaire consists of a brief demographic profile. The second part consists of measures of attitude towards the ad, brand image and intention to purchase. Each construct's development is briefly discussed as follows.

Attitude towards the Ad

The measures of attitude toward the ad was assessed using a 21 item seven-point semantic differential scale, with 1 representing strongly disagree and 7 representing strongly agree. The statements adopted have been included in numerous other studies (e.g. Burke and Edell, 1989; Zinkhan et al., 1986; Aaker and Lee, 2003; Hopkins, C. D., et.al. 2004; Cotte et al. 2005; Bernard, R. J., 2009; Marchand, J., 2010 and so on). Respondents were asked: "When looking at the advertisement and considering all the information given in it, what is your overall attitude toward the advertisement?" Respondents rated their agreement with statements like "the ad is useful", "the ad is pleasant", "the ad has a status appeal" that measured Cognitive response, affective response and materialistic response towards the ad shown. The internal reliability of the scale items is well documented in earlier studies. The composite reliability for statements 1-13 was 0.750 for the cognitive dimension and 0.770 forthe affective dimension. The square structural link between the cognitive dimensionand the affective dimension was 0.681 and the average variance extracted was 0.500 for the cognitive dimension and 0.534 for the affective dimension. While for the affective statements, cronbach α is 0.91, composite reliability is 0.90 and extracted variance is 0.76. The last three items measure materialistic appeal "not an 'image' appeal/an 'image' appeal", "non-materialistic/materialistic", and "not a status appeal/a status appeal" with α = 0.81.

Brand Image

Brand image has been conceptualized and operationalized in several ways (Reynolds & Gutman, 1984; Faircloth et al., 2001). It has been measured based on attributes (i.e. Koo, 2003; Kandampully & Suhartanto, 2000); brand benefits/ values (i.e. Hsieh et al., 2004; Roth, 1995; Bhat & Reddy, 1998); or using Malhotra's (1981) brand image scale (i.e. Faircloth et al., 2001).

The study adopted the measure described by Keller (1993) that the image benefits can be classified into functional, experiential and symbolic benefits, which was originally derived from the work of Park et al. (1986). The present research paper adopted five dimensions to measure the overall brand image i.e. experiential, symbolic, social, functional, and appearance enhancer. The items under each of the sub-category is developed and modified in context of the requirements of the present research work. Sondoh Jr, S.L. et.al. (2007) has also categorized brand image into the above mentioned five dimensions and the items under each sub-category is a adoption from the work of various authors, i.e. Sweeney and Soutar, (2001); Tsai (2005); Dee Rio, Vazaquez and Iglesias (2001). The two most appropriate scales, earlier adopted by Cronin and Taylor (1992) and Sondoh Jr, S.L. et.al. (2007) were reviewed and complimented to make it suitable in context of the present study.

Intention to Purchase

The scale used is typically characterized by multiple Likert-like items used to measure the inclination of a consumer to purchase the product shown in the advertisement. The various versions of the scale discussed here employed between two and four items. Most of the studies appear to have used seven-point response scales with the exception of Okechuku and Wang (1988) who used a nine point format. The most widely used and validated instrument for the measurement being a 3-item 7-point scale, i.e., likely/ unlikely, probable/improbable and possible/impossible developed by Scott, Mackenzie, Lutz, and Belch in 1986. The scale suggests acceptable Cronbach's alpha reliability with 0.857. A similar three-item metric scale was developed by Dodds et al. (1991), to study measures of willingness to buy. Respondents were asked to respond to the question, "If you were in the market for [the product], how likely is it that you consider buying [the target brand]?" on three seven-point scale items, measuring likelihood, probability and willingness to purchase. Several authors (Faircloth, Capilla and Alford, 2001; Kozup et al., 2003; Hopkins, Raymond and Mitra, 2004) adopted these measure, both in original and modified versions in their studies. Also, four additional statements developed by Bruner II (2000), were included to make the scale more comprehensive in nature.

Before the finalization of the questionnaire, mentioned in pre-testing of the questionnaire was carried out for qualitative investigation. Ten percent of the total sample i.e. 15 respondents were administered the questionnaire for this purpose. Subsequently, the language of some of the questions was simplified. For the final data collection, respondents were personally briefed about the purpose of the study and all queries were clarified.

Subjects

A total of 150 postgraduate university students in business administration, from North India, volunteered to participate in the study. The sample shows strong internal validity, which is prioritized over external validity in testing theory (Calder et al. 1982; 1983). Also, respondents belonged to only one region, thereby enhancing homogeneity among sample. The post graduation students, with age demographics ranging 22-25 years were chosen because the product's consumption is drastically affected by the opinion of the young consumers. Youngsters make an explicit effort to select such products, and even if they lack financial soundness to buy that product, they are the major decision influencers in this product category. As per the pretest results which asked the respondents to enlist the product categories that they are major purchase decision makers of, the advertised product ranked among the top of the list and was therefore selected for the present study.

Stimulus Design

Two hypothetical ads were designed to help identify consumers' attitude towards green and non-green ads and their intention to buy the brands. The hypothetical advertisements for the purpose of the experiment were developed using an advanced version of Corel graphics with the help of a professional graphic designer to ensure that the advertisements appear real and convincing to the respondents. Care was taken to develop the advertisements which dealt with some claims that explicitly reflected how the sponsor or its offering interacted with the biophysical environment. In terms of green and non-green, two versions of print advertisements (green and non-green) for a hypothetical brand (Paper Art) of stationary product were developed. Advertised page contained the full-page color print of the advertisement, along with the text about the advertisement and image of the advertised product. The ad page consisted of the text at the bottom half of the page and the top half of the page carried the picture of the advertised product along with the brand name printed in large bold letters, a logo and a tag line. The text of both the advertisements consisted of a set of statements about the product attributes. In line with the objectives of the study, one ad consisted of green claims while the second ad made no connection with the greenness of the brand. In addition to the hypothetical ads, we also used hypothetical brand name to avoid any previous perceptions about the brand due to past experiences.

Finally, the ads were viewed by five viewers independently and were asked to identify an ad to be green or otherwise. All the viewers correctly identified the green ads as being green and no green ads as being non green in nature and therefore the two ads constituted our stimulus.

Pilot Study

After the pretests and development of the advertisement stimuli, the questionnaire was made to undergo pilot survey consisting of the small sample size of 50 respondents to ensure that the questionnaire items are modified and corrections are incorporated. The procedure of the pilot survey was similar to the procedure followed for the final data collection, constituting the sample with same demographic characteristics.

Manipulation Checks

In order to avoid manipulations by the respondents, all subjects were verbally informed that the study was concerned with measuring the effectiveness of advertising in print media, designed to measure ad effectiveness. In this stage, the subjects were provided with a print advertisement of the product with enough time to look at the ad and study it. No attempt was made to prevent the interaction among the respondents over the exposure period. Since the green and non-green ads developed both for low and high involvement product categories were hypothetical, the respondents were asked to analyze the given ads assuming these appeared in a magazine or newspaper. This manipulation check on our sample, prior to data collection confirmed that our manipulation was effective in creating required experimental conditions.

Procedure for final Data Collection

This exploratory study uses an experimental design as this design lends itself to establishing causal relationships (Hoyle, Harris and Judd, 2002; Tabachnick and Fidell, 2001). Each of the 150 subjects was first exposed to the non-green visual print stimuli and told that this was a research to measure attitude of students toward advertising in general. They were given 90 seconds to read the stimulus advertisement. Following this, they were asked to provide feedback regarding the stimuli by checking what they thought was a valid response to each item on the questionnaire. The questionnaire contained items related to attitude toward ad, brand image and intention to purchase.

The procedure was repeated with the same respondents, but this time with a green advertisement stimulus of the same product. The respondents were asked to provide their feedback regarding the change in the advertisements. Demographic items were also included and the respondents were allowed to complete the questionnaire at their own pace. The entire task took approximately sixty minutes. The response sheets from each respondent was compared and analyzed to identify a shift or change in the respondent's attitude and perception with the change in the advertising appeal.

ATA ANALYSIS

Demographic Profile of the Respondents

The demographic profile constitutes the first part of the questionnaire including Gender, Qualification and Age group. Table 1 summarizes the demographic profile of the respondents.

Table 1: Demographic Characteristics of Respondents

S.No.	Respondent's characteristics	% of respondents
1	**Age group**	
	Below 20	29.3
	20-25	68.7
	25-30	2.0
2	**Gender**	
	Male	43.3
	Female	56.7
3	**Education**	
	Graduate	54
	Post Graduate	30
	Others	16

According to Table 1, males comprised 43.3 % while 54 % of students were graduates, 30 % post-graduate students and remaining 16 % belonged to other courses. Out of total 150 respondents, 44 respondents belonged to the below 20 age group, leaving 103 to the age group ranging 20-25.

Reliability Analysis

Firstly, the reliability coefficients for all the three scales of attitude toward advertising, brand Image and purchase Intention scales were measured. The most significant measure of reliability is coefficient alpha. The internal reliability score was measured using cronbach's alpha. The coefficient alpha reliability estimates indicate that the items in each scale are acceptable measures of each of the factors. Nunnally (1978) suggests that an acceptable level of coefficient alpha in exploratory analysis is 0.70. The overall Cronbach's alpha for 'Attitude toward Advertising' scale was 0.781 across all 21 items. For the brand Image and Intention to Purchase scales, the values of Cronbach's alpha were 0.821 and 0.857 respectively. Both these values were also within the acceptable limits.

Test of the Proposed Hypotheses

A multi-group moderated linear regression analysis was employed to test the relationship posited in the hypotheses. A moderator analysis is used to determine whether the relationship between dependent and independent variable depends on or is moderated by the value of a third variable i.e. type of ad-green/non-green.

Moderating Effect of 'Type of Ad' between Attitude towards Advertising and Brand Image

The first hypothesis states that the effect of Attitude towards the Ad on Brand Image is more for green ads than for non-green ads. The present study uses SPSS Ver.17 to measure the moderating effect of type of ad (Green or non-green) between attitude toward advertising and brand image. We created three variables- attitude toward the ad, which is the respondents' level of attitude towards advertising measured on a seven point scale; brand image- which is the respondents' perceptions about the brand as reflected by the brand associations held in consumer memory and type of ad i.e green ad and non-green ad. However, the moderator variable, type of ad, cannot simply be entered into linear regression equation and therefore a dummy variable is created.

To test the hypothesis that brand image is a function of attitude toward advertising, and more specifically whether type of advertising moderates the relationship between ad attitude and brand image, a linear regression analysis was conducted. In order to understand the moderating effect of ad type, we interpret the Model Summary (Table 2) which provides the change in R^2 measure used to determine the statistical significance of the interaction term and, subsequently, whether type of ad moderates the effect of attitude towards the ad on brand image, as highlighted in Table 2.

In the first step, two variables were included: ad attitude and type of ad. These variables accounted for a significant amount of variance in brand image, $R^2 = .340$, $F(2, 153) = 76.57$, $p < .001$. To avoid potentially problematic high multicollinearity with the interaction term, the variables were centered and an interaction term between ad attitude and type of ad was created (Aiken and West, 1991).

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.582	.340	.336	22.4865	.340	76.573	2	153	.000
2	.600	.360	.354	22.1800	.020	9.265	1	152	.003

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.542	.294	.285	.56965	.294	31.885	2	153	.000
2	.550	.303	.289	.56810	.008	1.838	1	152	.177

Figure 1: Green advertisement for the hypothesized brand of stationary products (Paper Art)

Next, the interaction term between ad attitude and type of ad was added to the regression model, which accounted for a significant proportion of the variance in brand image, $\Delta R^2 = .02$, $\Delta F(1, 152) = 9.27$, $p = .001$. The R^2 Change suggests an increase in variation explained by the addition of the interaction term (i.e., the change in R^2), which is the percentage increase in the variation explained by the addition of the interaction term. We can also see that this increase is statistically significant ($p < .05$). Examination of the interaction shows a change in effect with green advertising resulting in increased brand image while non green ads showed significantly lesser change in brand image. We, therefore, conclude that type of ad does moderate the relationship between attitude toward the ad and Brand Image.

Moderating Effect of 'Type of Ad' between Attitude toward Advertising and Intention to Purchase

Further, to test the hypothesis that the effect of Attitude towards the Ad on Intention to Purchase is more for green ads than for non-green i.e. type of ad moderates the relationship between attitude toward the ad and Intention to purchase, a multi group linear regression analysis was conducted. The overall model was significant, $R^2 = .294$, $F(3, 152) = 21.99$, $p = .001$. Variables that were predicted to have problematically high multicollinearity were centered (i.e., Attitude toward the ad and Intention to purchase; Aiken and West, 1991).

Figure 2: Non-Green advertisement for the hypothesized brand of stationary (Paper Art).

In the first step, two variables were included: attitude toward the ad and type of ad. These variables accounted for a significant amount of variance, $R^2 = .294$, $F(2, 153) = 31.89$, $p < .000$. Next, in the final step of the regression analysis, an interaction term between attitude toward the ad and type of ad score was created, which was entered into the next step of the regression. The interaction term did not account for a significant amount of additional variance in brand image scores, $\Delta R^2 = .008$, $\Delta F(1, 152) = 1.84$, $p = .117$ (Table 3).

The R Square Change shows the change in variation explained by the addition of the interaction term (i.e., the change in R^2). The change in R2 is reported as .008, which is a proportion. More usually, this measure is reported as a percentage so we can say that the change in R^2 is 0.08%, which is the percentage change in variation explained by the addition of the interaction term- type of ad. We can also see that this change is statistically insignificant ($p > .05$). As a result we conclude that type of ad does not moderate the relationship between attitude toward the ad and Intention to Purchase.

ISCUSSION AND IMPLICATIONS

To gain equity and to appeal to the environmentally conscious consumer, firms are increasingly trying to establish their brands as green brands. By doing so, marketers hope that consumers will respond more favorably to brands that offer a natural or eco-friendly alternative to satisfy their needs. Researchers in the past have struggled with the question about why despite concerns towards the environment (attitude), consumers fail to purchase environmentally friendly or green products. The present study therefore attempted to investigate the moderating effect of type of ad between attitude toward advertising and intention to purchase and brand image.

Findings of the present study reveal that the positive relationship between attitude towards ads and brand image is moderated by the type of advertisement such that the relationship between the dependent variable, brand image and the independent variable, attitude towards the ad is more positive for green ads as compared to non green ads. This implies that consumers' attitude and perceived quality or image of the product depends on the type of advertisement. It is established that high brand equity is accompanied by favorable, strong and unique associations in memory. In the case of environment or green advertisements, the perceived image of the brand becomes positive as such communications promote the environmentally responsible behavior of the firms. The same is not true in the case of non green communications; as such ads do not distinguish themselves from the run-of-the-mill advertisements.

Furthermore, the findings suggest that although type of ad moderates the relation between attitude and brand image it does not moderate the relationship between attitude and intention to purchase such brands. This implies that the positive relationship between attitude and purchase intention does not differ for green and non green ads. One can think of several reasons for such findings. In the Indian context, although consumers may be concerned about the environmental impact of what they buy, they still look for financial benefits that accrue from such a decision. Despite an increase in the number of green advertisements both in print and television, the persuasiveness of such appeals on the target audience is still relatively low. Consumers differ in their concern for and behavior toward environment preservation. This implies that the consumers concern for and attitude toward the environment may be high, but their inclination to spend more for such products is not high. A direct implication of this finding for the marketers and advertisers is that green advertising will help in building a strong and positive brand image but it may not translate in consumers' decision to purchase such brands.

IMITATIONS AND FUTURE RESEARCH

Although the present study took a positive approach in reviewing previous literature of attitude toward green ads, brand image, and intention to purchase and the moderating role of type of ad using advanced statistical tools, the conclusions and managerial implications of this study must be adopted with due caution, given that the research was experimental in nature and the data were gathered in an artificial environment. Some of the limitations worth acknowledging include issues with the presence of a single product category used in the study. Although we took care to ensure that the product used in our study was relevant to the test population, yet the findings are based on only one hypothetical brand of stationary notebooks and therefore generalization beyond this set should be made with caution. However, although the specific findings on the hypothetical brand may not be the same as the general populations', it is expected that the measurement protocol is generalizable. For future study, it will be worthwhile to investigate the same set of relationships with high involvement/feeling and low involvement/feeling product categories.

Further, although the present study examines linkages between multiple constructs which has not been undertaken in earlier studies, clearly, future research is required to provide a further understanding of linking these constructs by exploring the possibility of inclusion of other variables such as consumer satisfaction and brand equity. Research in the future might also concentrate on measuring the behavioral and attitudinal effects of green and non green advertising. Such a comparative analysis will in turn result in an improved understanding of the relationships between the considered constructs. A follow up study in the next 2-4 years is strongly recommended to determine if the recent changes in green advertising have further led to a change in the perception of consumers and whether advertisers have been able to take advantage of the strength of environmentally conscious consumers in the future.

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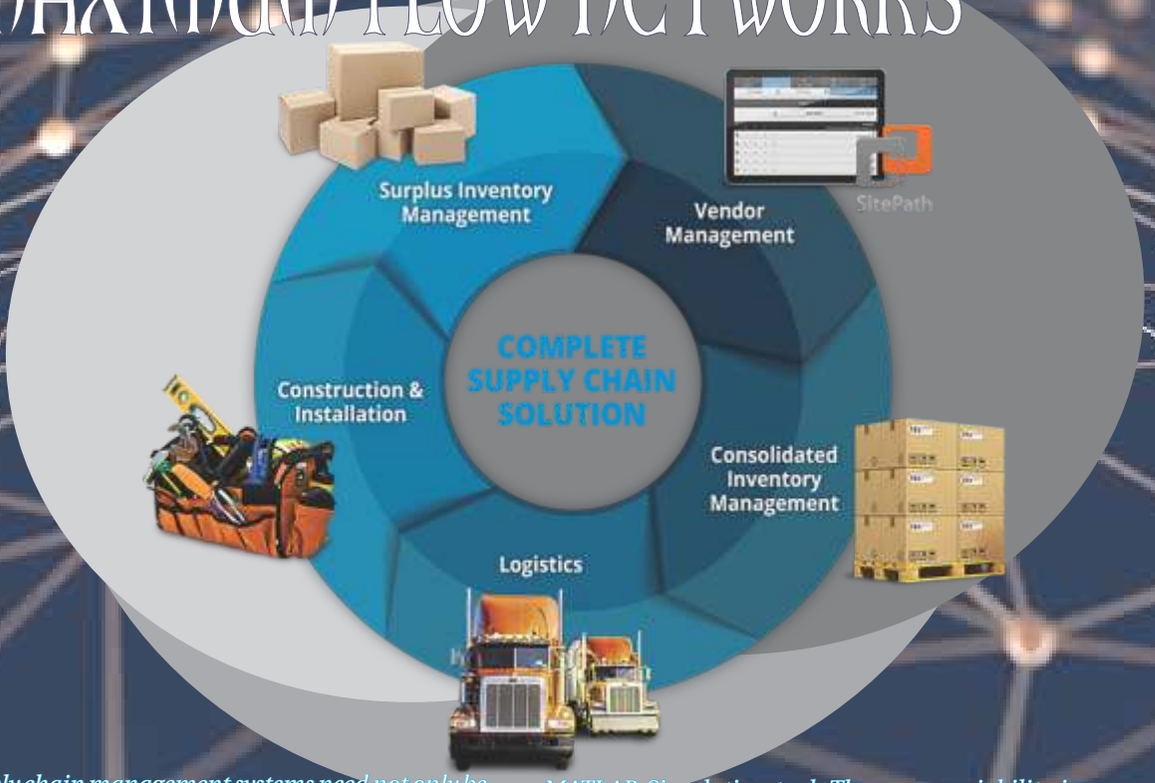
AN ANALYSIS OF RETAIL SUPPLY CHAINS: TIME BASED SIMULATION IN NEURAL NETWORKS AND MAXIMUM FLOW NETWORKS



ABSTRACT

Contemporary supply chain management systems need not only be adaptive to changing needs of the consumers but also to the varying terms amongst the members of the supply chain. Moreover, the on-time availability of services and goods is imperative for retaining customers. Hence, irrespective of a new supplier becoming a partner of the supply chain or an old supplier exiting the business, the demand must be met keeping cost constraints into account. Supply chain management is a cross-functional approach that involves managing the movement of raw materials into an organization, processing of materials into finished goods and finally providing finished goods to the end consumers. In this paper, the concept of SCM has been perused with the approach of network flows applying maximum flow network algorithm of graph theory with changing count of the supply chain players and their supplying capabilities. We have discussed cases of increasing count of Suppliers, Manufacturer, Distributors and Retailers from 8 to 88 players of an apparel retail chain. This variability is then analyzed for time using MATLAB Simulation tool. The same variability is assessed using feed forward neural networks for modifying the number of neurons within the various layers.

This study emphasize on the analysis of the performance of the two approaches which calculate the material flows across several alternate supply sub-chains from suppliers to the destined retail stores. The algorithms are simulated with varying data to compute actual supply chain logistics and then, the running time of the algorithm is compared in a dynamic node scenario. The results of the two approaches have been compared using mean squared error of the difference between actual demand and expected demand as well as running time of these two approaches. Simulation of supply chains has been performed using weighted graphs with non-negative edges and employing iterative Ford Fulkerson algorithm and multilayer feed forward network using inbuilt MATLAB functions.

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INTRODUCTION

In today's era, every enterprise needs complete visibility into its end-to end supply chain and seamless integration between internal system and external parties. A business looking to enter a global market must assess its supply chain to address the perfect region for the product. Ability to tap new local supplier is to raise the stiffness of the competition in a market from incumbent firms as well as new and emerging players. While competition can benefit consumers by optimizing cost, it keeps enterprises vying for innovative ideas and supply chain models – that can help them stay in this tight race. Supply chain is a network of suppliers, manufacturers, distributors and retailers who are collectively concerned with the conversion of raw materials into goods that can be delivered to the customer. It is a dynamic, stochastic and complex system.

The objective of the supply chain is to enhance the operational efficiency, profitability and competitive position of a firm and its supply chain partners. Supply chain stages include procurement, production, inventory and distribution. Supply chain management involves handling logistics at these different stages as shown in Figure 1.1. Production distribution planning is one of the most important activities in supply chain management. The main decisions involved are plant location, capacity allocation and market (demand) allocation. These decisions influence both cost and customer experience. Customer demand is not a static factor in real world situation and this has been modeled using various methodologies.

This study is concerned with changing number of suppliers, vendors or distributors and corresponding capacity allocation while demand is assumed to be accurately estimated well before it has to be fulfilled. The following sections include the description of the existing work and an insight into how supply chain dynamics are being modeled so far. Then the methodology and reference algorithms used in the study have been discussed. We, then, present a modified algorithm that works with varying nodes and changing capacities. The implementation of the approaches for certain scenarios and the running time analysis are finally put forward.

ITERATURE REVIEW

OVERVIEW OF INVESTIGATION STUDIES ON SUPPLY CHAIN

Keith Oliver, a consultant at Booz Allen Hamilton recognized the concept of Supply chain management in 1982. He popularized the terms like supplier, distributor, retailer, customer and defined the flow of information which intact the different entities in one relationship while maintaining the upstream and downstream of business to fulfill the proportion of supply and demand. Supply chain management provides an integrated environment where systems like production, storage, distribution, and material control are integrated in one plan i.e. ERP. The purpose of supply chain management is to improvise the factors of trust and collaboration among supply chain partners to further improve inventory visibility and the velocity of inventory movement. There have been many issues that have been addressed in achieving goals of SCM such as determination of inventory levels and forecasting demand accurately. These are critical design factors of supply chains with the uncertainty aspects modulated according to the supplier and the customer. The paper is focusing to the variability in the size of supply chain partners can be assessed using graph theory as well as neural networks for effective risk mitigation and better logistic flows.

ETHODOLOGIES OF ANALYZING SUPPLY CHAINS

There are different ways to create strategies for a total systems view of the links in the chain that work together efficiently and to create customer satisfaction at the end point of delivery to the consumer. As a consequence, costs must be lowered throughout the chain by driving out unnecessary expenses, movements, and handling. The main focus is turned to efficiency and added value, or the end-user's perception of value. Efficiency must be increased, and bottlenecks removed. The measurement of performance focuses on total system efficiency and the equitable monetary reward distribution to those within the supply chain. The supply chain system must be responsive to customer requirements. The impact of number of changing terms among the supply chain partners is mentioned in different parameters of the literature survey.

Benita M.Beamon [4] hasperformed the investigation of various processes within manufacturing supply chains. The paper focused on the performance, design and analysis of the supply chains. Several models were described which enhance the performance and design by implementing heuristic model and spread sheet based inventory model. These models maximize system flexibility measured by the time-based sum of differences between the capacities and utilizations of the inventory resources and activity resources. Another purpose of their work was to determine the location of distribution centre and assign the selected Distribution Centers (DCs) to customer zones. The design and analysis of supply chain

Figure 1.1: Supply Chain Logistics

determined the efficiency and/or effectiveness of an existing system or to compare competing alternative systems.

Abbas Tolie Eshlaghy and Maryam Razvai [1] have described the uncertainty in supply chain management which can be overcome through an emergency inventory. The idea of the paper was to integrate all the activities throughout the chain which reduced the inventory to be supplied to customers. The linear control method and transfer functions analysis for modeling the supply chain were used to control the negative effect of changes in demand on order rate. The system focuses on the structures and behaviors of combined systems comprising of mutual feedback loops by the customer. If feedback loop changes an amount of a variable opposite to the direction of the original deviation, then the loop is considered as a negative feedback else considered as positive feedback. The continuous-time condition calculates the best situation for exchanging order rate and inventory using Vensim Software.

Jefrey W. Herrmann et.al. [8]have discussed about the novel supply chain simulation framework that includes the Supply Chain Operations Reference (SCOR) which integrates discrete event simulation and spreadsheets. SCOR was developed to depict the business activities correlation with all phases of satisfying a customer's demand. They have further described the three levels of supply chain simulation model which designate the implementation of the framework using Arena and Microsoft Excel. The simulation models were hierarchical in nature and used sub-models that capture activities specific to supply chains. The approach of paper was to integrate the libraries of reusable sub-models to build unified supply chain models with less effort within the specified time available for evaluating the system. The focus was to improve the performance of entire supply chain model.

Barnett and Miller [3] explained specialized supply chain simulation software that applies SCOR. The goal was to perform supply chain simulation models using the SCOR model with reusable components from discrete-event simulation software to facilitate model construction. The dynamic system analyzed and defined the perspective of the evolutionary process of supply chain collaboration with the SCOR usability.

S.D. Chandrasekaran [13] described the crystallized concepts about integrated business planning that have been supported by logistics experts, strategists and operation research practitioners to compute the quality and desirability of a product which was further conceptualized in terms of optimization along with the genetic algorithms. The genetic algorithm frame in supply chain networks identified the multi point search technique that further examined a set of solution which can be extracted to find the solution of complex supply chain network. Various constraints were considered for optimization of the supply chain network of an organization with the aim to reduce the total operating cost and maximize the profit of industry with the help of mathematical modeling. The modeling was done using genetic algorithm in MATLAB. Genetic algorithms have found applications in bioinformatics, phylogenetics, computational science, engineering, economics, mathematics, chemistry and other fields. The effectiveness of the algorithm was tested through computer simulation for various real life problems and found to be very effective. The GA approach not only satisfied the customer's requirements but also defined a near minimum cost.

C. Edward Wang et.al. [5] explained how supply chains are affected by the production and inventory strategies, which influence the amount of information needed by the chains. The lack of precise market demand and reliable supplier's stock level makes it inappropriate to use the statistically based inventory model to extract inventory strategies for the new product supply chain. This paper demonstrated a fuzzy neural network model to determine the uncertain market demand and reliability in supply products to the customer. The paper also explained the long term effect of supply and customer's demand in the multi –echelon acyclic network supply chain. The study considered the shortage, backordering costs and applied a fuzzy neural network model to crystallize the capacity at each production facility in order to improve the entire supply chain. The algorithm was derived to estimate minimal inventory costs under given capacity range.

Stephan M. Wagner and Nikrouz Neshat [11] described about the susceptibility caused by the frequent natural and manmade disaster in supply chain. They have explained an approach which quantify and mitigate supply chain using graph theory. The purpose was to assess the vulnerability of the supply chain and provided the effective strategies of risk mitigation. The proportion of vulnerability drivers in supply chain structure stem to a large degree from the disintegration and the globalization of value added activities. The supply chain vulnerable dependency affected both the supply side and demand side if errors in inventory planning were made. Therefore, graph modeling used an appropriate method to quantify the vulnerability and tap the interdependencies. The vulnerability drivers acted as a nodes and interdependencies acted as edges or links in graphs. Graph modeling measured the vulnerability assists in converting supply chain vulnerability to an index. The further use of index has allowed managers to better manage the vulnerability and defined the interaction among the drivers which considered as direction dependent. These interactions and the intensities were represented by a weighted directed edge which determined the value associated with each edge and can be mapped in adjacency matrix provided the allocation of an information in the prescribed path. The strategies which can be implemented were augmented by three parameters like graph size, graph order and graph permanent values were used to reduce the risk in supply chain and subsequently improve financial performance of the firm.

Yisheng Wu [12] explained about the closed loop supply chain by determining the information flow like forward supply chain or reverse supply chain with effect from the fuzzy graph theory. The paper had eleven constituents which described about the information and fund flow direction from supplier to consumer. The primary coverage of fuzzy graph theory was generalized fuzzy matrix and multi level direction fuzzy graph and their principles were based on many valued logics. The fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. Fuzzy logic has been expressed to handle the concept of partial truth, where the truth value may range between completely true and completely false. When

linguistic variables are used, these degrees may be managed by specific functions.

ROBLEM DEFINITION AND STUDY METHODOLOGY

A supply chain model must be able to keep into account all characteristics of the system, including dynamic specifications such as demand fluctuations, delays in lead time and variable system components. It is of interest to analyze how the change in the tally of supply chain players affects the logistics. The impact of varying the player counts is also dependent on the strategy of finding out optimum flows. A case of an ABC apparel retail chain is thereby taken to represent scenarios of how an increase in the number of suppliers will affect the time to compute material flows across the supply chain to meet the demand. Similarly, a change in number of the manufacturers or distributors will impact the material supplies and is, therefore, studied. The supply chain of ABC retail group initially considered in the analysis has the following topology having a supplier to provide raw materials to two manufacturers, and two intermediary distributors who furnish demands of three retail branches, each. Hence, flow of materials is directed from left to right in the Figure 3.1.

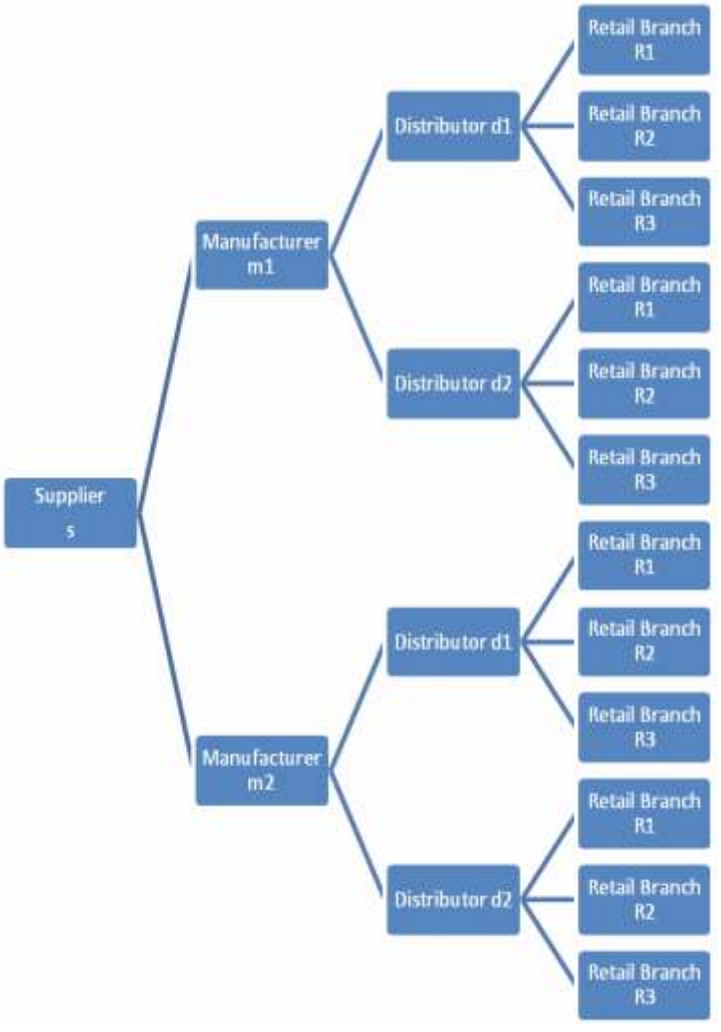

Figure 3.1: Basic supply chain

There are numerous methodsthat can be deployed to model supply chains. These include deterministic, stochastic, game theory models, and simulation based models. This paper is exercising simulation of the supply chain using network graph modeling as well as neural networks in MATLAB. A network flow graph is a weighted directed graph with two extraordinary vertices, the source vertex, and the sink vertex, with no incoming edge and outgoing edge respectively. Corresponding to the supply chain network, suppliers are the source nodes and retailers are the sink nodes. Each pair of supplier node and retail store node forms the end points of flow networks. The edges represent logistics between the two player nodes, and edge weights, here, are the capacity of channels between any two players. The capacity of the channel is determined based on the processing capabilities of the receiving player and is negotiated whenever a deal occurs between two players. This capacity is considered to be a function of time and retail demand is factored in this value. Therefore capacity can be updated from time to time. The supply chain management system should be able to compute the maximum flow possible and the corresponding conceptual augmented path from every supplier to the retailer to not exceed the capacity of the network. The procedure makes an iterative use of an old strategy by Ford and Fulkerson (http://www.geeksforgeeks.org/ford-fulkerson-algorithm-for-maximum-flow-problem/). Ford Fulkerson algorithm takes as input a digraph with its vertex set and edge set, the source and sink nodes, and non negative edge capacities. The flow conservation is maintained between the nodes, that is, the sum of flows of all outgoing edges of a vertex cannot exceed the sum of flows of all incoming edges of this vertex. Also, edge capacity obviously is the upper limit for edge flow. Ford and Fulkerson computed residual paths to finally reach at the maximum flow. G(V, E) is the given directed graph with V vertex set and E edge set, and for any two vertices u, v, c(u,v) defines the capacity of the edge from u to v, and f(u, v) denotes the flow from u to v. A residual network $G_r(V, E_r)$ is the network with capacity $c_r(u, v) = c(u, v) - f(u, v)$ and no flow. An augmented path from s to t is found using Edmonds-Karp breadth first search method or depth first search method. The algorithm is as follows:

Ford Fulkerson Algorithm:

Inputs Graph G with flow capacity c, a source node s, and a sink node t

Output Maximum flow f from s to t

Steps:

1. Initialise f (u, v) as zero for all edges (u, v)

2. While there is an augmented path p from s to t in residual graph Gr with positive edge capacities $c_r(u, v) > 0$ for all edges (u, v), do the following

1. Find $c_r(p) = \text{minimum } \{cr(u,v) : (u, v) \text{ in } p\}$

2. For each edge (u, v) in p

a. $f(u,v) = f(u,v) + c_r(p)$

b. $f(v,u) = f(v,u) - c_r(p)$

Hence, the maximum flow has been attainted when the residual graph has no more augmenting paths. MATLAB will be used in order to implement the algorithm using graph maxflow function. An instance of such a network with 1 supply node, 2 manufacturing nodes, 2 distributors and 3 retail branches with their augmented paths is shown in the diagram in Figure 3.2 generated in MATLAB.

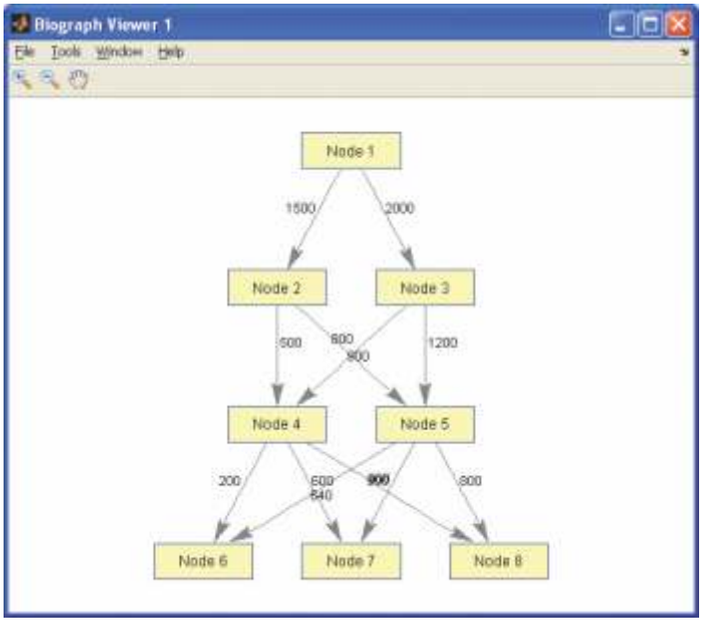

Figure 3.2: A Network Flow Biograph of 8 nodes generated in MATLAB

Besides using max flow algorithm, another approach was taken as a means to capture the structure of interconnection of the supply chain components and flows among them. Feed-forward back-propagation neural networks are popular neural network architectures [6].To apply a feed-forward NN to supply chain, allowable flows to a player from its provider will be provided as inputs and demand to be met at the retail stores will be taken as anticipated outputs of the network. Then based on the actual outputs produced and error between desired flow and actual flow, the weights of the connections will be adjusted. Since there is layered architecture of the supply chain where each player category forms an echelon in the chain, the same can be modeled using a multi layer feed forward network as shown in the below instance diagram in Figure 3.3 of the neural network with seven suppliers furnishing supplies at the input layer and meeting targeted demand of twelve instances of retailers forming output layer. The five manufacturers and eight distributors are the two hidden layers.

The neurons are performing weighted sums of the incoming flows and the activation function is simply a sigmoid function to represent convergence to the targeted demand from uplinked layer. Output nodes yield the actual demand met based on the current initial weights of the interconnections. Then based on the difference between the desired demand to be met and actual output demand, the weights are readjusted. This learning process is useful to fine tune the flows from the suppliers all the way through to the retail branches. These weights can be analogously compared to the flows in the network flow graphs used in the previous methodology. Both the strategies are examined in the paper using MATLAB toolboxes.

The algorithm for a generalized feed-forward back-propagation method is as follows:

Inputs A neural network with multiple sets of input values as training patterns; weights of connections initialized as small random numbers, between -1 and 1; desired outputs from the output layer; Threshold values for each connection.

Output A neural network with all weights assigned such that error between desired and actual output vector is minimum

Steps:

1 For each given training pattern, do the following: Initialise the network with the pattern;

While there are layers in the network, do the following: For every node in the layer, do:

a. Calculate the weightsum of the inputs to the node

b. Add the threshold to the sum

c. Calculate the activation for the node end

For every node in the output layer, do:

Compute the error between desired output and actual output generatedend

For all hidden layers, do the following as back-propagation:

For every node in the layer, do:

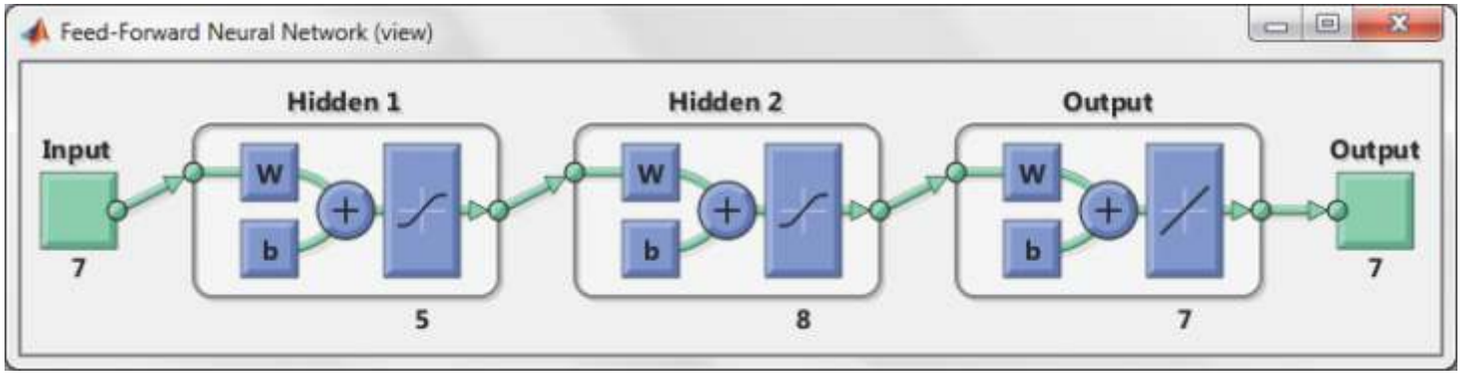

Figure 3.3: Multi-layer Feed-forward Network with an input layer, an output layer and two hidden layers

a. Compute the node's error

b. Update the node's weight

end

end

end

2 Repeat step 1 while the error exceeds the minimum error permissible.

The implementation of this algorithm is directly performed using MATLAB functions and sigmoid function is taken as the activation function for the neurons since it generated non negative derivatives showing a natural convergence to the desired value attainable.

DAPTED NETWORK FLOW ALGORITHM FOR MAXIMUM MATERIAL MOVEMENT

The supply chain network has node count changing every unit of time. It is assumed that the number of suppliers and consumers are changing and recorded at regular discrete intervals of time t1, t2, t3, t4 and so on. The demand (capacity) of each supply player has been predetermined and is assumed to be constant during a time unit. The algorithm will assume that there is only one good type and there is a one to one correspondence between one unit of good and one unit of raw material, i.e. one unit of raw material replenishes one unit of demand of the good. The algorithm may be extended to over multiple good types and multiple raw material components. Following are the variables used in the procedure to record observed and computed data.

S	set of suppliers = {si: i = 1 to Smax}
M	set of manufacturers = {mj: j = 1 to Mmax}
A	set of distributers = {ak: k = 1 to Amax}
R	set of retail branches = {rl: l = 1 to Rmax}
Dr(tL)	Estimated demand or capacity by rth player at time tL
δSt	Change in number of suppliers at time t
δMt	Change in number of manufactures at time t
δAt	Change in number of distributers at time t
δRt	Change in number of retail branches at time t
L	Maximum Lead time from demand ordered to replenishment
Xijt	number of goods furnished by ith player to jth player at time t

Capacities of the supply channels are available based on the predicted demand for time t.

The algorithm is as follows:

Input:

A graph Ginitial with initial supply chain topology at time t1, with number of vertices = |S|+|M|+|A|+|R| and edges from each supplier si, to each manufacturer mj to each distributor ak to each retail branch rl

A graph Gnew1 with updated supply chain topology at time t2>t1, with vertices count |S|+ δS_{t2} +|M|+ |A| +|R| and edges from each supplier, to each manufacturer to each distributor to each retail branch

A graph Gnew2 with updated supply chain topology at time t3>t1, with vertices count |S|+ |M|+ δM_{t2} + |A| +|R| and edges from each supplier, to each manufacturer to each distributor to each retail branch

A graph Gnew3 with updated supply chain topology at time t4>t1, with vertices count |S|+ |M|+ |A| + δA_{t2} +|R| and edges from each supplier, to each manufacturer to each distributor to each retail branch

A graph Gnew4 with updated supply chain topology at time t5>t1, with vertices count |S|+ |M|+ |A| +|R| + δR_{t2} and edges from each supplier, to each manufacturer to each distributor to each retail branch

Output:

Maximum flow values from each si to each rl via each manufacturer and distributor

Time taken to run the algorithm at time t1 and t2

Steps:

1. Initialise time t = t1 and G = Ginitial;

2. For time t, do the following:

For each supplier si in G as source node do:

for each retailer rl as sink node:do:

Compute the maximum flow and corresponding path using Ford Fulkerson algorithm and record time taken to compute the same

end;

end;

3: Update time t = tx and G= Gnewx where x = 2, 3, 4, 5 and repeat step 2.

4: Compare the computational costs for a unit change in each of the supply chain player

This algorithm models the changing dynamics of the flow due to changing count of players. The iterative Ford Fulkerson algorithm is being analysed for this model. Step 4 implements step 2 repeatedly for each of the following scenarios:

Updating number of suppliers.

Updating number of manufacturers.

Table 5.1: Data Set Size for Experimentation for two approaches

Player Matrix Size	# of Suppliers	# of Manufacturers	# of Distributors	# of Retailers	Source Node	Sink Node
8 × 8	1	2	2	3	Supplier Node s1	Retail Nodes r1 to r3
32 × 32	7	5	8	12	Supplier Node s1 to s7	Retail Nodes r1 to r12
44 × 44	12	6	12	14	Supplier Node s1 to s12	Retail Nodes r1 to r14
80 × 80	16	18	26	20	Supplier Node s1 to s16	Retail Nodes r1 to r20

Updating number of distributors.

Updating number of retail branches.

The algorithm works with changing nodes of the network flow graph.

MPLEMENTATION

MATLAB by MathWorks is a powerful computational and modeling tool that is quite often used in engineering and information technology research. We have also deployed the tool in order to compute the flows in the supply chain under dynamic demographical conditions over time.

The BioInformatatics Toolbox provides several graph theory functions for network analysis and visualization. graphmaxflow(*G, SNode, TNode*) function accepts a sparse matrix representing a directed graph *G* with a source node *SNode* and a sink node *TNode* and outputs the maximum flow *MaxFlow, FlowMatrix,* a sparse matrix with all the flow values for every edge, and Cut, an optional row vector indicating the nodes connected to *SNode* after calculating the minimum cut between *SNode* and *TNode*. Since we don't require the cut matrix for our computations, it's not taken as an output parameter [14].

This function was iteratively called with varying input parameters. Table 5.1 shows below the inputs to the function: matrix of capacity of movement from suppliers to manufacturers, from manufacturers to distributors, as well as from distributors to retail branches; the suppliers as source nodes and retail branches as the sink nodes. The output generated by running the code is specified in the results section for each input data set. The time taken by the algorithm has been also recorded.

Neural network designing for the supply chains for these varying supply chain sizes has been done by:

1. First setting up the multilayer neural network with an input (supplier) layer, an output (retail store) layer, and two intermediate hidden layers (manufacturer and distributor),

2. Then configuring the network with the same input data sets as above altering the number of perceptrons at each layer,

3. Then initializing the weights and biases and training the network using a training algorithm (*trainlm* is used here with mean square error performance function which uses Levenberg-Marquardt algorithm)

4. Finally validating and using the network

The *feed forward net(hidden Sizes, trainFcn)* function in the Neural Network toolbox accepts as inputs a row vector of one or more hidden layer sizes and a training function trainFcn default of which is trainlm.

ESULTS

When run for the data sets for varying number of supply chain members, the following measurements were taken.

Approach	Matrix Size	MSE of Target Demand & Supply	Time Taken (in sec)
Iterative Fold Fulkerson	8 × 8	69525	0.0312
Feed-forward back-propagation Neural Net	8 × 8	8.9E-23	0.59

Approach	Matrix Size	MSE of Target Demand & Supply	Time Taken (in sec)
Iterative Fold Fulkerson	32 × 32	66138.84	0.0468
Feed-forward back-propagation Neural Net	32 × 32	2732	0.962

Approach	Matrix Size	MSE of Target Demand & Supply	Time Taken (in sec)
Iterative Fold Fulkerson	44 × 44	82878.04	0.0936
Feed-forward back-propagation Neural Net	44 × 44	3700	1.138

Approach	Matrix Size	MSE of Target Demand & Supply	Time Taken (in sec)
Iterative Fold Fulkerson	80 × 80	58516.2	0.1
Feed-forward back-propagation Neural Net	80 × 80	9210	2.66

The comparative study between the two approaches using histograms is shown in figures 6.1 and 6.2.

In all scenarios, it was found that using Feed forward back propagation Neural Network strategy to model dynamic supply chain leads to better results in terms of meeting the demand more accurately than Iterative Fold Fulkerson strategy (Figures 6.1(a) to 6.1(d)). However the time taken by

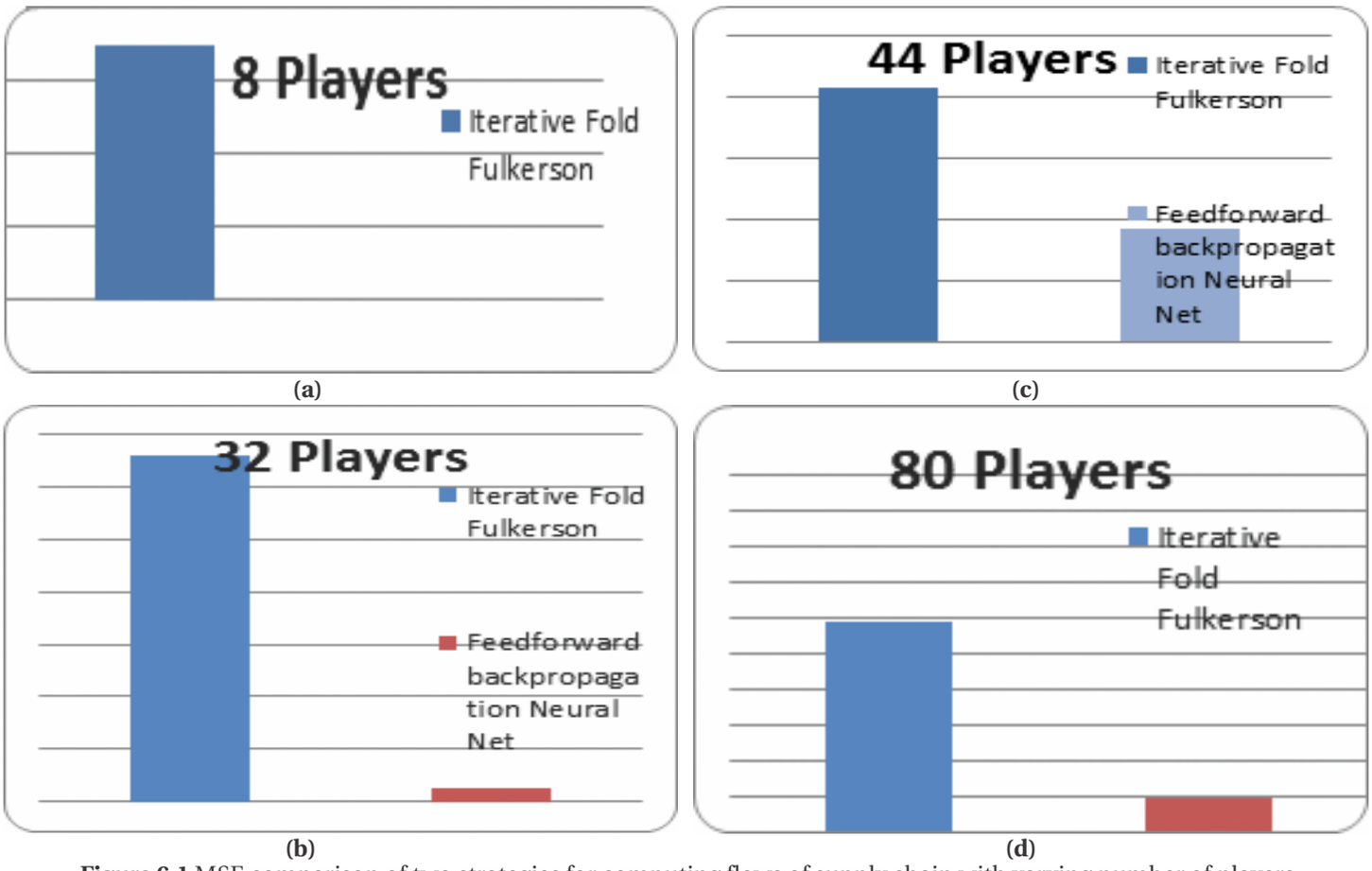

Figure 6.1 MSE comparison of two strategies for computing flows of supply chain with varying number of players

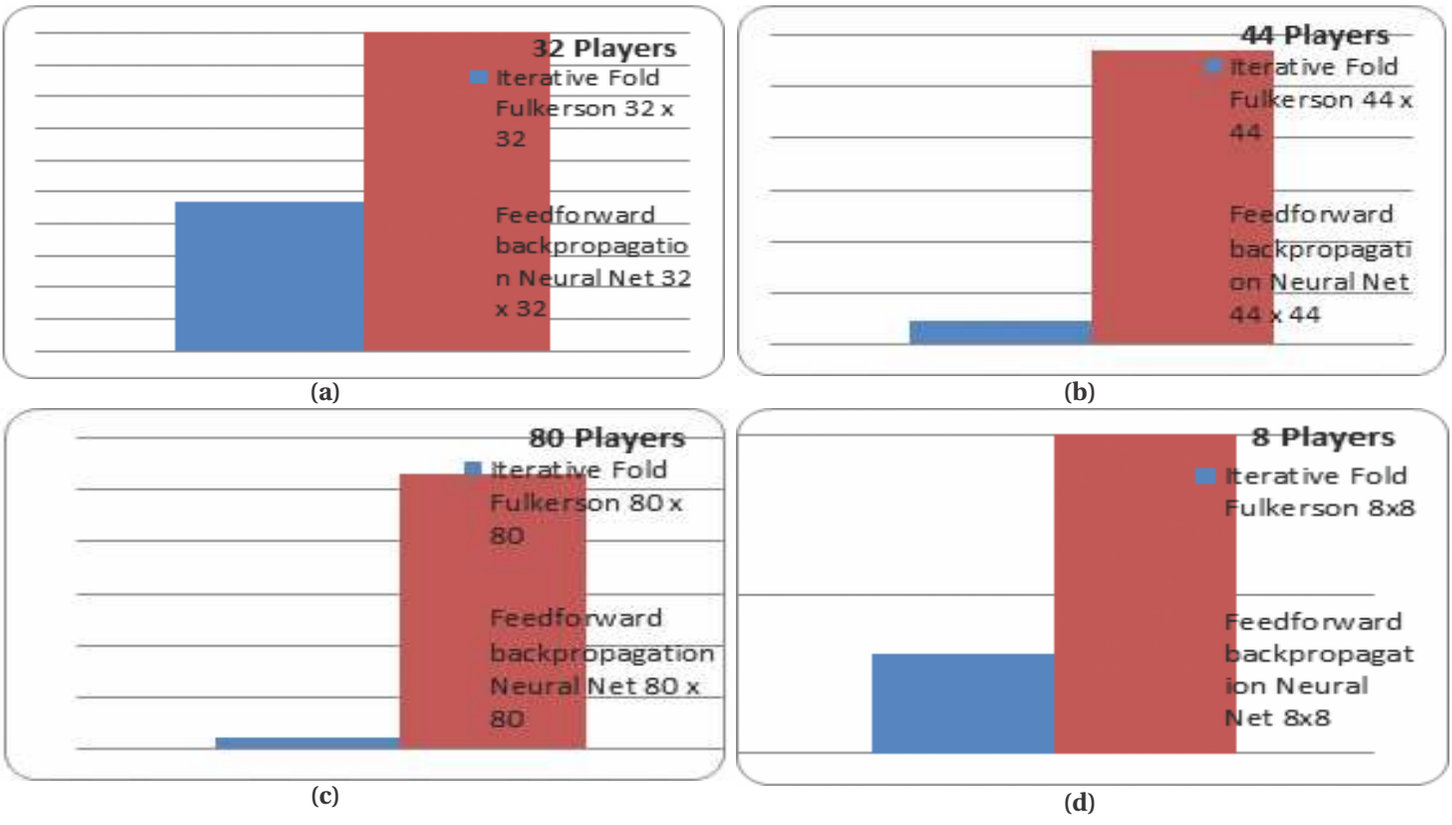

Figure 6.2 MSE comparison of two strategies for computing flows of supply chain with 8 players

Iterative Fold Fulkerson methodology is less as compared to Feedforward backpropagation Neural Net strategy (Figure 6.2(a) to 6.2(d)).

ONCLUSION

Balancing the growing needs for better customer satisfaction with changeability of supply chain size in terms of number of material suppliers, growing manufacturing units and distributors is a crucial factor for the success of the business operations. A highly dynamic supply chain in terms of variable number of players requires a quick as well as an efficient means to reflect the changes in the flows in order to meet the required demand of the end customers.

Using one of the two proposed methods for computing the material flows under dynamic supply conditions is a managerial decision and is based on the tradeoff between speed v/s accuracy. Our case study justified through the analysis that time sensitive systems that can tolerate some unmet demand may use maximum network flow graphs and apply Ford Fulkerson algorithm iteratively. Most supply chain management systems however are considered reliable if they meet target demand requirements more precisely. Neural network modeling therefore has been a better strategy with lower mean squared errors between desired and actual supplies according to the experiment results. To mathematically compute the performance difference between the two approaches is left for further research.

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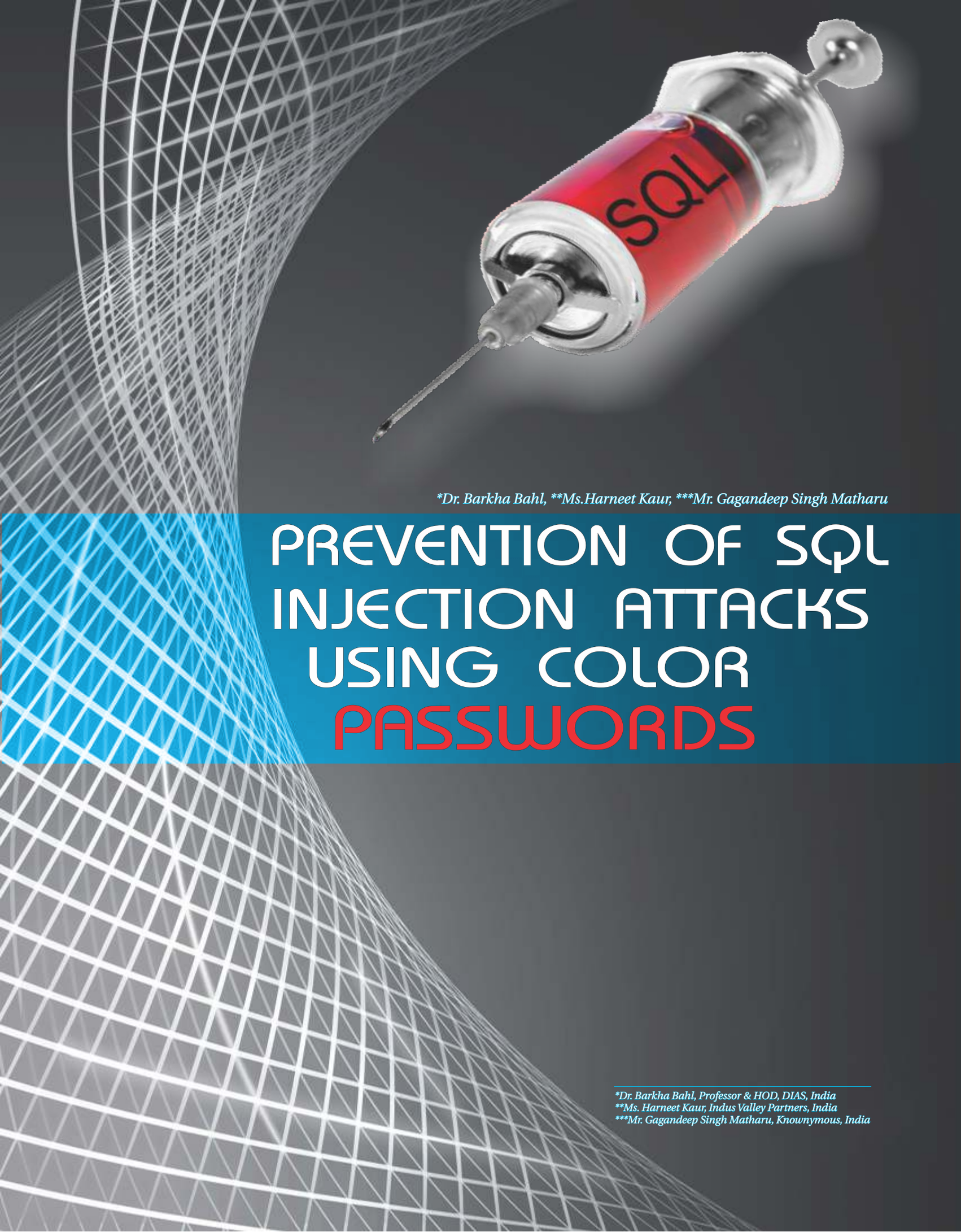

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PREVENTION OF SQL INJECTION ATTACKS USING COLOR PASSWORDS

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ABSTRACT

The biggest challenge nowadays is to secure the website against cyber-attacks. Structured Query Language Injection Attack(SQLIA) is one of the most critical cyber-attack. As a result of SQLIA an attacker can have the access control on the database of an application and accordingly can make changes in the critical data stored on the database server of the website. Authentication plays an important role in securing critical data. Generally, alphanumeric passwords are most commonly used for authenticating users in computer systems but they are highly prone to cyber-attacks. However, graphical authentication systems have been proposed as a relevant and possible alternative solution to the traditionally used text-based (alphanumeric) authentication and the idea is motivated particularly by the fact that human brain has the ability to remember images better than text. Graphical passwords are mainly created by clicking or dragging activities on the pictures or certain parts of a picture rather than conventional typing of textual characters. The main objective of the paper is to highlight the various SQL injection attacks and SQL injection vulnerabilities on website databases, to study and analyse existing authentication systems and to propose a secure mechanism of authentication through colour code graphical passwords.

To enhance the security of colour passwords, an encryption algorithm has been proposed keeping in mind the vulnerabilities that existed in earlier techniques. The proposed encryption algorithm is called "Colour Matrix Map" algorithm. This algorithm provides a method to protect against SQLIA. The proposed algorithm has been tested for its efficiency and security by rigorous testing on various applications.

Keywords: *SQLIA - SQL Injection Attacks, User Authentication, Vulnerability, Graphical Passwords, Color code passwords, Web Security, Encryption, Color Matrix Map Algorithm, Website Databases.*

INTRODUCTION

Web applications have become one of the most important communication channels between service providers and clients but these web application databases are easy targets of sophisticated hackers. The increasing frequency and complexity of web based attacks has raised awareness among web application administrators of the need to effectively protect their web applications from such attacks (Gandhi et al., 2013). Every web application has an authentication mechanism. A system verifies the identity of the user during the authentication process. It is through this process that the user is allowed to either access a system or an application or an object running in a device.

In simple terms, authentication mainly provides security to the system by allowing only the authenticated user to use the system. Also, adequate authentication provided initially while logging into the system, protects the system from the malicious users. Various user authentication mechanisms are prevalent these days; however, most out of them are vulnerable to SQLIA in some form or the other. The SQL Injection Attacks and their concepts are discussed in detail in section 1.1.

1. Sql Injection Attacks

SQL injection is a technique where malicious users can inject SQL commands into SQL statements intentionally of web page inputs. Injected SQL commands via user inputs can make changes in the SQL statement and hence compromise the security of any vulnerable web application by giving unauthorized access to website databases. SQL injection must exploit some security vulnerability in the application software, for example, if user input is either incorrectly filtered or string literal escape characters are deliberately embedded in SQL statements or user input is not strongly typed and that input gets unexpectedly executed.A successful SQL injection exploit can read sensitive data from the database, modify database data (Insert/Update/Delete), execute administration operations on the database (such as shutdown the DBMS), recover the content of a given file present on the DBMS file system and in some cases issue commands to the operating system.SQL injection is most commonly known as an attack vector for websites' databases but it can easily be used to attack any type of SQL database systems(Gandhi et al., 2013).

Key Concepts Of Sql Injection

SQL injection is a type of software vulnerability that generally occurs when data entered by users are sent to the SQL interpreter as a part of a SQL query. For example, by entering an expression such as 'or 1=1' appended to the input string of username will always execute to value 'true' and hence in most cases will trigger the backend operation of the databases and user will be able to bypass the authentication without entering a valid user id and password as shown in fig. 1.

Attackers deliberately provide specially crafted, malicious input data to the SQL interpreter and exploit the interpreter to execute malicious commands in such a way that the

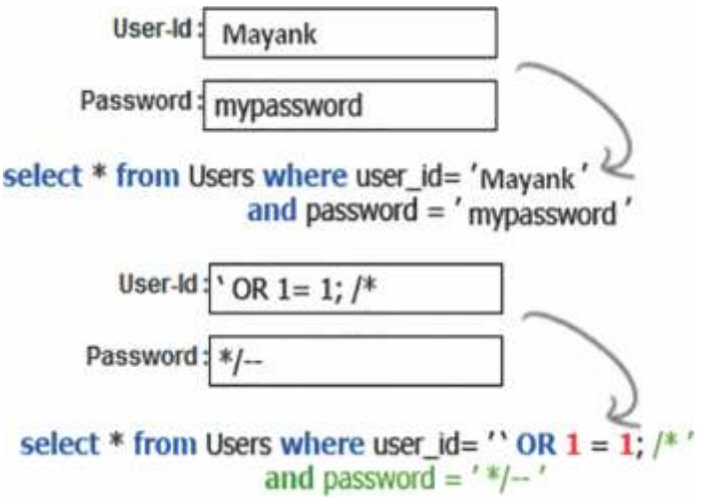


Fig. 1 Example of SQL injection using query string

interpreter is not able to differentiate between the actual commands and the attacker's specially crafted data. The interpreter then executes the SQL injection and exploits the security vulnerabilities at the database layer of a system (Gandhi et al., 2013).

SQL injection attacks allow attackers to spoof identity, tamper with existing data, cause repudiation issues such as voiding transactions or changing balances, allow the complete disclosure of all data on the system, destroy the data or make it otherwise unavailable, and become administrators of the database server. By exploiting the system's vulnerability, attackers can bypass authentication and then create, read, modify, or delete sensitive data. These types of attacks were found easier to trigger for systems which use textual passwords. Hence to overcome this, Graphical passwords were proposed as one of the solution for preventing the SQLIA. The brief idea about graphical passwords is given under section 2.

2. GRAPHICAL PASSWORDS

A graphical password is an authentication system that works by allowing the user to select from a given set of images, patterns, etc. in some specific order, present in front of the user in a graphical user interface (GUI). For this reason, this approach is sometimes also called as graphical user authentication (GUA). A graphical password is easier to remember for most of the people than a text-based password. Graphical passwords may provide better security when compared to text-based passwords because many people, in order to easily memorize text-based passwords, use easy, plain words (rather than the recommended jumbled up combination of characters) which is always easier to interpret (Fulkar et al. 2012).

3. LITERATURE REVIEW

There exist various techniques under SQLIA which can be used to get unauthorized access to any database system.An attacker can get access to confidential information available on the website's database server and can exploit the database. This is generally caused due to vulnerability of SQL in Relational Database Management System which results from

Table 1: Various SQLIA, Their Impacts and Risk

S.NO.	SQLIA	IMPACT	IMPACT OF ATTACK ON WEB APPLICATIONS
1.	Generate errors to display database table fields.	Enumeration of backend database table fields which assist in building further attacks	Medium Risk
2.	Login without authentication.	By pass authentication, unauthorized access to the application.	High Risk
3.	Bypass authentication.	Unauthorized access.	High Risk
4.	Bypass authentication using numeric input fields.	Bypass authentication, unauthorized access.	High Risk
5.	Create users on the database machine using stored procedure insertion description.	Unauthorized execution of arbitrary commands	Medium Risk
6.	Second-order SQL Injection.	Changing of the administrator password.	High Risk
7.	Insertion when input data length is fixed.	Execution of user specified commands.	Medium Risk.
8.	Evade logging in SQL.	Bypassing logging mechanism resulting to undetected SQLIA.	Medium Risk
9.	Insert injection.	Retrieval of unauthorized data from the database.	Medium Risk

inappropriate programming practices (Singh et al., 2012). The various types of SQL Injection Attacks are discussed in section 3.1.

SQLIA Approaches & Their Impacts on Web Applications (Singh et al., 2012):

A SQLIA takes place when an attacker endeavours to change the logic, semantic or syntax of a legitimate SQL statement. This is done by inserting new SQL keyword or operators into the SQL query through a web application interface that are accomplished in a back-end database of a web application. An application is said to have SQLIVs (SQL Injection Vulnerabilities), when SQL queries are generated by using some implementation language (e.g., Java Server Pages or JSP) and the incorrect inputs supplied by the user become part of the query generation process without proper validation checks of the input data. These vulnerabilities can be exploited through SQLIAs, which might cause unexpected results of authentication by-passing which can give any malicious user the unauthorized access and information leakage where sensitive information may be misused (Singh et al., 2012) .

Various different SQLIA along with their impacts and degree of risk on web applications has been summarized in the following table (Orso et al., 2006):

The above discussed advanced SQLIAs are few identified attacks which need to be prevented from all web based databases. One

such prevention measure being suggested is to implement graphical passwords for user authentication. There are majorly two classified password techniques, one is recall-based and the other is recognition-based. The legacy textual passwords are mainly recall-based techniques where the user has to remember the alphanumeric password string. Recognition-based techniques were later on proposed as a better alternative (Tajpour et al.,2010). Majorly, all graphical password techniques are recognition based where the user has to recognise the password from a given set of images. Under this study, it was found that graphical passwords can play an important role in minimizing the vulnerability of databases. Few of these techniques are discussed in section 3.2.

Graphical Password techniques

A graphical password is a technique that requires users to select a predetermined image or set of images on the visual display presented in a Graphical User Interface. A user is authenticated if the user enters some images only in a particular sequence. This feature is based on easy recognition of pictures by humans and can be effectively used for authentication. Users can select elements appearing on a screen as part of their graphical password (Kimwele et al., 2010).

Various different graphical authentication password techniques are available. They are discussed under section 3.3. Various weaknesses were observed in the stated techniques and hence to overcome those weaknesses, a new technique of COLOUR MATRIX MAP has been proposed.

Types of Graphical Passwords

Various techniques were well studied and analysed as below:

Déjà vu Authentication Technique

Déjà vu Authentication Technique is a recognition based authentication technique(Sonkar et al. 2012), which authenticates a user through their ability to recognize images that were previously shown to them. Deja Vu is based on the observation that humans have an excellent memory for

images. Using Deja Vu, users first create an image portfolio for themselves, by selecting a subset of images out of a given set of sample images. Then to authenticate the user, the system presents a challenge set, consisting of 'n' images. This challenge contains 'm' images of the portfolio and the remaining 'n-m' images are decoy images. To get authenticated, the user must correctly identify the images which are part of the portfolio. Deja Vu technique is carried out in three phases: portfolio creation, training, and authentication. A trusted server stores all portfolio images of each user. Since each image is derived directly from the seed, the server only needs to store the seed and not the entire image.

The weakness observed in this system was that there is a considerable server memory overhead since it has to store different set of images for each user, also a larger image set may not be easy to remember for the user. Memory overhead is a major concern and it was much needed to be handled efficiently.

Colour Image Gallery

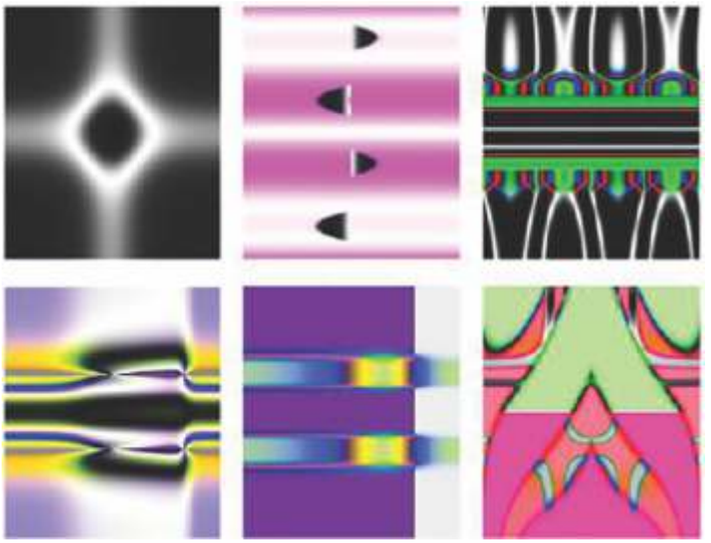


Fig 2: Sample set of image portfolio

Another recognition-based technique under study was Color Image Gallery. This technique is previously prevalent among web systems. In this technique, the user is required to select random image colour blocks at the time of registration/sign-up(Sonkar et al. 2012). It means suppose that user has selected first colour image block as Red, Second colour image block as Black and Third colour image block as Yellow. This sequence on colour blocks selected by the user gets stored in the database as that user's password and the user then must remember it to login each time into the system. But certain shortcomings were noticed in this system as this system stores the exact color images, it is still vulnerable to SQLIA to some extent that if this database gets hacked, the colour passwords can still be retrieved. This system lacks encryption of passwords.

Pass doodle

Pass doodle (Fulkar et al. 2012)is a recall-based technique. It is a technique that has handwritten drawing or text, which is normally sketched with a stylus over a touch sensitive screen as shown in Fig. 3 below. It shows that users can easily recognize a complete doodle password as accurately as they would have recognised any of the text-based passwords. After in-depth study of this technique it was found that this mechanism has certain weaknesses in a way that it is vulnerable to attacks such as key-logger, shoulder surfing, guessing, spyware, etc. and can also be a little difficult to reproduce the exact drawing/sketch each time.

Fig 3: Example of Pass doodle

Picture Password

This technique of picture passwords(Jansen et al., 2003) was designed especially for handheld mobile devices such as PDAs, etc. In this technique the user is first asked to select the theme (e.g. sea shore, cat and dog, etc.) which consists of a set of small thumbnail photos. Then the user selects and registers a sequence of the selected thumbnail photos to form the password. The user needs to recognize and identify the previously seen photos and either click it or touch on it in the correct sequence using a stylus in order to be authenticated.

Fig 4. Cats and dog theme for picture password scheme

The major drawback of this scheme is, as the number of thumbnail photos in this technique is limited only to 30, the number of possible password combinations is considerably

small. A numerical value is assigned for each thumbnail photo and the sequence of selection of these thumbnails will produce a numerical password. This numerical password is generally shorter than the length of textual password. To overcome this problem a user can select more than one thumbnail photo as one single combined action or as one composite password in order to create and increase the size of the password length. However, this makes it a complex password which becomes difficult to remember for the human brain and also there is some extra memory overhead as it needs to store thumbnails based on various different themes.

Passfaces

An interesting technique that used human face images as passwords had been previously existing is named as Passfaces. Based on the assumption that humans can recall human faces easier than other pictures, Real User Corporation has developed their own commercial product named Passfaces TM (Fulkar et al. 2012). Basically, Passfaces works as follows:

Users are required to select the previously seen human face from a grid of nine faces one of which is known while the rest are just decoys. This step is continuously repeated until all the four faces are successfully identified.

Fig. 5 – Passfaces TM

A comparative study was carried out by Real User Corporation as proof of concept in which 34 people were involved in the test and it was shown that, it was easier to remember Passfaces password as compared to textual passwords for human beings. But the results also showed that Passfaces took a much longer login time in most cases than textual passwords (Sonkar et al., 2012).

Passlogix

Passlogix Inc. is a commercial security company located in New York City, USA. The scheme proposed by them is called Passlogix v-Go (Fulkar et al. 2012) which uses a technique known as "Repeating a sequence of actions" which means creating a password by a sequence. In this scheme, users can select background images of their choice based on the environment or scenarios, for example image of the kitchen, bathroom, bedroom, etc. then to enter a password, user can click and/or drag on a series of items within that image. For example in the kitchen scene, user can prepare a meal by selection of certain cooking ingredients, then the click action of taking out food from refrigerator and putting it in the microwave oven, selection of some fruits and washing them in washbasin and then putting it in a clean bowl. The sequence of these actions together may form a person's password.

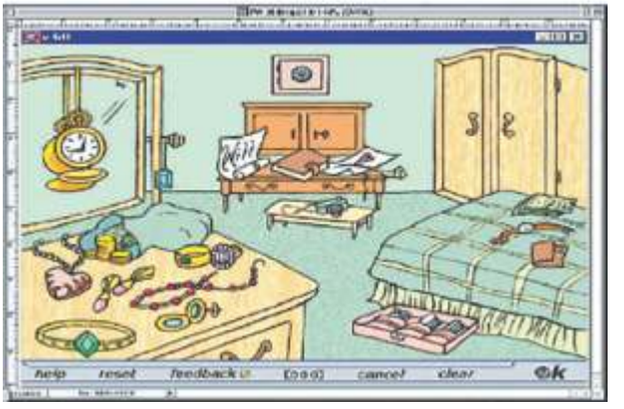


Fig. 6 - Passlogix scheme

This technique of Passlogix authentication system is easy to remember for the user since it is very logical. But, on the other hand, there are some disadvantages of this scheme i.e. the number of possible passwords are small. There are limited places that one can take vegetables, fruits or food from and put into, therefore, these results in making the passwords to be somewhat guessable or predictable.

Pass-Go

Last but not the least, another technique taken under study wasPass-Go(TAO, 2006) that can be considered as an improvement of DAS (draw – a – secret technique, as it keeps most of the advantages of DAS and provides stronger security and better usability. These improvements are believed to arise from the innovative design.

A simple teaching management system was developed on an Internet website, through which students could access their grades and study materials by logging in with Pass-Go

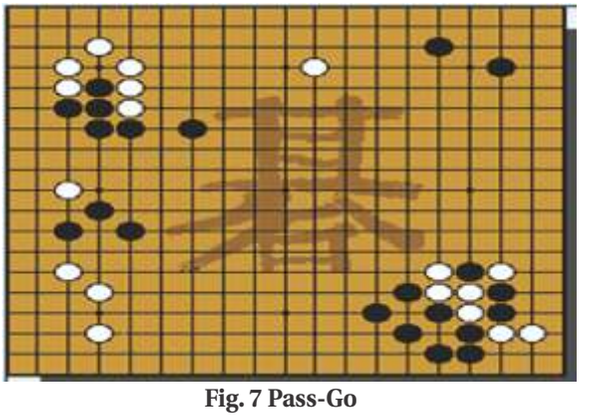


Fig. 7 Pass-Go

passwords. This was a system where Pass-Go technique was applied and tested previously. Major concern with this type of graphical passwords is that the registration process and log-in process which take longer time than in text-based passwords. During the registration process, the user picks image portions of different colours from a set of selections to make a colour graphical password. During authentication, the user has to identify the images and this process can be tedious and take long. The need for higher security can override the long and tedious process of registration in graphical passwords. Graphical passwords because of their sizes require more space than text based passwords. The pictures also have to be maintained in a centralized database which implies that network transfer is an area of concern for graphical passwords. However, with the high computer storage space and increased bandwidths, this concern about graphical passwords is no longer a serious issue (Kimwele et al., 2010).

After studying the above discussed techniques, identifying their weaknesses and in order to make further developments on Graphical Passwords, a new authentication technique called Colour Matrix Map to provide a better mechanism of protecting web application databases from the severity of SQL Injection Attacks has been proposed.

The problem of memory overhead identified in Déjà vu technique (Sonkar et al., 2012) has been overcome in the proposed system of COLOUR MATRIX MAP, which uses considerably less space to store the user passwords as it stores a commonly shared grid structure for all users. The Colour Image Gallery (Sonkar et al., 2012) technique lacked the encryption of password. This shortcoming has been overcome in the COLOR MATRIX MAP algorithm as the proposed algorithm comes with an encryption technique. The proposed technique also caters to the problem that was faced in Pass-doodle technique of authentication. Pass-doodle was prone to certain attacks like key-logger, shoulder surfing, guessing, spyware, etc.(Fulkar et al. 2012). The proposed COLOUR MATRIX MAP algorithm can prove to be a better alternative technique than techniques like Pass-faces and Passlogix since it makes the login process much faster when compared to other techniques.

The following table highlights and summarizes the weaknesses of each of the previously proposed techniques and how this new proposed system "Colour password technique and its security through Colour Matrix Map" provides counter measures for each of the weaknesses:

Table 2: Weaknesses of previously proposed techniques and their counter measures in the proposed scheme

S.NO.	Previously Proposed Technique	Weaknesses	Counter measures by the proposed Technique
1.	Prevention of SQLIA through Hashing Techniques	-Uses textual passwords only -Vulnerable to various different attacks like dictionary attacks, key logs, spyware, etc. -Hash functions are difficult to implement	Colour password proposed Easy to remember Safeguards from dictionary attacks , brute force, SQLIA Easy to implement algorithm
2.	Authentication using Images - Déjà vu technique (Sonkar et al., 2012)	-Uses image portfolios -Server memory overhead as it has to store different set of images for each user -Not easy to remember	Uses same colour set for each user Minimum memory requirements
3.	Graphical password authentication scheme based on colour image gallery	-Can be still vulnerable to SQLIA -Database can be hacked and colour passwords can be retrieved	Encryption of colour passwords.
4.	Pass-doodle (Fulkar et al. 2012)	-Vulnerable to attacks such as key-logger, shoulder surfing, guessing, spyware, etc. -Difficult to remember	Easy to remember -Safeguards from key-logger attacks
5.	"Picture password"- Passcode (TAO, 2006)	-thumbnail photos are limited only to 30 -thumbnails converted to numerical passwords, shorter in length -memory overhead as it needs to store thumbnails based on themes. - it often becomes difficult to memorize the complex password.	Colour block set can be increased as required No conversion into numerical
6.	PassFace Technique(Fulkar et al. 2012)	Takes much longer login time	No extra login time
7.	PassLogix V	Easy to guess logical sequence of events size of password space is small	No easy guessing
8.	PassGo (TAO, 2006)	Difficult to implement Pixel calculations involved	Easy implementation

Proposed Authentication Technique – COLOR MATRIX MAP:

A new password technique of Colour Codes along with its encryption algorithm has been proposed. When the user selects the colour password while registering to any web application, the colour password gets encrypted using colour matrix map algorithm and gets stored in the database. The encryption algorithm that has been designed is simple to implement yet difficult to break using attacks like eavesdropping, dictionary attacks, social engineering, etc. The proposed encryption algorithm is called "Colour Matrix Map" algorithm. The user must remember the colour code in order to login into the system. The introduced system has been tested for its efficiency and security by rigorous testing on various applications. The proposed algorithm is given in section 4.1 followed by its flowchart and algorithm design.

4. Proposed Algorithm:

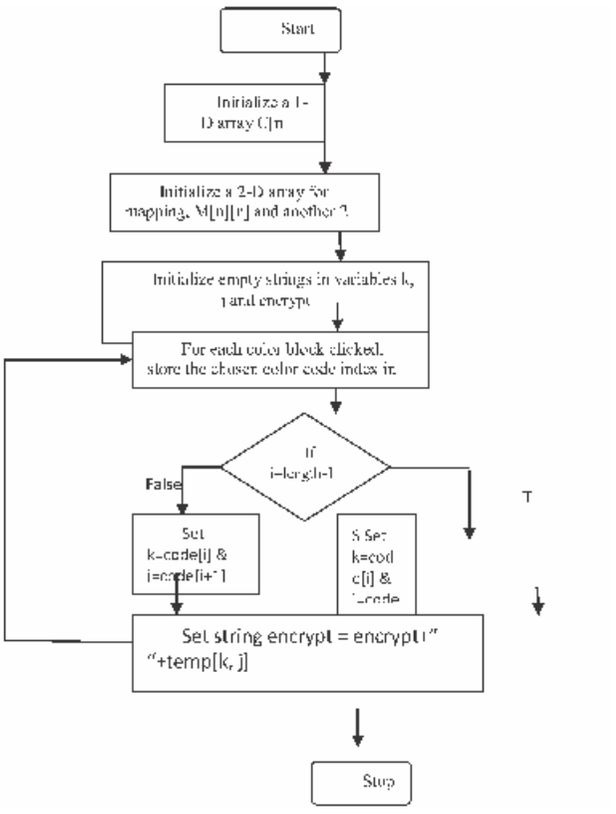
```
Step 1: Start
Step 2: Initialize an 1-D Array C[ n]

Step 3: Initialize a 2-D Matrix for mapping M[n ][n ] and a temporary matrix temp[ ] [ ]
        Initialize strings k, j and encrypt

Step 4: For each colour block clicked
                Store the chosen colour code index in another char array code[ ]
Step 5: For i=0 to (no. of selected blocks) Repeat steps 6 and 7
Step 6:         Check if (i == length -1)
              then  k = code[i]
                    j = code[0]
               else
                    k = code[i]
                    j = code[i + 1]

 Step 7: Set string encrypt = encrypt + " " + temp[k, j];
Step 8:  Stop
```

Flowchart 1. Algorithm:



Algorithm Design:

The algorithm proposed is an easy-to-implement algorithm. The algorithm aims at encrypting the colour code chosen by the user at the time of registration. The process of choosing the colour password in the system is that at the time of registration the user has to enter the User ID and for the password, there is a set of colour blocks provided to the user. For example: the colour blocks are provided to the user in the following sequence as shown in Fig. 8, the colours are stored in a 1-Dimensional array named C in the algorithm, with the array indices as inscribed on them.

Fig. 8 Array C

The user has to choose randomly the colour blocks in any sequence. The user has to remember the entered colour password. The colour blocks selected are stored as string of colour names in the database. The encryption algorithm is applied at the server code. For simplicity of explanation, six different colour blocks have been considered at present. The number can be increased as per the requirement. At the backend, a 2-Dimensional COLOUR MATRIXof 6*6 colour blocks named M has been created as shown in Fig. 9.

Fig. 9 COLOUR MATRIX M[ ] [ ]

The colours in the matrix are so arranged that each colour appears once in each row and once in each column. Each colour block shows the index value (i, j) of that array element inscribed on the block. This algorithm manipulates the above 2D matrix to encrypt the colours chosen.

Working of the Algorithm: The detailed working of the above mentioned algorithm is explained below:

Considering the sample registration form of a web application below in Fig. 10

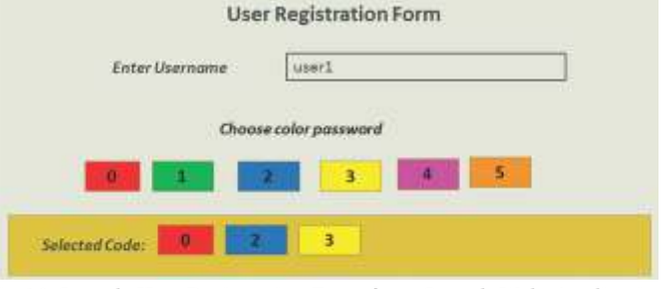


Fig. 10. Sample User Registration Form from Sample Web- Application

Considering the above example, suppose the user has selected the 1st colour as Red which is at the array index 0, 2nd colour as Blue with array index 2 and then the user selects the 3rd colour to be Yellow with the array index 3.

Now the colours selected are first translated into an array of characters named C[ ] which represent the index of each of the selected colour block i.e "023", C=[023] in this example.

Applying Encryption:

To apply encryption, 6*6 colour matrix M[ ][ ] has been considered,

Fig. 11 Color Matrix M[][]

STEP 1:

To encrypt the first colour block, we have used the index value of first and the second colour as in the 1D array C shown in Fig. 12.

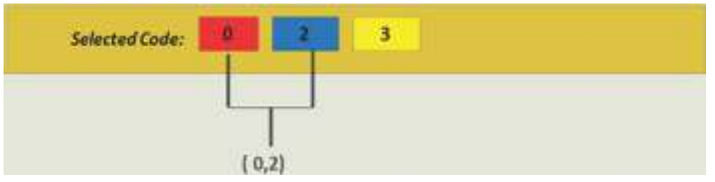


Fig. 12 Encryption Step 1

The first colour block index in array C forms the i, and the second colour code index in array C forms j. This (i, j) is then mapped to the (i, j) Th element in the 6*6 matrix M.

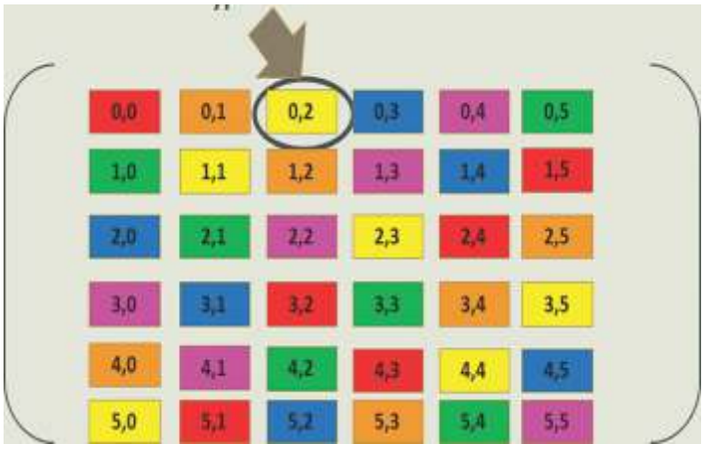


Fig. 13 Encryption mapping in Step1

Encrypted colour pattern at the end of step1 is shown in Fig. 14.

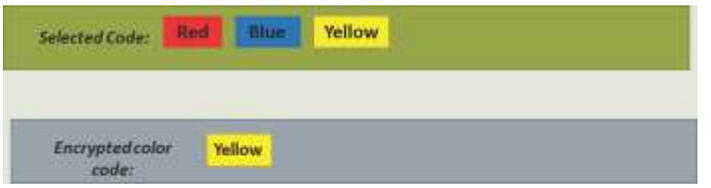


Fig. 14 Pattern at the end of step1

STEP 2:

To encrypt the second colour block, we have used the index value of second and the third colour as in the 1-D array C shown in Fig. 15.

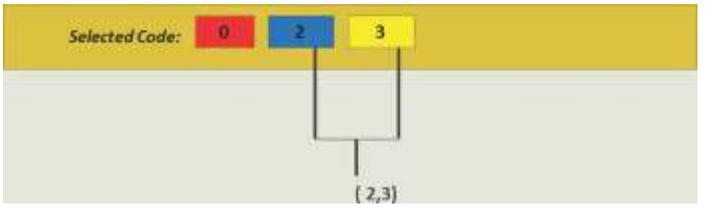


Fig. 15 Encryption Step 2

The second colour block index in array C forms the i, and the third colour code index in array C forms j. This (i,j) is then mapped to the (i,j)th element in the 6*6 matrix M.

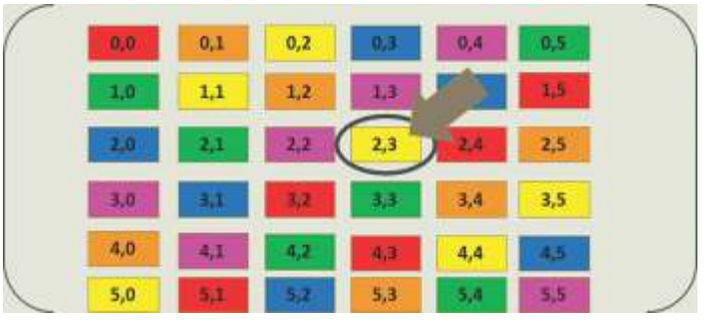


Fig. 16 Encryption mapping in Step2

Encrypted colour pattern at the end of step 2:

Fig. 17 Pattern at the end of step 2

STEP 3:

To encrypt the third colour block, we have used the index value of third and the first colour as in the 1-D array C shown in Fig. 18:

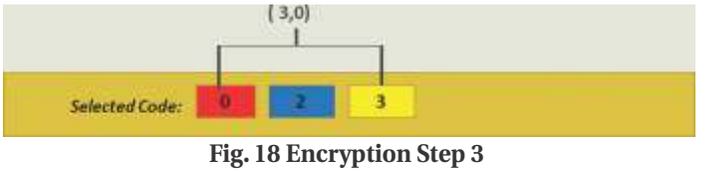


Fig. 18 Encryption Step 3

The third colour block index in array C forms the i, and the first colour code index in array C forms j. This (i,j) is then mapped to the (i,j)th element in the 6*6 matrix M.

Fig. 19 Encryption mapping in Step 3

Encrypted colour pattern at the end of step 3 is shown in Fig. 20.:

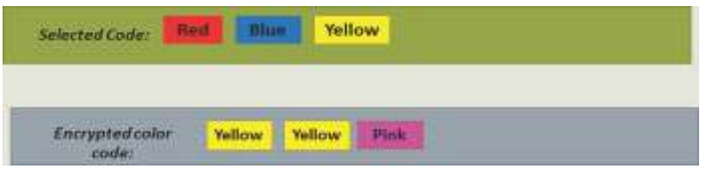


Fig. 20 Pattern at the end of Step 3

Hence, after encryption the colour password that goes into the database is:

YELLOW YELLOW PINK

Note: The number of steps for the algorithm depends on the number of colour blocks chosen by the user. And the number of encrypted colours will be same as the number of chosen colours.

It is advisable to choose maximum number of colour blocks (in this example it is 6) for creating a secured password

Application of Algorithm:

The algorithm of COLOR MATRIX MAP technique when applied to any application can be better understood through the following flow chart for web application:

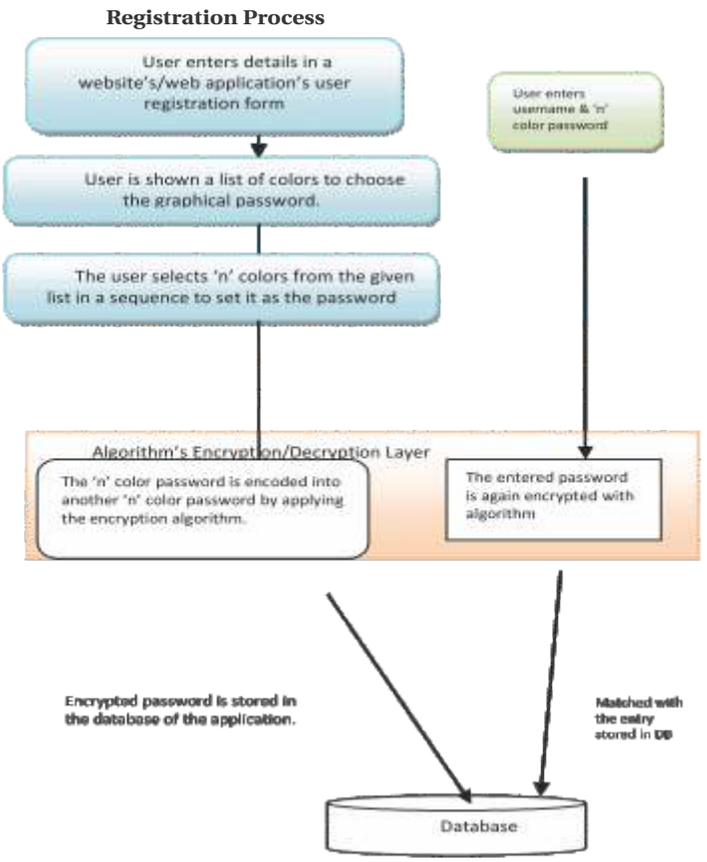
The above flow-chart explains the simple application of the algorithm and the interaction with the database through the encryption layer.

The process explains the flow right from the time when the user registers for the first time with the web application and when the user comes back to login into the system each time.

The application of the proposed algorithm has been shown with relational database for simplicity but this can be efficiently applied on other types of databases such as object oriented databases, etc. as well.

ESTING METHODOLOGY

The proposed algorithm was implemented and tested on a simple web application, which was created on .NET platform that supported 50-100 users. While testing, the algorithm was applied using six color combinations in the selection grid of COLOR MATRIX. Around thirty five dummy user accounts were created for the application and the user details where stored in the underlying database that was SQL server. The



Flow-chart II: Web Application

application's login screen provided the option to enter the color password. The sample application was rigorously tested by hitting various SQL Injection queries through the Login screen. But it was seen that due to the absence of textbox to enter string based literals as password the SQL Injection attacks were unsuccessful on the application. To test it to the next level, the application's database was then exposed to a tester. Getting access to the database which contained the encrypted passwords, the tester was unable to decrypt the color coded passwords into actual user passwords. Hence this very easily proved that the COLOR MATRIX MAP algorithm was a secure graphical password technique that can replace legacy string based passwords.

ONCLUSION:

After the in-depth analysis of various SQLIA and existing graphical password techniques, the identified weaknesses have been overcome in the proposed technique of colour passwords along with its secure encryption mechanism.

The proposed system has the advantage that even if somehow the hacker gets access to the database entries. The hacker can see the colour passwords in their encrypted forms and the hacker might get fooled by this trick and try the retrieved combination, but his attempts would fail. It is observed that this type of graphical password is easy to memorize. Since colour passwords do not require providing text fields to enter passwords, the chances of SQLIA and the loop holes get

eliminated to great extent. This encryption algorithm provided counter measures to weaknesses of previous techniques like avoiding memory overheads, increased number of possible combinations of passwords, etc. The "Colour Matrix Map" is simple to understand and implement hence even a beginner programmer can implement the algorithm code.

Analysis of the Proposed algorithm

The strength of the proposed algorithm lies in the fact that it can easily withstand various common attacks like dictionary attacks, brute force attacks, key logger attacks, etc.

The following calculations to analyse the proposed scheme were done: Since we have taken only 6 colour options for creating the password, and we have applied the restriction that the user can at most choose 6 colours. Colours can be repeated. User can choose single colour password, 2 colour passwords, and 3 colour passwords and so on till 6 colour passwords. So it has been analysed that the total number of passwords options can be:

(6^6)+(6^5)+(6^4)+(6^3)+(6^2)+(6^1) = 55986

So, we can conclude that it is difficult to apply brute force attacks, guessing attacks as the hacker will need to try 55986 combinations of colour passwords which are not easy to do.

Hence, we can say that this algorithm is quite efficient and could not be broken easily.

UTURE SCOPE

The efficiency of the proposed system has been well analysed and tested on a dummy web application with few hundred users and this algorithm is found to work very well for small and medium sized web applications since these kind of web applications have around few hundreds to few thousands of users. The database retrievals are efficient for such small scale applications. Future work can be done in this area for using advanced colour schemes for generating colour codes. These techniques canbe applied to large sized web applications with millions of users like mailing services, social network sites, etc. For that purpose, bigger colour pellets can be used to give a bigger range of choice. This will result in increasing the matrix dimensions as well. But this can provide further enhanced security features.

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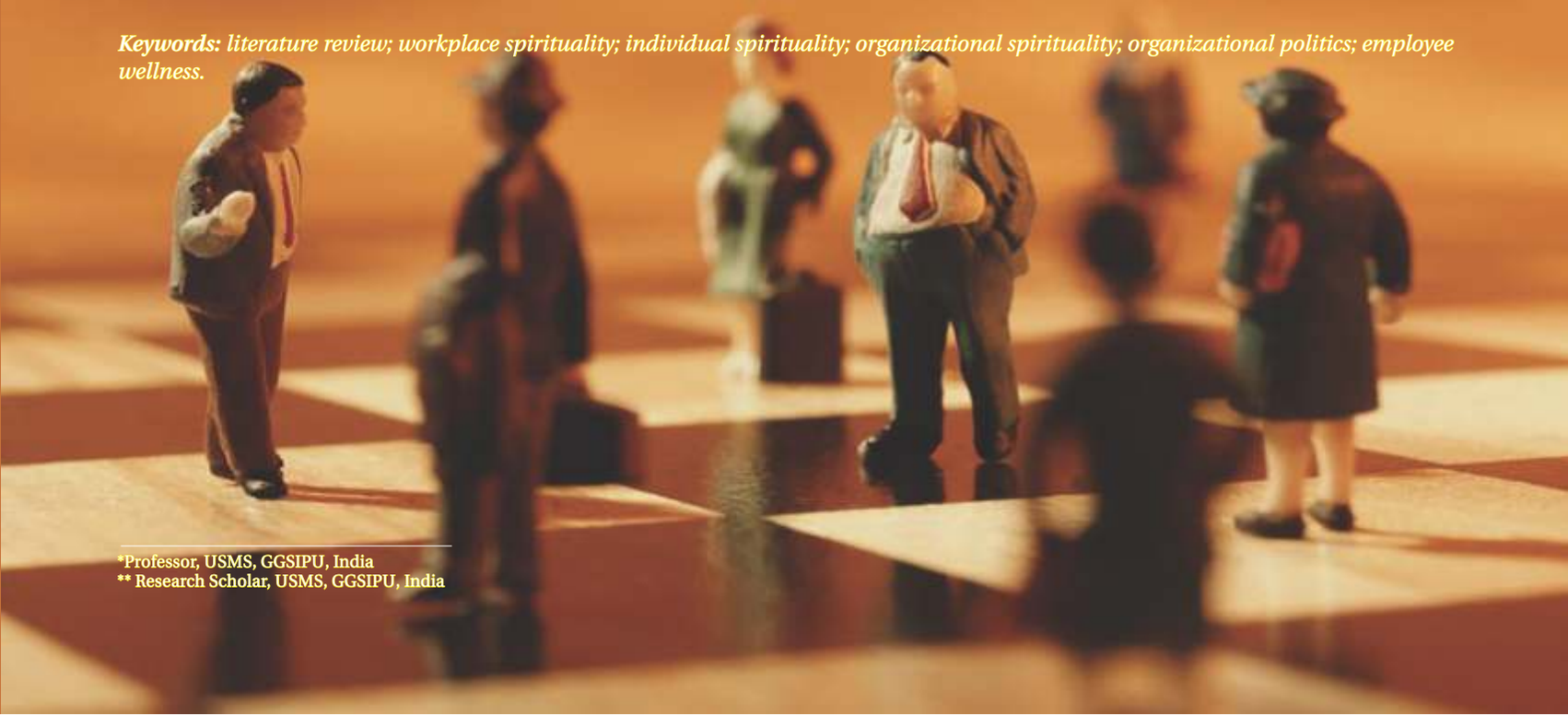
Workplace Spirituality, Organizational Politics and Employee Wellness: A Research agenda

ABSTRACT

Spirituality in workplace has caught snowballing attention of the popular literature and organizational practitioners; however it still is far away from being considered an established theory in management sciences. Although there are innumerable articles available on workplace spirituality, still it lacks a comprehensive definition and elucidation of the concept owing to the complexity of the construct. In this article, the authors review various literature streams to explore what dimensions and attributes are considered to be important and effective in terms of practical applications of spirituality in the workplace. It also provide a conceptual framework that covers the research in workplace spirituality and its relationship with the comparatively under-researched constructs of organizational politics and employee wellness. The paper concludes with a discussion on the gap areas across the various research domains and a discussion of the important areas for future research.

Keywords: *literature review; workplace spirituality; individual spirituality; organizational spirituality; organizational politics; employee wellness.*



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INTRODUCTION

As far as the human history is concerned, spirituality has occupied a significant place in the lives of human beings. Beliefs and practices relating to some higher power, authority, or presence beyond the physical plane have always formed a part of most civilizations and cultures. Furthermore, it has become important to distinguish religion from spirituality as recently many people have begun to define themselves as "spiritual, but not religious".

The spiralling interest in spirituality in corporations and businesses around the world is apparent and manifested through various theoretical and methodological attempts by organizational consultants (Barrett, 2003). The Corporate world is gradually realising the spiritual side of individuals and their immense potentials (Ashmos & Duchon, 2000; Giacalone & Jurkiewicz, 2003; Kolodinsky et al., 2007; Marques et al., 2007; Mitroff & Denton, 1999). The soaring importance of workplace spirituality can be mapped by the launch of innumerable spirituality courses in management studies and social sciences; roaring sales of bestsellers like 'Spiritual Audit of Corporate America' (Mitroff and Denton, 1999), 'Spirit at Work' (Conger, 1994), Corporate America (Whyte, 1994); special issues of renowned journals such as the Journal of Organizational Change Management (1999& 2003), Journal of Management Inquiry (2005) and the Leadership Quarterly (2005). Furthermore, a separate unit was created to focus on increasing interest in spiritual issues - the 'Management Spirituality and Religious Interest Group' (MSR Group) within the 'American Academy of Management' in 1999 (Brown, 2003).

Literature is interspersed with the ideas about why there has been such immense interest in workplace spirituality and grown so widely in recent times. Unprecedented and ever-increasing instability in organizational settings (Mitroff, Mason and Pearson, 1994), caused by innumerable factors, have trickle-down effects that are widespread and genuinely felt by most of the workers (Pfeffer, 1998). However, in spite of the increasing interest, not much theoretical development has been achieved until now. Most of the perspectives in the field has been primarily subjective, conceptual, or theoretical in nature (Lund Dean, 2003). Scholars believe that much of the interest in spirituality as an academic topic has grown perhaps as a result of the confluence of different events. The growing attention in the past one and a half decade was focused on investigating the association between workplace spirituality and myriad benefits it brings to the organization (Biberman & Whitty, 1997; Mitroff & Denton, 1999; Giacalone & Jurkiewicz, 2003). The focus of most of the research indeed has been in the direction of examining the benefits it brings to the organizations and how workplace spirituality has developed into a distinct area of study.

This literature synthesis aims at exploring the existing literature stream on spirituality at workplace and attempts at bringing together various views on the meaning, definitions and dimensions of spirituality and how it is perceived at varied levels of expression such as individual, team and at the organizational level. This research aims to explore and discuss a variety of researches undertaken on the motley potential benefits and negatives related to its manifestation in the workplace. This article primarily focuses on identifying the gaps in the studies within and across different research streams and develop a theoretical framework that covers the research on workplace spirituality and its relationship with the other much researched organizational constructs like employee wellbeing and organizational politics. The relationship propositions based on our literature review may certainly be useful in directing important avenues of future research.

ETHODOLOGY

The authors conducted an extensive exploration of prior literature, utilising a range of online databases to shortlist an all-inclusive and its associations with other organizational constructs to study. In addition, we also hunted Google Scholar for studies that included any of the below mentioned key terms. The databases used were:

Emerald Fulltext; Elsevier's Business, EBSCO host and Research Gate Besides, a few published and unpublished theses from *UMI Proquest dissertation* databases were also studied for further insights.

The key terms used for reaching out the included articles for this paper from amongst the various journals are:

Spirituality, Workplace Spirituality, Spirit at work, Spirituality at workplace, organizational spirituality, dimensions of spirituality, spiritual values, organizational values, transcendence, inner life

Additionally, review time was dedicated towards researching the domain of employee wellness and organizational politics.

This paper is organized as follows: Literature relevant to workplace spirituality is discussed first, wherein different aspects of spirituality at workplace as identified in earlier research are discussed, then the notion of spirit at work (individual spirituality) and organizational spirituality and its constituting dimensions are identified. After this, the employee wellness construct, the existing models in the wellness domain and its most important elements are examined. Finally the attempt is made at investigating the relevant literature on organizational politics and its inherent components- both negative connotations as well as positives. The review also explores the linkages between these constructs and presents the proposed theoretical framework for future exploration.

The Concept of Spirituality Review of literature shows innumerable definitions ad perspectives on spirituality. As the term 'spirituality' offers varied meanings to the interpretation by different people, it is quite challenging to have a common, agreeable definition. This part of the study will assess the advancement in conception of the essence of spirituality and especially focus on its association with religiosity.

The word 'spirituality' originates from the word 'spirit' coined from the Latin word 'spiritus' meaning 'breath' – breath of life (Pfeffer, 2000). This implies that spirit is the life-breath which helps in kindling both the singular and organization pursuits with fresh lease of life.

Although the workplace spirituality is gaining attention, still the debate on what constitutes spirituality is a never-ending one. Skelley (1996) explained spirituality as: (i) human ability to seek self-transcendence; (ii) religious part of life to help connect self with otherworldliness; (iii) A specific experience by way of following a particular religion Hindu, Buddhist, Jewish, Christian, Muslim to help creating self-transcendence. Spirituality as defined by King & Nicols (1999) is the search of righteousness, meaning of life, inner strength and connection with other forms of life and a supreme connect. In summation, spirituality is that which comes from inner self, beyond the basic existence of life.

Canda, Nakashima, and Furman (2004) have proposed that the individual spirituality may be expressed through the religious or nonreligious forms; nevertheless the term spirituality embraces religiosity but is not limited to it alone. Garcia-Zamor (2003) reasoned that the basic beliefs in spirituality and religion are similar but not identical and they may or maynot coexist in an office setting; however it is important to appreciate that both are distinct. Anderson (2000) suggested that religion is the path that some choose to nurture their spirit. Much of the literature on spirituality separatedShankar', "Spirituality is like the banana, and religion is like the peel. What's happening is that people are holding on to the peel and throwing away the banana". opposed to adherence to exclusivity, dogmatic beliefs, the concept of spirituality from that of religion (Piedmont, 2001).

According to renowned spiritual leader, Ravi Shankar, popularly known as 'Sri Sri Ravi As rituals and practices in institutionalised religion, spirituality is characterized as an inclusive, self-driven and universal human feeling. Spirituality is considered to have a broader ambit than religion.

Spirituality is looked upon as a private, all-inclusive and a widespread feeling of one universe of human sensitivity, as opposed to adherence to dogmatic beliefs, rituals or practices of a particular religious institution or tradition (Marques, Dhiman and King, 2007).

From the discussion above, it thus is clear that spirituality involves the search of human beings' meaning and purpose of existence, while religion is an organized effort to connect to a higher power or God with aid of rituals and practices. Therefore the researchers postulate that spirituality sans religion is a feeling of self-transcendence which extends beyond the mundane life yet remains connected to it. It must be noted that although historically spirituality has been rooted in religion; the outlook of workplace spirituality is not associated with any particular religion (Korac-Kakabadse et al., 2002).

ONCEPTUALIZING DEFINITION AND DIMENSIONS OF WORKPLACE SPIRITUALITY

After establishing the link between spirituality and religiosity and articulating how "spirituality" will be interpreted in this study, we now need to consider spirituality at workplace. Further review of the key articles

brought up two basic issues; first is how to define spirit / spirituality at workplace and identify its core dimensions and secondly to identify the level at which it occurs - individual/ group/ organisational. We attempt to find appropriate explanation to both these issues by examining prominent empirical studies.

Karakas (2010) reviewed the literature and discovered more than seventy definitions of spirituality at workplace and it is fascinating to note that despite this there still is no broadly established definition of spirituality (Markow and Klenke, 2005). Laabs (1995) specified that it is simpler to elucidate what does not constitute spirituality in business than it is to define what does. He further stated that "defining spirituality in the workplace is like capturing an angel - it's ethereal and beautiful, but mystifying".

Workplace spirituality although considered to be an extremely subjective and philosophical theory, most of the academic explanations concede that it comprises of a sense of entity, deep connections at workplace and work values (Gibbons, 2000). Widely known for their path-breaking study, Mitroff and Denton (1999) have viewed workplace spirituality as an exploration of one's ultimate goal in life, to acknowledge the importance of developing strong ties with co-workers and also have an alignment with the values of the organization. Table 1 gives a snapshot of the various definitions found in literature review.

Table 1: Representative Sampling of Definitions for Workplace Spirituality found in the Literature Review

Definitions given	Source
That vast realm of human potential dealing with ultimate purposes, higher entities, with God, with life, compassion and purpose	Tart (1975)
The human dimension within human experience	Shafranske & Gorsuch (1984)
The human dimension that transcends the biological, psychological, and social aspects of living	Mauritzen (1988)
Our response to a deep and mysterious human yearning for self-transcendence and surrender	Benner (1989)
A subjective experience of the sacred	Vaughn (1991)
A personal life principle which animates a transcendent quality of relationship with God	Emblen (1992)
An inner experience an individual has that can be evidenced by his or her behaviour	McCormick (1994)
Expressing our desires to find meaning and purpose in our lives and is a process of living out one's set of deeply held personal values	Neck & Miliman (1994)

Definitions given	Source
Spirituality is an individual's inner source of inspiration	Dehler & Welsh (1994)
How the individual lives meaningfully with ultimacy in his or her response to the deepest truths of the universe	Bregman & Thierman (1995)
A human attitude consisting of affective, cognitive, and behavioral dimensions	Beazley (1997)
Spirituality in the workplace is about people seeing their work as a spiritual path, as an opportunity to grow personally and to contribute to society in a meaningful way.	Neal (1997)
That which involves ultimate and personal truths	Wong (1998)
The basic feeling of being connected with one's complete self, others and the entire universe	Mitroff & Denton (1999)
Universal aspect of human experience concerned with the search for a sense of meaning, purpose, and morally satisfying relationships with self, other people, the universe, and ultimate reality, however a person or group understands it	Canda and Furman (1999)
The personal experience of ultimate concern	Emmons (2000)
The recognition that employees have an inner life that nourishes and is nourished by meaningful work that takes place in the context of community	Ashmos & Duchon (2000)
Workplace spirituality involves positively sharing, valuing, caring, respecting, acknowledging, and connecting the talents and energies of people in meaningful goal-directed behaviour that enables them to belong, be creative, be personally fulfilled, and take ownership in their combined destiny	Adams and Csiernik (2001)
An individual state of being, the essence of the inner-self, and the part of life that transcends the basic five senses but is as real as the physical realm	Klenke (2003)
A framework of organizational values evidenced in the culture that promotes employees' experience of transcendence through the work process, facilitating their sense of being connected to others in a way that provides feelings of completeness and joy.	Giacalone & Jurkiewicz (2003)
Spirituality seems to point to the intuitive, non-rational, meditative side of ourselves, the side that strives for inner and outer connection and a sense of wholeness	Forman (2004)
Spirituality is a deeply intuitive sense of relatedness or interconnectedness to the world and the universe in which we live	Eckersley (2000)
Some internal substance, belief, attitude or emotion that influence people's behaviour	Moore & Casper (2006)
An experience of interconnectedness and trust among those involved in a work process, engendered by individual goodwill; leading to the collective creation of a motivational organizational culture, epitomized by reciprocity and solidarity; and resulting in enhanced overall performance, which is ultimately translated in lasting organizational excellence	Marques (2006)
Spirituality concerns creating a sense of transcendence, or vocation, through one's work and foster bonds of connectedness between employees experiencing completeness, fulfilment and self-actualization in their work	Gotsis and Kortezi (2008)
Aspects of the workplace, either in the individual, the group or the organization that promote individual feelings of satisfaction through transcendence	Giacalone & Jurkiewicz (2010)

While a precise and universally recognized definition of workplace spirituality has yet not been established, a number of themes have been consistently identified in the course of research. Ashmos and Duchon (2000) recognized and established the theory of spirituality at work by ascertaining its dimensions and its presence at three levels that of individual level, the work- unit level, and the organizational level.

Milliman et al. (2003) based their study on the work undertaken by Ashmos and Duchon. They took three of the seven identified dimensions for the individual level viz., inner life, meaning at work and community. Their research endorses the findings of Ashmos and Duchon (2000) and the authors provide some early critical empirical evidences of the positive impact of workplace spirituality on the employee work attitudes and the organization. Rego and Pina e Cunha (2008) studied the impact of five dimensions of workplace spirituality viz., meaningful work, sense of community, sense of contribution to society, alignment between organizational and individual values and inner life on organization commitment. Houston and Cartwright (2007) point out that within the research literature there are four common components to the definition of spirituality and the combination of experiencing the Transcendence, love and compassion, interconnectedness, coupled with the journey to find meaning in life leads to a profound sense of belonging and inspires the spiritual person to serve the common good.

Kinjerski and Skrypnek (2004) carried out a qualitative study comprising of in-depth interviews and written surveys on 14 professionals who were asked to reveal their individual experiences of spirit at work. As contrast to the other investigators of the field who spoke about spirituality at workplace (Mitroff & Denton, 1999; Ashmos & Duchon, 2000; Giacalone & Jurkiewicz, 2003); on the basis of the results of their work, the authors repositioned the construct as the 'spirit at work' which focuses on individual experiences at work. Further in their 2006 article, Kinjerski & Skrypnek provided the following comprehensive definition:

"Spirit at work is a distinct state that is characterised by cognitive, interpersonal, spiritual, and mystical dimensions. Spirit at work involves: (1) engaging work characterised by a profound feeling of well-being, a belief that one is engaged in meaningful work that has a higher purpose, an awareness of alignment between one's values and beliefs and one's work, and a sense of being authentic; (2) a spiritual connection characterised by a sense of connection to something larger than self; (3) a sense of community characterised by a feeling of connectedness to others and common purpose; and (4) a

mystical or unitive experience characterised by a positive state of energy or vitality, a sense of perfection, transcendence, and experiences of joy and bliss" (Kinjerski & Skrypnek, 2006a; p. 12)

Table 2: Summary of select studies on dimensions of Spirituality in the Workplace

Dimensions of Spirituality in the Workplace	Inner Life	Meaningful Work	Sense of Community	Blocks to Spirituality	Personal Responsibility	Positive connections	Contemplation	Alignment with Organizational values	Work Unit values and community	Transcendence	Love & Compassion
Ashmos & Duchon (2000)	×	×	×	×	×	×	×	×	×		×
Milliman et al. (2003)		×	×					×			
Sheep (2006)	×	×	×						×	×	
Kinjerski & Skrypnek (2006)	×	×	×							×	
Houston & Cartwright (2007)	×	×								×	×
Kolodinsky et al. (2008)			×			×		×			
Rego & e Cunha (2008)	×	×	×					×		×	
Badrinarayan Shankar Pawar (2009)		×	×					×			
Petchaswang & Duchon (2009)	×	×	×							×	
Nasina & Doris (2011)		×	×					×	×		

The authors have proposed anywhere from three to 20 dimensions of workplace spirituality. These dimensions have wide variations. Sheep (2006) confers that despite this diversity, a conceptual convergence of workplace spirituality as a multidimensional theory. The dimensions and themes representing spirituality at workplace as identified during the literature review have been presented in Table 2 above.

Based on the review of literature, Giacalone and Jurkiewicz (2003) defined workplace spirituality as

"a framework of organisational values evidenced in the culture that promotes employees' experience of transcendence through the work process, facilitating their sense of being connected to others in a way that provides feelings of completeness and joy".

The paper by Kolodinsky et al. (2008) has given the following three distinct thoughts on workplace spirituality-

Application of personal spirituality at the workplace, implying assimilation of individual spiritual values and beliefs at work

Organizational spirituality as individual perception of the spiritual values embodied within organizational boundaries

Interactive workplace spirituality involving the interplay between spiritual values of the individuals and the organizational values.

Kolodinsky et al. (2008) believed that the above way of postulating workplace spirituality fits the concept of person-organization fit, that is, the match between workers' spiritual values and their perceptions of the spiritual values exuded by the organization.

Marques (2005) endorsed the view presented by Giacalone and Jurkiewicz (2003) that employees have an inherent yearning for assimilating their individual and organizational values, assuming their profession to be an extension of their inner expression. The inherent values within the workplace spirituality construct have been collated in the Table 3 given below.

Table 3: Listing of the values embodied in workplace spirituality studies

Attributes	Author	Remarks
Equality, Honesty, Compassion, Avoiding Harm, Respect, Peace, Justice, Forgiveness, Service, Duty, Trustworthiness, Being a good citizen, Peace, Thankfulness	Jackson (1999) Kriger & Hanson (1999)	Taken from an article by McGhee & Grant (2008) - Spiritual values from world's main religions (Sikhism, Buddhism, Judaism, Christianity, Hinduism, Islam, Bahaism, Confucianism & Jainism)
Integrity, Humanism, Awareness, Meaningfulness, Responsibility, Love, Inner Peace, Truth, Humility, Service to others	Giacalone & Jurkiewicz (2003)	Manifestation of spirituality
Integrity, Humanism, Awareness, Meaningfulness, Responsibility, Love, Inner Peace, Truth, Humility, Service to others	Giacalone & Jurkiewicz (2003)	Manifestation of spirituality
Forgiveness, Kindness, Integrity, Empathy, Honesty, Patience, Courage, Trust, Humility, Service to others	Fry (2003)	Tied to spiritual leadership – comes under altruistic love
Benevolence, Generativity, Humanism, Integrity, Justice, Mutuality, receptivity, respect, Responsibility, Trust	Giacalone & Jurkiewicz (2010)	Values framework of workplace spirituality
Honesty, Forgiveness, Hope, Gratitude, Humility, Compassion, Integrity	Fry (2005)	Set of core values reflected by a spiritual being
Respect, Understanding, Openness, Ethics, Honesty, Self-motivated, Giving, Trust, Kindness, Team orientation, Peace & Harmony, Acceptance, Creativity, Appreciation, Helpfulness	Joan Marques, S. Dhiman & R. King (2005)	Vital themes for a spiritual workplace

It becomes evident from the review of literature above that there is no dearth of definitions and identified components of workplace spirituality; also there are many possible levels of analysis for workplace spirituality such as individual, group, team, organisational level and interactive observations.

ORKPLACE SPIRITUALITY AND ORGANIZATIONAL OUTCOMES

No research gains prominence in academic and organizational sciences unless its benefits and outcomes are mapped with it. It is generally an accepted notion that implementation of workplace spirituality leads to creation of an amiable work environment which then creates a mutually beneficial situation for both employees and the employers. Individual accomplishment and high morale are closely related to exceptional performance, therefore, have a straight bearing on the financial success of the organizations (Milliman et al., 1999; Krishnakumar & Neck, 2002). Hence, workplace spirituality studies largely looks at organizational constructs such as commitment to the organization, turnoverintention, job satisfaction, job involvement, OBSE, employee morale, turnover, and absenteeism among others.

Duchon and Plowman (2005) explored the linkage between the workplace spirituality and work unit (team) performance and leadership. The results of this study indicated that work unit performance is superior when there is feeling of community among its members and that their leaders score higher on a measure of spirituality at work further signifying the existence of distinctive management practices which could be associated with spiritually enriched work units. Bosch (2009) observed that the spiritual practices help in lowering the stress levels in organizations and also that spirituality influences the decision making virtues of people and assists them to effectively associate with people in organizations. The authors have attempted to summarize the organizational outcomes associated with workplace spirituality in Table 4.

Past research have successfully shown both positive and inverse associations between various dimensions of Workplace spirituality and attitudinal/ behavioural outcomes, however critical areas in modern organizational setup such as employee wellness and perceptions of organizational politics are still unexplored. So, this study focusses on analysing the association of workplace spirituality with some of the lesser researched constructs in management sciences, i.e., employee wellness and organizational politics. Figure 1 is our proposed theoretical model for the purpose of this conceptual review.

Table 4: Review Summary of relationship of workplace spirituality and organizational outcomes

Dependent variables	OCB	Job Satisfaction	Organization Commitment	Organization based Self-esteem	Organizational Identification	Leadership	Organizational Performance	Ethics	Job Involvement	Organizational Frustration	Workplace stress	Turnover Intention	Counterproductive work behaviour	Absenteeism	Organizational Politics	Personality	Wellbeing
Furnham (1998)								×									
Perrewe & Zellars (1999)											×						×
D Elam (2000)																	×
Y. Hoong (2000)		×										×					
Fabricator et al. (2000)																	×
W. D. Thompson (2000)											×	×		×			
Tepper (2001)	×																
Sirgy et al. (2001)		×															×
Kolodinsky et al. (2003)															×		
Milliman et al. (2003)		×	×	×					×			×					
Rego & Pina eCunha (2003)			×														
Donofrio (2004)																×	×
Fry (2005)			×			×	×	×									
Matherly & Fry (2006)			×			×	×										
Hui-O Liu (2008)	×					×											
Marshke (2008)		×	×														
Kolodinsky et al. (2008)					×				×								
McKee (2008)						×											×
Pawar (2009)		×	×						×								
Salami (2010)											×		×				
Drake (2011)				×													
Chand & Koul (2012)		×									×						
Tevichapong (2012)	×	×			×		×					×					×
Heinsohn (2012)	×	×	×						×								
Chavers (2013																×	

While research into well-being has been ongoing for some time, it has only recently captured the interest of management scholars. Employee wellness is one outcome that has attracted very little attention in the scientific research related to workplace spirituality. World Health Organization defined health as a

balanced state of physical, mental and social wellbeing and not merely the absence if any disease. Further development of the definition of health has led to the usage of the term 'wellness', which is defined as a process by which one thoroughly identifies areas of life that needs to improve and subsequently make better lifestyle choices (Owen, 1999 as cited in Evans 2004). Travis & Ryan (2004) argued that wellness is subjective and it is difficult to accurately define and measure the construct.

Many scholars have explored

and categorised the various dimensions comprising wellness. Depken (1994) observed that most of the academic scholars explain wellness as an all-encompassing concept including dimensions like physical, psychological/emotional, social, intellectual and spiritual. Wellness as defined by Greenberg (1985), is the assimilation of five dimensions; he further concedes of a high level wellness as balance among them. Renger et al. (2000) established wellness as comprising of the following dimensions: physical, emotional, social, intellectual, spiritual and additionally included environmental wellness to ascertain the significant bearing of one's environs.

The perceived wellness model proposed by Adams et al. (1997 defined it as the way of living that involves balanced growth in the physical, social, emotional, occupational, intellectual and spiritual dimension of human existence. The authors proposed that wellness is all about maintaining balance among dimensions and it is never static.

National Wellness Institute (NWI) cofounder, Dr. Bill Hettler proposed the interdependent model of total wellness, universally referred to as the "Six Dimensions of Wellness", constituting of physical, social, emotional, occupational, intellectual and spiritual dimensions. Hettler (1980) was instrumental in introducing the dimension of occupational wellness; he argued that wellness is a gradual progression of understanding its importance and actively make optimum lifestyle choices. So, through a six dimensional model an individual realises the significance and contribution of the interconnectedness of each dimension towards healthy living.

Table 5: Summary of select studies on dimensions of Employee Wellness theory

Dimensions of Employee Wellness	Physical	Psychological/ Emotional	Social	Intellectual	Occupational	Spiritual	Environmental	Cultural	Economic
Adams et al. (1997)	×	×	×	×	×	×			
Hettler (1998)	×	×	×	×	×	×			
Anspaugh et al. (2004)	×	×	×	×	×	×	×		
Travis & Ryan (2004)	×	×	×	×	×	×	×		
Hales (2005)	×	×	×	×	×	×	×		
Heliwell (2005)	×	×	×	×	×	×	×	×	×
Myers et al. (2005)	×	×	×	×	×	×	×	×	×
May (2007)	×	×	×	×	×	×	×	×	×
Dolan et al. (2008)	×	×	×	×	×	×	×	×	×
Diener et al. (2009)	×	×	×	×	×	×	×	×	×

The above table summarises presence of several key dimensions of theory of wellness i.e., physical, psychological/emotional, social, intellectual, spiritual, occupational, environmental, cultural and economic.

Physical Wellness: Wellness was originally recognized and studied from the physical viewpoint of health and it was generally supposed to include the physical aspects of health like physical activity, nutrition and taking care of oneself (Cooper, 1977). The deviations in physical wellness included physical disabilities, physical injuries and sexually transmitted diseases. Helliwell (2005) established that positive attitude about maintaining good health lead to high scores of wellness.

Emotional/ Psychological Wellness: Emotional wellness is recognised as the acceptance and control of one's feelings and a truthful, affirmative value of self-worth, knack of dealing with adverse life situations, stress handling and above all ability to maintain mutually satisfying relationships (Adams et al., 1997). According to Helliwell (2005), it is a constant process of becoming aware of one's feelings and managing it in a positive manner to present an optimistic view of oneself and other human beings.

Social Wellness: Social wellness comprises of the human necessity of making a connect and becoming comfortable with others, willingness to convey one's feelings, desires and opinions, have mutually supportive relationships and intimacy (sexual interaction) and having a conducive social environment and making contributions to society at large (Renger et al., 2000).

Intellectual Wellness: Intellectual wellness as explained by Hales (2005) is lifetime commitment to learning so as to develop requisite knowledge, skills and abilities to have a fulfilling life and share one's knowledge with others. Adams et al. (1997) believed that it is also important to have the perception of being revitalized by a recurrent process of intellectually stimulating activities.

Spiritual Wellness: Scholars (Hettler, 1980; Adams et al., 1997; Renger et al., 2000) have defined spiritual wellness as the process of pursuing meaning and purpose of one's existence. Spiritual wellness encompasses the understanding of vagaries of life and realising that the universe cannot be apprehended as out of one's own realm of experience.

Occupational Wellness: This dimension is related to having an optimistic attitude towards one's personal and professional work. Hettler (1980) and Anspaugh et al. (2004) defined occupational wellness as the professional enrichment and satisfaction achieved by an individual in the course of fulfilling job responsibilities and the extent to which he is able to assimilate his values with that of the organization. So, occupational wellness is about succeeding in creating a balance between the professional responsibilities and personal commitments.

RESEARCH ON WORKPLACE SPIRITUALITY AND EMPLOYEE WELLNESS

In their review of the physical and emotional benefits of spirituality, Larson and Larson (2003) reported that studies have demonstrated religious and spiritual practices are associated with improved health behaviours, such as smoking cessation, diminished alcoholism and increased physical activity and

more extensive social relationships. Many studies have displayed linear relationships with spirituality and lower levels of psychological distress (Laubmeier, Zakowski, & Bair, 2004), higher quality of health life and psychological well-being (Dalmida, 2006), and improved sleep quality and status of health (Phillips, Mock, Bopp, Dudgeon, & Hand, 2006). With such potential benefits, it is perhaps not surprising that Lund Dean and Fornaciari (2007) while exploring the management, spirituality and religion literature found that 17% of empirical studies done by researchers from the domain between 1996 and 2005 were in the health care field.

PERCEPTIONS OF ORGANIZATIONAL POLITICS

Politics in organizations is a sacrosanct fact of life; for years it has been generally believed that behaviour in and of organizations is most often political in nature. As long as there are human beings, politics will be played in the workplace. Some people are better adapted to participate in organizational politics than others, because of their values, ethics and the work habits from the environment in which they grew up.

Ferris et al. (1989) defined organizational politics as "a social influence process in which behaviour is strategically designed to maximize short-term or long-term self-interest, which is either consistent with or at the expense of others' interests".

Researchers have commonly suggested that organizational politics generally have a negative influence on employees and their working environment (Ferris et al. 1989, 2002; Kacmar and Baron 1999). We have presented a summarised view of the elements of organizational politics ranging both in negative and positive context in Table 6.

Bacharch (2005) have revealed that many of the organizational members may believe in the inevitability of the political behaviour at workplaces particularly when someone is interested in advancing in the organizations (promotion) or being recognized as a good employee or an effective manager by the employers and the fellow co-workers. Even the managers were found to be achieving their goals effectively with the help of organizational politics. As a matter of fact, some aspect of 'good' politics in the leadership behaviour, general managerial decisions and valid HR practices may actually lead to win-win consequences for the employer, the employees and the organization as a whole.

Based on studies conducted in the 1950s and 1960s, May (2007) propositioned a strong argument for the involvement of powerful aspects of organizational politics arising due to organizational conflicts in creating positive and resourceful influence on the organization. Pfeffer (1981) believed that the organizational conflicts and power politics acts as balancing forces between those who have power and those who don't and thus improves the organization's agility and ability to deal with a dynamic environment, prevent organizational inertia, prevent herd mentality and fruitfully supplement the decision-making processes. Employees who are apt at handling the organizational politics are more productive than those who are not able to do so.

Organizational politics is most often considered adversarial because it can potentially disrupt organizational efficiency and effectiveness (Kacmar et al., 1999). Politics is said to consume productive time of the employees, restrict the sharing of information and can have serious damaging effects on organizational functioning.

Nonetheless, organizational politics may also have some positive outcomes. Some of the studies such as Gandz & Murray (1980) and organization. In this context, the study by Maslyn et al. (2005) is also significant as it established the need for having a complete picture of organizational politics by including its positive sides along with negatives

Table 6: Summary of select studies on elements of organizational Politics

Perceptions of organizational Politics	Self-serving behaviour	Go along to get ahead	Co-workers content	Cliques Content	Pay and promotion content	General political behaviour	Negative political behaviour	Positive political behaviour	Influence tactics	Ethical behaviour	Persuasion	Ref to super-ordinate goals	Development of coalitions & networking	Reconciliation of competing agendas	Organizational democracy
Kipnis et al. (1980)	×								×						
Ferris et al. (1989)	×	×			×	×									
Kacmar and Ferris (1991)		×	×	×	×	×									
Patricia Buhler (1994)		×	×		×					×					
Valle and Perrewe (2000)	×														
Zanzi and O'Neill (2001)									×						
Fedor et al. (2002)							×	×							
Vigoda (2003)	×								×						
Gunn & Chen (2006)											×	×	×		
Kurchner-Hawkins and Miller (2006)									×				×	×	
Butcher and Clarke (2008)														×	×

RESEARCH ON WORKPLACE SPIRITUALITY AND ORGANIZATIONAL POLITICS

Researchers have suggested that the presence of organizational politics is inherent in all organizations (Gandz & Murray, 1980). At times excessive conflicts hinder the development of a community feeling within the organization. Inevitably, this will bring out the worst in people and make the organization become very political. Excessive politics in the organization is mitigated by development in spirituality at workplace (Tan 2006).

Joan Marques (2010) contended that there are common ground of support,

connections, and reciprocity between workplace spirituality and organizational politics. However, on one hand, the organizational politics provide benefits for a handful of workers and make others suffer; workplace spirituality is geared towards unbiased work practices and bringing in all the stakeholders in its fold by incorporating a team spirit which envelopes the entire unit or the organization involved.

Kolodinsky et al. (2005) believed that the leaders have a decisive role in extending the benefits of spirituality to all the individuals in the organizations, by dispersing the negative influences of organizational politics and accommodating workplace spirituality. They view organizational politics as being disruptive vis-à-vis workplace spirituality as having unifying features. The negativities of organizational politics can surely obstruct the positivity that can be brought about by accommodating spirituality at workplace and to become spiritually effective, the organization requires a balancing factor like "inspiring and enabling organizational leadership" (Kinjerski and Skrypnek 2006).

In this research we take a two-pronged approach of evaluating the perceptions of organizational politics, one including the classical conceptualization of a negative connotation of politics and on the other hand viewing politics as a positive construct in the organizations' interest. This view is consistent with Ferris et al. (2002) who has brought up the positive side of political behaviour, although political yet bringing positive consequences for the actor or others in the M. James (2005) in her doctoral thesis postulated that spirituality contributes in making employees feel generally even when the organizational environment is not secure. The sense of spirituality at work is the reason why the individuals react differently to the negativities in the work environment. A spiritual approach helps in restoring faith and achieves a balanced view about contradicting continuums of good and bad, safety and danger, justice and injustice and eventually will lead to buffering the effects of negative organizational perceptions. Supporting this viewpoint, Tan (2006) argues that presence of unwarranted organizational politics is mitigated by development in spirituality at workplace.

UMMARY OF THE RESEARCH GAPS FOUND IN THE LITERATURE REVIEW ANALYSIS

Even though spirituality at workplace has been popularised in the recent years, the subject is still awaiting the desired attention from the management scholars. The study of workplace spirituality calls for an intense investigation of theoretical organizational concepts as the essential topics of management and the very basis of the business conduct, lie in them.

This study observed the important gaps and point out future research areas in Table 7 after reviewing both the perspectives

Table 7: Summary of select studies detailing the research gaps found in the Literature Review Analysis

Authors	Title	Year	Journal	Abstract	Research Gaps
Summary of studies on Workplace Spirituality					
Ashmos & Duchon	Spirituality at Work – A conceptualization and Measure	2000	*Journal of Management Inquiry Vol.2, Iss 9, Pg 134-145*	To offer a conceptualization and definition of SAW and present empirical evidence for it	Dimensions of WPS needs to be validated through empirical investigation in different etups/locations/samples Need to investigate its contribution in the organization
Duchon & Plowman	Nurturing the spirit at work: impact on work unit Performance	2005	*The Leadership Quarterly Vol.16, Iss5, Pg 807- 833*	Exploratory study to examine "work unit" spirituality and explore its relationship with work performance	Small sample used Other work settings/ sector need to be explored Different location to be considered
Kinjerski & Skrypnek	Creating organizational conditions that foster employee spirit at work	2006	*Leadership & Organization Development Journal Vol. 27, Iss 4, Pg 280-295*	identify organizational factors that foster an individual's experience of spirit at work	Very small sample Need to study other population Need to empirically investigate its relationship with organizational outcomes
Petchsawanga & Duchon	Workplace Spirituality, Meditation, and Work Performance	2012	*Journal of Management, Spirituality & Religion Vol.9, Iss 2, Pg 189-208*	It examine how an organization might enable more productive work practices by encouraging the expression of its employees' spiritual	Study conducted in Thailand with Buddhist-centric culture, which encourages meditation practice The spirituality measures need to be replicated to see its validity in other

Authors	Title	Year	Journal	Abstract	Research Gaps
				selves in an eastern context	context Dimensions of WPS – Meaningful work, compassion, mindfulness, transcendence need to be explored
Summary of Studies on Workplace Spirituality and Organizational Politics					
Fedor, D., Maslyn, J., Farmer, S., & Bettenhausen, K.	Perceptions of Positive and Negative Organizational Politics: Roles of the Frequency and Distance of Political Behavior	2008	*Journal of Applied Social Psychology, 38(1), 76-96*	This study examined factors that contribute to an understanding of both a positive and a negative side of perceptions of politics.	Need to see whether outcomes of political behaviour or the process of politics in organizations has more significant effect on organizational members on various parameters (such as workplace spirituality)
Poon, J. M.	Situational antecedents and outcomes of organizational politics perceptions.	2003	*Journal of Managerial Psychology, 18(2), 138-155.*	Employees who perceived a high level of politics in their workplace reported higher levels of stress, lower levels of job satisfaction, and higher levels of intention to quit than did employees who perceived a low level of politics.	Researchers should identify and examine new variables – such as workplace spirituality (i.e. workplace practices that allow employees to connect with their inner self, develop their spiritual values, and experience work meaningfulness) – for predicting perceptions of organizational politics as well as explore the effects of POPS
Miller, Brian K. Rutherford, Matthew a. Kolodinsky, Robert W.	Perceptions of Organizational Politics: A Meta-analysis of Outcomes	2008	*Journal of Business and Psychology, Vol.22, Issue 3, pg: 203-222*	Strong negative relationships between POP and job satisfaction and between POP and org. comm., moderately positive relation-ships between POP and the outcomes of job stress and turnover intentions, and a non-significant relationship between POP and in-role job performance. Moderator tests show that age, work setting and cultural differences have contingent effects on certain POP relations.	Primary studies are required to better determine the true nature of the relationship between POP and absenteeism, job involvement, justice reactions, trust, spiritual orientation and, actual political behaviour, as these relationships have been studied too infrequently to be meta-analysed as of yet.
Kolodinsky, R. W., Bowen, M. G., & Ferris, G. R.	Embracing workplace spirituality and managing organizational politics: Servant leadership and political skill for volatile times	2003	*The handbook of workplace spirituality and organizational performance (pp. 164–180*	***Conceptual Paper:*** Workplace spirituality and organizational politics coexist in most organization Effective organizations seek to minimize the factors that give rise to organizational politics and encourage spiritual practices at work	Subjective research on POP, construct must be explored empirically

Authors	Title	Year	Journal	Abstract	Research Gaps
Ely Weitz , Yoav Vardi & Ora Setter	Spirituality and organizational Misbehaviour	2012	*Journal of Management, Spirituality & Religion*	Spirituality can mitigate the intention to misbehave at work and thus moderate the relationship between multilevel workplace antecedents and a measure of OMB Highly spiritual people more sensitive and vulnerable to elements of misbehaviour in their surroundings	Need to study the direct relationship of WPS and POPS, rather than mediating effect Need to study the concept of organizational level justice to be ensured through WPS leading to perceptions of Org politics
Komala, K., & Anantharaman, R. N.	Rationale for Spirituality in Organizations.	2004	*NIIT Centre for Research in cognitive systems*	**Literature Review:** Some of the prevalent cultural norms that make discussion of religion or spirituality (like politics) taboo in the workplace hamper the expression of spirituality	Need to see whether outcomes of political behaviour or the process of politics in organizations has more significant effect on organizational members on various parameters (such as workplace spirituality)
Joan Marques	Workplace spirituality versus workplace politics: what's wrong with becoming a "NON"?	2010	*Human Resource Management International Digest, Vol. 18 Iss: 4 pp. 3 - 6*	WP spirituality and org politics share common grounds of support, connections, reciprocity and community. Org politics distinguishes who will be eligible for special favours and advancement, while WP spirituality refrains from such bias. The org's culture is the overarching element, which determines all interactions and upward or downward flows within the organization. Based on the existing org culture, the nature and severity of the org's politics are developed and nurtured	Many workers choose to leave these highly political environments, and become NONs (no fiefdom, outsider, no fit). Even though they may have experienced severe setbacks in their collaborative efforts, they may still maintain relationships with one or more powerful individuals in the highly political workplace, which are often translated into mentorism.
Summary of Studies on Workplace Spirituality and Well-Being					
Janine Elizabeth, Gauther	Spirituality, health locus of control, and wellness in organizational health promotion and wellness programs	2001	*Journal of Clinical Health Psychology*	To explore individual's level of spirituality, health locus of control, and participating in wellness activity (primarily physical activity)	Research on relationship between spirituality, health LOC and positive wellness behaviour (including all dimensions)
DAVID A. ELAM.	An Exploration of the Relationship Between Spirituality and Emotional Well-Being	2000	*Doctor of Philosophy Degree in **Clinical Psychology,** at Southern Illinois University at Carbondale*	This study examined the relationship between spirituality	Need to examine the relationship of spirituality with total wellness.

Authors	Title	Year	Journal	Abstract	Research Gaps
				and both negative and positive affect. In addition, this relationship was investigated with stress included to determine possible moderator effects of spirituality. Religiosity and spirituality were also compared in these analyses. Subjects	
Passagorn Tevichapong	Individual spirit at work and its outcomes	2012	*70th Annual Meeting of the Academy of Management*	Investigate the relationships between individual spirit at work and three employee work attitudinal variables (organisational identification, job satisfaction and psychological well-being) and three organisational outcomes	Wellness test to include further dimensions of well-being other than psychological well-being
J J de Klerk	Spirituality, Meaning In Life, And Work Wellness: A Research Agenda	2005	*International Journal of Organizational Analysis; 2005; 13, 1;*	Explores work wellness variables like work orientation, certainty, Biographics, Career commitment, Job involvement, work satisfaction; from a spiritual framework through the construct of meaning in life	Need to explore how organizational culture and leadership style influence sense of meaning in life. Also need to empirically explore the employee wellness constructs as determined by six dimensions model
Clarissa Saunders-Newton	Spirituality and well-being in the daily lives of African American women	2011	*Doctor of Philosophy Degree in Occupational Science*	Investigated relationship between spirituality and well-being as defined by a narrative reasoning process - A qualitative research design using narrative interview strategies	Need to empirically explore the wellness dimensions as defined by Complete wellness model characterised by six dimensions
Summary of Studies on Organizational Politics and Well-being					
KaijaTuomi, Sinikka Vanhala, Erkki Nykyri and Minna Janhonen	Organizational practices, work demands and the well-being of employees: a follow-up study in the metal industry and retail trade	2003	*Great Lakes Herald – April 2007 Volume 1, Issue 1*	Increases in the promotion of employee well-being, in opportunities for influence and development, improvements in work organization and supervisory support, and decreases in conflicts and uncertainty at work were all associated significantly with positive development with respect to well-being. Several features of organizational practices are strongly associated with employees' well-being	Need to empirically explore the direct and indirect effect of organizational politics

Authors	Title	Year	Journal	Abstract	Research Gaps
Marques, Joan F.	Spiritually or politically driven behavior: differences in the workplace	2010	*Development And Learning In Organizations, Vol. 24 NO. 6 2010*	Conceptual Paper: political motives may lead to faster outcomes, but not to lasting performance excellence, as they will ultimately become transparent and lead to negative long-term outcomes. Spiritual motives, on the other hand, will lead to the exact opposite: slower, but lasting progress and wellbeing for the organization and its stakeholders.	Need to empirically explore the relationship between spirituality, organizational politics and employee wellbeing

that of psychology of religion/spirituality and management science.

ONCLUSION AND SCOPE FOR FUTURE RESEARCH

It is clear from the above analysis that the investigation of workplace spirituality requires a careful examination of the organization theory and some of its concepts as they form the very basis on which business is conducted. Some of the key-points of the analysis are:

The definition of spirituality at workplace provides for an all-encompassing conceptual framework at three levels – individual, team and organizational level. Most of the studies have incorporated only individual spirituality at work and only a few have spoken about the organizational spirituality, the researchers/ academicians must adopt a all-inclusive model to analyse/ harness the benefits of spirituality at work

Scholars have observed that it is imperative to have more scientific investigation on the link of workplace spirituality with the organizational outcomes as it is still lagging (Giacalone and Jurkiewicz, 2003; Duchon and Plowman, 2005; Milliman et al., 2003). First attempts of statistical analyses have been made; yet a cohesive empirical understanding of the construct is still lacking.

A plethora of scholarly literature was found linking spirituality with wellness, most of them just accounting for partial conception of wellness, particularly physical wellbeing. Some other studies worked in the area of psychological wellbeing or emotional wellbeing; however none of the studies really took into account a multidimensional approach of measuring wellness and looking at its relationship with workplace spirituality to have a complete picture.

Some literature regarding workplace spirituality and its alleviating effect on perceptions of organizational politics was also identified but most of the studies considered organizational politics in a negative context, this study recognizes the need to include the positive side of organizational politics too. Also, there is a need to analyse the moderating/ mediating impact of organizational politics on the probable positive relationship of spirituality and employee wellbeing which has not been yet explored.

The conceptual framework provided by this qualitative research needs to examined through empirical enquiry.

To summarise, workplace spirituality undeniably is currently one of the most thought-provoking topic in management sciences and is looked upon as the universal remedy for all the ills of working life. Research in the field is still in the developing phase and the need is to systematically handle the issues pertaining to the definitions and methodology of its measurement to make it more viable. Employee wellness is yet another hot topic as businesses have realised that a healthy workforce is a productive workforce and thus it makes perfect business sense to promote wellness programs at work. Furthermore, power politics in organization is a reality and positive politics as opposed to negative, help in building employee confidence and motivates them to work harder. This is in turn increases productivity and helps in employee retention too. Thus it is imperative for both the academicians and organization practitioners to recognise the significance and implement spirituality at work to encourage better results and performance from both the employees as well as organization at large.

Appendices

Tables and Figures– the exact position has been indicated in the main document

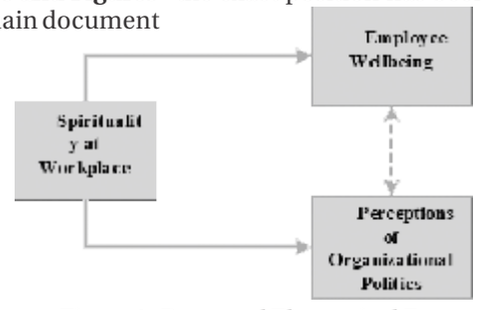

Figure 1: Proposed Theoretical Framework

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CASE STUDY

The Phoenix Rises from its Ashes: A Case Study of Aam Aadmi Party

*Ms. Tritpi Mishra**

ABSTRACT

The historic win of the Aam Admi Party in Delhi Assembly elections 2015 , after it's serious debacle in General Elections 2014 has once again made it the subject of analysis in the political circle, media houses as well as academic arena. In an era of corporate politics where big giants parties are having unlimited and un-traced sources of funding and media rallying behind them, a barely 3 year old party has been successful in challenging the high and mighty established political parties. Taking the Indian political scenario by storm the Party won 2013 election with 29 seats and form the government with the support of Congress that lasted just for 49 days ,witnessed massive defeat in Lok Sabha elections but came back in full force with land slide victory in re-election of Delhi Assembly .This case study explores the back end activities that propelled them to success. The right balance of management theories applied along with latest technologies used in the process has been emulated in this paper.

Keywords : *Government, Corruption, Political Party, Election*

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INTRODUCTION

The party system in India dates back to the formation of Indian National Congress by A.O. Hume to allow Indian representation in the British Government and thus suppress the rising dissatisfaction among Indians. Kesalu(2013). Indian National Congress, that mobilized the masses against the British Raj and played a key role in getting independence enjoyed a monopoly on Indian political front in the post-independence era. It dominated the Indian political spectrum and ruled the country for four decades, forming governments with a coalition of other parties. India witnessed many scams rolling out of congress lead center and the state government closet Coal scam, 2G scam, Telecom Scam to name a few. The other major party that emerged in the Indian political system was the Bhartiya Janta Party(BJP) and it voiced its' concern against the corruption purported by congress. Kumar and Lone 2013 explain, that due to inner dispute and lack of secular orientation BJP could never provide a strong central government. Several other parties were formed based on ideological differences as well as personal idiosyncrasies that resulted in multiparty systems with 74 parties in 1952 to currently more than 364 in 2012 .

Little did India know that within 63 years of independence the very Indian politicians from different political parties will plunder her more than the Britishers. A study by Mathias Willians 2011, suggested that corruption was a huge cost to the Indian economy and threatened to derail it's growth. Each and every single party seemed to be tainted with corruption, crimilization and arrogance along with a general apathy towards the common people.

The words said by Pundit Jawahar Lal Nehru, towards midnight on 14 August 1947, "A moment comes, which comes but rarely in history, when we step out from the old to the new, when an age ends, and when the soul of a nation, long suppressed, finds utterance." appeared apt for the current chaotic situation of the country and with this rose the movement called India against Corruption which created the backdrop of the birth of the Aam Aadmi Party.

TEPPING STONE-INDIA AGAINST CORRUPTION

During the last three decades of Congress government, people suffered from corruption, Inflation, external security threats, Internal Insecurity etc. and the simmering collective anger erupted as the movement India Against Corruption led by Anna Hazare. Putting up his demand for establishing Citizen's Ombudsman by passing Jan Lok Pal Bill, he went on indefinite hunger strike for 12 days in 2011. People came out in massive support to him, from common man to people like Justice Santhosh Hegede, Prashant Bhushan. Shashi Bhushan from Judiciary, Activist Medha Patekar, Former cop Kiran Bedi and Arvind Kejriwal from Indian Reveniew Services. The movement was called off by Anna Hazare when the Congress Government promised to pass the bill. However after sending the bill to a committee the Government never passed the bill. At this juncture the rift became wide between Anna and Kejriwal as later believed that without active hold in government it would not be possible to fight against corruption.

Aam Aadmi Party (AAP) was formally launched on 26th November, 2012.

The man behind the formation of the party **Arvind Kejriwal,** an IIT alumnus, was a person connected to people. Leaving his post of Joint Commissioner in the Income Tax Department he started an NGO Parivartan that helped people get their official work done, using Right to information legislation. He also received the Magsaysay Award for his work in this field of social service. His experience of the problems faced by common man in day to day life made direct bond to people very fast and soon he got massive support from the masses. The underlying ideology of the party has been Purna Swaraj that advocates self governance, accountability of the government and power decentralization. (Kusum, 2014)

AAP led series of protests against rising electricity and water bills, rape, corruption and many others issues. All these protests were close to the masses who wholeheartedly supported the party in Delhi assembly and AAP became the second largest party after BJP to win the elections getting a total of 28 seats. Arvind Kejriwal defeated 3 times CM Sheela Dixit by 25,864 votes and it was clear that a new kind of politics had arrived on the Indian political scenario. Arvind Kejriwal became the media's most favourite figure and finally AAP formed the government with the support of Congress. The beginning of AAP government was impressive with announcement of free 20,000 liters of water, free electricity, determination to end corruption etc. but not without controversies due to behavior of AAP members and protests by CM on Rajpath. The praise as well as criticism was showered in equal measure on them. Within a short span of time Kejriwal resigned from the post of CM and dissolved the house as the Janlok Pal Bill proposed by him was not passed in the house. There was a pitch of sympathy as well as disappointment. Then they expanded at National Level with Lok Sabha Elections and this time Arvind Kejriwal took the fight against Narendra Modi. But, Modi wave washed his dreams and AAP lost in all seats except four.

The defeat in Lok Sabha Elections appeared to be an end of Aam Admi Party and political career of Arvind Kejriwal, but the party became a live wire when Delhi Assembly re-election was announced for February 2015. Though the party had lost badly in Lok Sabha, the ground work of AAP never lost it's track, and this became the success mantra for AAP in the fresh elections conducted in Delhi. In re-election AAP rose from its own ashes like Greek Phoenix and witnessed a landslide mandate from Delhi Citizens who wanted to see Arvind Kejrywal as CM. In the following sections, the paper explores how latest IT tools and technologies, Management principles and Entrepreneur skills were used by AAP to build the political castle brick by brick changing the very fabric of election campaigning.

A political Enterpreneur

Established parties like Congress, BJP, JDU, Samajwadi Party have always believed in traditional politics, which manifest

itself into "unapproachable" high profile leaders with their corporate nexus generating funds, and huge money involvement during elections. Also leaders with criminal records were integral part of almost all the parties. They believed in visiting the constituency, only when elections are near.

In the total contrast AAP had to build the party brick by brick with limited means. What AAP had in its hand was people's support in their fight against corruption and the time was apt to mobilize this emotion to an asset for the party, which AAP aptly did by involving citizens in all decision making and governance of the party. This unique strategy was like a fresh breeze for the masses, because for the first time people were having a say in the policy making.

In the Indian Political market AAP arrived as a political entrepreneur and took the market by surprise by its ability to dismantle the political monopoly of two Giants Congress and BJP.

According to Dillhon et.al 2014, an entrepreneur needs to work smart and not just work hard. Entrepreneur visualizes goal and success, should be able to delegate tasks, manage time effectively using the latest technology and should be able to take risks.

AAP had visioned itself as a national party fighting against corruption and a mission to help people, and it started moving in the direction utilizing its resources wisely. Arvind Kejariwal risked his political career by standing in elections against three times CM Sheela Dixit and finally defeated her with a huge margin. The risk taken had payed rich dividend.

Manish Sabarwal (2013) in the Economist explains how AAP decided to break with the past practice of contesting the election; right from funding, volunteer model, to non-caste appeal every concept brought was 180 in opposition to what citizens had witnessed so far. Its mass appeal made other parties copy the model.

According to Harshdeep Raphael 2013, the startup companies can learn few lessons from AAP. Identifying the trend and moving along with it, the way AAP turned angst of masses against corruption and aligned the fundamentals of the party along it thus touching the right cord with the public. AAP also found the 'gap' in the market that 'common man' was missing link and no party included them. AAP brought the concept of Purna Swaraj where the government was accountable to common man and could be called back if it did not perform. The importance given to the masses brought citizens in full support of AAP.

A detailed preview of the strategies based on management principle and effective use of technology is discussed.

ARKET ANALYSIS

Two major competitors congress and Bhartiya Janta Party were closely studied. Congress, in power for the third term, with a series of corruption charges leveled against it, bearing huge public angst, was already standing on the downhill slope where as BJP with better image and good governance in some states was riding high on a Narendra Modi wave. However, it was clear that BJP as such was not successful in stopping corruption. Further its' high profile people and political arrogance had completely alienated BJP from the common man where the power to change existed. This was the actual catch point. The huge support that IAC got from youth was a clear indication of the paradigm shift in the political arena and Arvind Kejriwal was quick to capitalize on this connect with the masses when the rest of the political parties were restricted to higher classes. Thus introducing the product in the market in such way that it instantly connected to target audience was essential and they began this process with coining an appropriate name.

Branding- Endorsing the Common Man

As the party was founded after the deep dissatisfaction and disappointment of common people the name had to represent the public and hence it was named Aam Admi Party. 'AAP' in Hindi, means 'You' and it clearly sent a message that the party was built by the common man, for the common man and was all concerned about the common man. Many established parties made fun out of this name without even realizing that the very name will derail their otherwise sure route to power in the forthcoming assembly elections.

As the movement of IAC had attracted intelligentsia and masses alike, the selection of the party symbol had to hold an appeal for both. The broom was selected as the symbol demonstrating the eagerness to clean the cesspool of Indian Politics and it connected well with the masses due to its ubiquitous presence in every household. Having established the connection the next step was to concentrate on the promise that the new product will carry.

USP-The Party Manifesto

The manifesto of a newly born party needed to have a new flavor different from the exisiting manifesto of other parties. Also it was essential to feel the pulse before finalizing the manifesto and make people aware that they were actually a part of it.

A lot of ground work and research went before writing the manifesto with personalities like Atishi Marlena, a Rhodes scholar from Oxford being apart of manifesto writing fro AAP. 31 policy committee consisting of academicians, administrators and surveyors etc. worked upon different issues of public concern like economic, social, industry and welfare, taking inputs from colunters who were continuously visiting various constituencies. Even the figure of 700 liters of free water was decided after deep research based on consumption pattern of consumers and on the fact that it simply required proper redistribution of existing infrastructure and controlling water mafia. For the first time a party was considering electricity, water, roads and women safety as election issues and that too quoting a figure rather than giving ambiguous targets like "adequate" and "sufficient".

Parties like Congress and BJP just modified their eariler manifesto hurriedly whereas AAP's colunteers interviewed prople in all 70 constituencies and listened to their problems. Thus, AAP created 70 manifestoes one for each constituency and one central manifesto. When all the three parties released their manifesto it was AAP's manifesto with which people identified with, A comparison of all the three are shown below

Table 1: Comparative study of Congress and AAP manifestos for Delhi

AAP	CONGRESS	BJP
Lokayukta bill will be passed in 15 days of AAP getting elected which will have the CM, ministers and MLAsunder its purview.	Nothing on Jan lokpal bill but speaks of transparency through e-goverance with an aim to cover 90 percent of government services.	The institution of lokayukta would be made effective powers and helplines would be set up for reporting corruption cases, public grievance cell shall be established in government offices for redresal of grievances in a time- bound manner.
Introduction of swaraj Bill Mohalla Sabhas to decide on local governance issues.	Already has Bagidari Scheme	To ensure good governance the party would promote e-governance to ensure transparent, responsive and corruption free administration, and form Accountability Commission to ensure efficient use of public money.
Full statehood to Delhi, police and law and order should come under Delhi government.	Demands full statehood and centralised command structure. Also Free Economics Zone across NCR so that business and traffic can move seamlessly.	Promised full statehood to the city
Electricity bills to be reduced by half, electricity distribution companies will be audited.	To set up fast track grievance cells to address complaints, increase power generation and promote solar power.	Promised to reduce electricity charges by 30 percent in a manifesto for the December 04 Delhi Assembly Elections.
700 litres of free water to every family. Those consuming more will pay more, opposes privatisation of Delhi jal Board.	Will extend the subsidy to domestic consumers from current 30 Kilo litre per month to 40 Kilo litre per month, 3 new water treatment plants to be set up.	
Education in government schools to be as good as that in private schools, 500 new schools to be opened. New law would be introduced to control profiteering by private schools and colleges.	Introduce the option of second shift in all private schools to open second shift and thereby creating at least 25 per cent more seats, 150 new government schools 10000 new teachers.	
New colleges to be started for students specifically from Delhi.	More evening colleges to increase seats by 30 percent. University of Health Sciences with 5 medical colleges.	
Secuirty for women. Citizens security Force will be established.	Push for police reforms, evolve mechanism for better cooperation with police, special training for police to handle crimes against women.	Emphasising on taking steps for safety of women, 24-hour call centres and a dedicated 'Women Security Force' ,construction of more hostels for working women and set up fast track courts for speedy trial in cases of violence against women
Ensure use of SC component plan for the welfare of scheduled castes and implementation of SC/ST and OBC reservation in Delhi Government. Zero or low interest loans for entrepreneurs.	Easy loans for self employment groups (SC/ST, OBC, Minority), rs 1800 per year for every child in school, scholarships.	
Ensure that false cases against Muslims are not registered Bring transparency in the functioning of Delhi of Delhi Waqf Board	Moderisation of Madrassa education, Haj house in Dwarks	Formation of madrasa board and expansion of Lal Dora area.

Source: Subhajit Sengupta, 2013

No doubt the final manifesto of AAP, with its' mass appeal made established party sit up with wonder.

- Resource Management

The election campaign by most of the parties have been a huge display of might and money.Huge billboards would spring up across the city, famous personality would be called to support parties, huge rallies would be conducted with crowd being bought and brought from far off places finally buying votes through money and liquor. This all has been a common practice.

In this regard AAP was standing on ground zero. As in any organization people are a greatest asset so was the case with AAP. AAP started requesting the citizen for donation of as small as 5Rs. and the process of donation was kept transparent by showing it on their website. With this the donor also became an member of AAP ,and this practice instilled a feeling of loyalty and belongingness in them.With this unique concept AAP not only raised the funds but also increased its' vote share.AAP further raised the bar of transparency by putting a cap on the donations as 20 crores beyond which they stopped accepting the donations impressing the masses with their integrity.

In second assembly election when it was little difficult to raise the fund initially some supporters of the party h started a Twitter campaign where they promise to donate money to AAP based on the number of retweets as shown below

Figure 1: AAP's Fund Raising Collection through Twitter

Bringing Youth to Booth

The best of middle class brains including engineers, doctors, academician as well as cobbler, small shop owner , cooks gave full support to AAP. AAP compaign had special message " Ask your friends to vote" and AAP had succeeded in converting a generation averse to politics ,to passionate driving force working relentlessly for them.Even the Election Commission has acknowledgedthe AAP's contribution in creating awareness amongst people about the voting process and urging them to come out and vote.In a record voting of Assembly election the voting for the time went to 66% in Delhi.Not only this, AAP also discovered72,000 fake voters in some areas of Delhi and informed the Delhi election commission. The volunteers kept bringing such anomalies to the notice of the election commission. One of the reasons for a higher percentage of voter turnout in Delhi has been this very weeding out of fake voter names-another step that ended up helping the Election Commission.

AGIC WAND OF IT: LOWBUDGET, HIGHIMPACT CAMPAIGNING

Behind the AAP's land Slide victory was the magnificent use of technology that gave it an edge over the rest of the parties who could only use it marginally.

i) Use of Voice Telephony

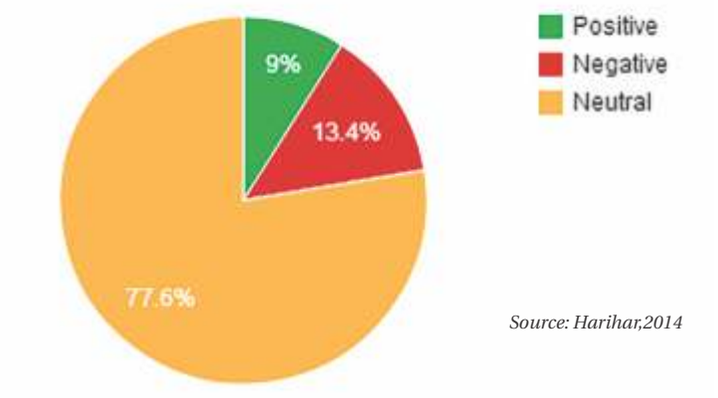
According to PranavPrateek ,2015, AAP was the first party to use cloud telephony in collaboration with Voice Tree Technologies that helped make any citizen agreeing with AAP ideology become a member of AAP. With the help of Cloud Telephony, a volunteer (who can be anyone) could call on a toll free number which was then mapped to a central server.This server then used to select a random number and make the volunteer connect to this number .After the call is made that number is dropped from the list. So at a given time, above 100 volunteers could simultaneously make the call to the citizens of Delhi.The campaign has been live since November 20th,2013 and according to the data nearly 5,00,000 calls have been done in one week by more than 7,000 volunteers that could go 60,000 calls a day.

ii) Use of Google Hangout

With the use of Google Hangout ,AAP could persuade NRI's to adopt a constituency and help raise the fund for that constituency upto 1.5 million Rupees.NRIs also shared their higher experience on Google Hangout.

iii) Sentiment Analysis

Sentiment analysis concepts were applied to twitter handles and Facebook to record sentiments of people towards various issues. The campaign as well as the manifesto was changed in the direction of the trending sentiments like demand for free Wi-fi and education. This helped AAP get a strong public connect which other partied missed upon.



Source: Harihar,2014

Figure 2: Sentiment Analysis

iv) Social Media Power

AAP Website was more interactive and it asked for donations, nomination for the upcoming LokSabha polls 2014, membership, suggestions through its website

http://www.aamaadmiparty.org. It also conducted opinion polls and asked for suggestions on important issues through its website. The followers of websites of three major parties are as under:

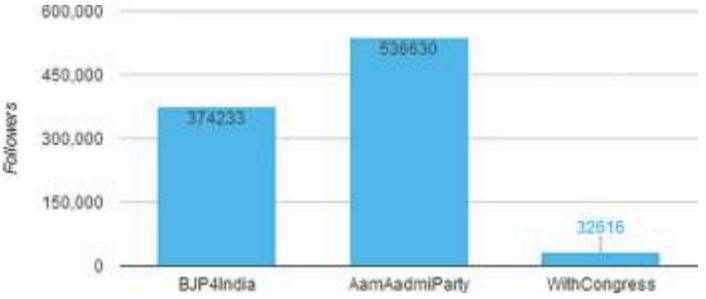


Figure 3: Website follower Graph

A unique concept of political internship #internship4AAP with the party was floated for youth-an offer no other party had given. The young voters who took the internship became loyal voter as well as volunteers and kept the social media pages updated and became a campaign led through word of mouth. Similarly a powerful message was sent across by #Donate4CleanPolitics where people donated whatever their capacity was and as every donation was kept transparent though their website it proved to be a successful way for fund raising.

There was also an application to promote the same. The donation trends on their website showed that the party is highly motivated to showcase each day's donation count and the breakup of the same. It is an intelligent idea to promote donations through social media especially because it was the best way to display to a common man each day's collection details, hence encouraging them to be a part of the collection.

Source: Harihar, 2014

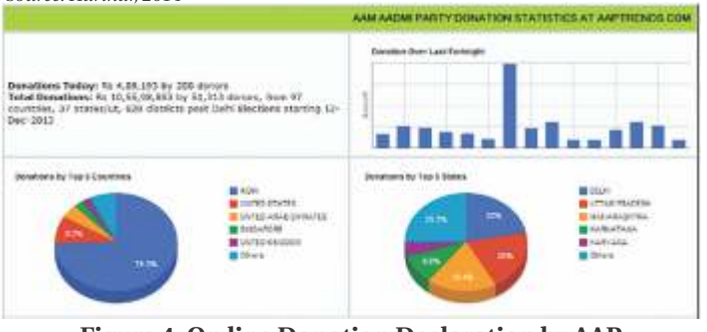


Figure 4: On line Donation Declaration by AAP

Maintaining a consistent communication led to no confusion among the minds of the masses. It was a great marketing strategy. It not only created a recall value but instilled in the minds of the public that the party stands for them and not for themselves.

At Twitter AAP had been hyperactive with approximately 40 tweets per day. Hash-tags like #Kejriwal At Kanpurwas used brilliantly and ran a certain campaign for specific time periods to keep country updated about every move. Similarly, sharing of videos explained the work that AAP carried out across the city. The party had joined hands with Facebook Talks and News Laundry to talk live to stay within the public view.

Mohalla Sabha- Groundwork

At ground level AAP recruited thousands of volunteers with an aim to connect to common man one to one basis. The concept of Purna Swaraj was fulfilled through Moahalla Sabha that was attended by local people and AAP candidates. These were the platforms to know the basic needs and problems of people of that particular area. It helped AAP know the expectation of the people and incorporate it in their manifesto. People having a say in the governance also made people inclined towards AAP. AAP Model of transparent Citizen Empowered Governance seemed to be the epitome of governance.

IV Winning Streak

With the commendable preparation and hard work AAP contested Delhi Assembly election 2013 with Arvind Kejriwal fighting against the then Chief Minister Mrs Sheila Dixit. The 15-year rule of the Congress in Delhi came to an end with the results of the 2013 Delhi Assembly elections. No single party got a majority with BJP highest seats of 32 followed by AAP 28 and Congress just 8 seats. Like a David killing the Gollieth, Arvind Kejrieal, defeated three times CM Sheila Dixit. AAP had taken the Voters imagination by storm, and became a game changer.

The resulting hung Parliament got a solution when AAP formed the Government with the support of Congress. The AAP government began with all the zeal and zest and took some initiatives like ending VIP, Red-light Culture, Cutting Electricity Bills for those consuming up to 400 units, Free Water for those consuming up to 20 KL per month stopping retail FDI, Surprise checking schools and hospitals, `starting anti corruption help line etc. However controversies and method of working of AAP MLAs were criticized. On the issue of Passing Jan Lok Pal bill Arvind Kejriwal resigned from CM post thus dissolving the assembly.

However, AAP with an eye over National politics decided to fight General Elections.

V Debacle in General elections

AAP, riding high on its' success of Assembly elections decided to fight on 432 seats of the Lok Sabha. Depending upon the

Source Gagan Jain ,2014

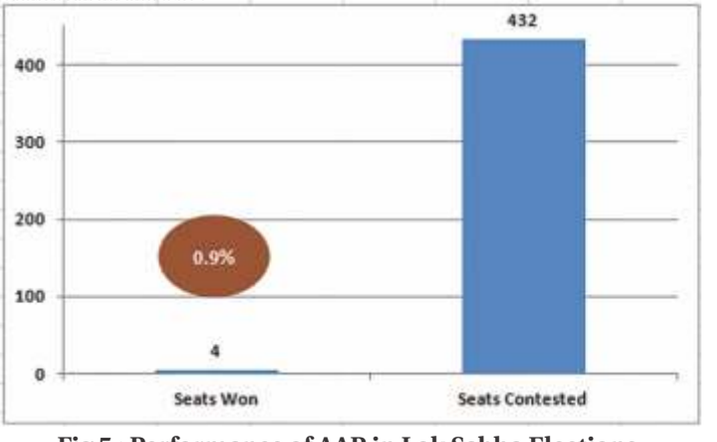


Fig 5 : Performance of AAP in Lok Sabha Elections

micro-financing and crowd magnetism is was difficult to scale the performance at national level. This time Arvind Kejriwal took on Narendra Modi, the prime ministerial Candidate of BJP without realizing that Modi was not Mrs Sheila Dixit. With Arvind Kejriwal losing in Varanasi against Narendra Modi AAP lost on all seats except four.

For a nascent party like this performance was not dismal, however, the rhetoric of AAP during elections made this number seem all the more less.

Crest Fallen: Lessons Learnt

The unprecedented popularity of AAP and its meteoric rise in Delhi tapered off at the national level. Like many startups , it showed a rise sharply initially only to bite the dust later.

Unscalablility: At national level AAP could not scale up the structure, rather it showed complete lack of it with the decision power lying in the hands of few. The acute shortage of manpower at that level was not foreseen by the leaders of AAP, and further the volunteers also could not be as organized as they were in Delhi .

Non delivery: Running an office of CM stature with anarchy and humdrum had created a bad impression of non seriousness. Leaving Delhi in lurch after 49 days also seemed to be a major reason to have an impression that if one can not take care of state how he would take care of the country.

Underestimating the Competitor: AAP could not comprehend the Modi Wave. Modi had behind him the experience of starting from scratch and build an aura around him. To consider Modi at par with Mrs Sheila Dixit was biggest mistake as corporate style politics has been the forte of Modi and had not failed him yet.

However, the not so bad performance of AAP being the youngest party in the contetstant had kept the fighting spirit of AAP high and they were rearing to go in Delhi Assembly re-election in February.

VI Resurrecting from ground Zero

The spirit of AAP was not dampened by the General election results and they continued with the same zeal to perform the ground work, meeting people and talking about the problems that faced, doing surveys to improve their manifest. Thus AAP remained connected with the masses while they were fighting the Loksabha elections and this was heart winning attempt.

When AAP was marketing just one Brand "the common man" that had an instant connect with the masses, BJP was still in searching for a local face, which finally resulted in the choice of Kiran Bedi. But BJP landed up confused with two brands to market –Modiji and Kiran Bediji. It further increased the inter party conflicts within BJP which certainly sent wrong signal to the masses.

BJP did not do much to improve their manifesto rather the BJP leaders indulged in name calling .Also lot of expectation of citizen was not being fulfilled by BJP. There were serious mistakes in the Digital Vision purported by the BJP and had brought anguish the north Eastern students who were called "migrant".

In stark contrast AAP delivered an improved manifesto that included genuine problems of Delhites like unauthorized colonies, Better facilities for slums, contarctualization of labour, Justice for victims of 1984-Sikhs, sanitation, employment, opening of new colleges, women safety. The rigorous manifesto was a result of relentless research, continuous contacting the masses in person through mohalla Sabha as well as taking their suggestion on web site and monitoring social media.

For every negative advertisement thrown by opposing BJP and congress AAP had a humble message. Like for Arvind Kejriwal accepting his mistake for leaving after 49 days and asking forgiveness for the same showed the very humane side of a leader.

The excellent work done by AAP MLAs during those 49 days negated the feelings of "run away CM" as mocked by opposing parties proved to be a boon in disguise. The voters were totally inclined towards Arvind Kejriwal as CM even if they were not AAP supporters.

Apart from this the high headness of established parties with the display of power and money added woes to agony of Delhi citizen who remained unfazed by pomp and show of BJP and congress.

VII Creating History

It was clear that Delhi Assembly election 2015 would be neck to neck fight. Speculations were high that Delhi would give another chance to AAP to prove itself. Pre-election and post-election surveys intensified the heat in the political arena. BJP remained in the constant denial mode rebushing.

With each passing day as the battle intensified the inclination towards AAP became clear as is visible from pre poll and exit poll survey given under.

Table 2: Pre Poll and Exit Poll Counts

	AAP		BJP		CONGRESS	
Surveyer	**Pree-Poll**	**Exit Poll**	**Pree-Poll**	**Exit Poll**	**Pree-Poll**	**Exit Poll**
C-Voters	28	39	37	29	5	1
IBN7	27	36	36	33	7	1
ZEE TAleem	30-34	31-39	32-36	26	4	1
News Nation	30-34	39-43	31-35	25-29	5	1-3
ABP NEWs	35	43	29	26	6	1
Chankya	24	48	41	22	5	0

AAP's internal survey conducted by psychologist Yogendra Yadav predicted 15 seats to BJP and 51seats itself which was dismissed by BJP for its small sample and had predicted 43 seats for itself.

When the results were declared on 12th February 2015 it appeared as if the broom was sweeping entire Delhi,

constituency by constituency. Finally when the counting stopped AAP had not won but conquered Delhi with 67 seats out of 70, trouncing Congress and marginalizing BJP to just 3 seats.

Table 3: Result Of Assembly Elections 2015

Party	Seats Won	Vote Share
AAP	67	54.3
BJP	3	32.2
Congress	0	9.7
Others	0	3.8
Total	**70**	**100**

From 2013 to 2015 Delhi has witnessed 3 elections including two assembly and one general election. From the % vote share it is evident that it is only AAP whose vote shares has been increasing continuously . BJP's vote share has decreased after increasing in 2014 where as Congress has shown continuous decline throughout.

The massive victory of AAP has placed huge responsibilities on their shoulders. The win has been achieved riding high on the waves of huge promises made, which may not be easy to fulfill. With the center and the neighboring states being ruled by the opposition, it would be difficult to have their own way.

Further, it would be essential that the mistakes committed in the first short tenure are not repeated. In place of protests solutions should be found amicably following the code of conduct and the dignity of the post of CM is maintained. The arrogance should not follow the victory as they are all the more in the public eye.

Ambitions and ideologies of different fractions of the party

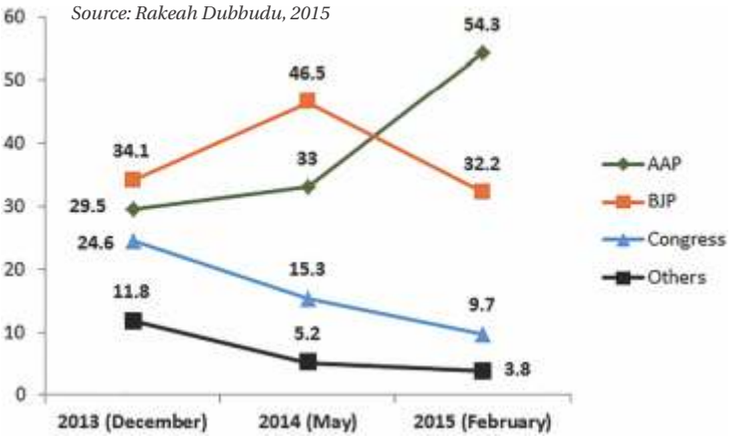


Figure 6: Vote Shares of Parties Challenges Ahead

have already started to arise and conflicts are intensifying. Before the elections 2015 party has seen descendants like Shaizia IIlmi, Binni and many others who left the party and joined BJP. After the massive win the cracks have started appearing with Yogenda Yadav and Prashant Bhushan being removed from the core group. ArvindKejriwal has been known to be dominating and the one who can sacrifice internal democracy if things don't go his way.

Thus, holding the party together, satisfying the hope of thousands of volunteers and motivating them to keep doing constructive work and steering the party to win in assembly elections of other state is not going to be easy. But as is rightly said " when the going gets tough the tough gets going..." Arvind Kejriwal might succeed and it will in the best of the interest of Delhi which has placed so much faith in him.

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DOCTORAL ABSTRACT

*Dr. Barkha Bahl**

ENHANCED DATA MODELS FOR GEOGRAPHIC INFORMATION SYSTEMS

ABSTRACT

Geographic Information Systems (GIS) are becoming essential tools for analyzing and geographically transferring the information about the world. GIS incorporates, both spatial and non spatial data, and has the capability for searches, overlays, association and display output in 2D/3D incorporating non spatial data. In addition to spatial data a GIS systems contain geo referenced information which enables near true representation of geography and capability to provide measurements, variations etc. These features make the technology different from the CAD systems and conventional database applications. The capabilities of GIS have brought a paradigm shift in the approach to the presentation of information.

A GIS data contains spatial and attribute data. The spatial data models popularly use data in Vector and Raster forms. Both these data sets are complimentary to each other and have their significant roles in any GIS application. Storage/retrieval of raster models has their primary role in visualization while vector representations have focus on the analytical capabilities. The present research work is mainly focused on vector data management.

Vector data is basically represented using Point, line and polygons. The point data is primarily stored in a data base as X and Y co-ordinate or it could be lat/long in case of a geo referenced data. Stream of the points forms a line and a closed line is represented as polygon. The data models in geographic databases allows any geographic features in real world to be digitally represented and stored in a database so that they can be presented in map form, and can also be worked with and manipulated. The data base design incorporates real world data in the form of layers and each layer may further represent multiple aspects. For analytical capability of any system, the appropriate database designing will lead to efficient results. The data modeling process, which enables the database design consists of three levels namely, conceptual, logical and physical levels. The conceptual level defines the entities, their properties and relationship between entities, which are important for a particular application domain. The conceptual model is translated into a set of constructs supported by the target database management system (DBMS) at the logical level. At physical level, data are mapped onto the physical structure of the DBMS.

The present research has evolved an approach to represent spatial data at conceptual level and to design vector model at logical level for efficient vector data storage. Spatial data representations have been investigated further under two important aspects, namely geometric and topologic consistencies using the developed terzatto tool.

At conceptual level a Topo-Net Spatial Entity relationship model has been proposed for representing topological and network geo-primitives being required for GIS applications. A Triangular Pyramid Framework for enhanced object oriented data model for GIS applications has been proposed at logical level. The model covers the representation of complete information required by GIS application in three levels i.e. Object, Geometric and Location. Further to analyse the performance of the triangular pyramid framework, it was compared with the existing bi-level object oriented data model, whose vector data storage has been done using the developed Digitiz tool to digitize raster map to vector data. Triangular Pyramid framework has been implemented through Terzatto Tool. Using Terzatto tool Shape file data has been transformed into Triangular Pyramid Framework. The developed Terzatto tool assessed the effectiveness of the proposed model for removal of geometric and topological inconsistencies using the additional common reference table at location level. To evaluate the proposed Triangular Pyramid Framework for topological consistency of spatial objects a scene has been described. Topological consistency of a scene description means that there is no internal contradiction among the individual relations due to their properties. Properties such as the converseness of pairs of relations and the composition of relations have been considered in order to guarantee that a scene description is free of internal topological contradiction of relation. The object of concern in this research are spatial regions, which are defined as homogeneously 2-dimensions point sets with connected boundaries. The definition of binary topological relations between two spatial regions A and B, is based on the four intersections of A's boundary (A) and interior (A) with the boundary (B) and interiors(B) of B. The consistent integration of topological information relies inherently on the algebraic properties of the relations between the objects. A rigorous computational method has been adopted to infer the topological information consistency between spatial regions for the scene description.

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INTRODUCTION

GIS concepts today have brought a paradigm shift world over in the approach for developing the information system. GISs developed with incorporation of satellite/aerial images, survey maps, location information from GPS devices and their integration with data from management work flow systems are revolutionary in nature. Visualization of information has added immense power to resolve complex situations.

The power and potential of GIS, however, in India is not yet exploited thereby it could be attributed that there is need and scope to work in this area on various aspects. The primary motivation to undertake research in this area is to explore the core of spatial data model and database design which can be relooked at in terms of the relevance to a GIS application.

GIS is defined by Konecny, 2003 as, "A Computer System for the input, manipulation, storage and output of digital spatial data. It is a digital system for the acquisition, management, analysis and visualization of spatial data for the purpose of planning, administering and monitoring the natural and socio-economic environment".

Thus, GIS is a computer based information system used to digitally represent and analyze the geographic features present on the Earth's surface and the events (non-spatial attributes linked to the geography under study) that are taking place on it.

GIS has its application in wide number of areas including Engineering Mapping, Tax Mapping, Highway Maintenance, Event Mapping (accidents, fire, crime, facility breakages), Census and Statistical Mapping, Land use Planning and Management, Environmental Impact Studies, Natural Resource Mapping and Management, Urban and Regional Planning and so on(Albert and Yeung, 2009). Development of an efficient GIS application not only depends on the GIS product but also needs to develop suitable spatial /non spatial databases, adoption of standards, deployment of spatial data infrastructure (SDI) concepts etc.

The data models in geographic databases or the GIS data model allows the geographic features in real world locations to be digitally represented and stored in a database so that they can be presented in a map form, and can also be worked with and manipulated to address spatial analysis and decision making (Tadakaluru *et al.*, 2005). GIS data models can broadly be either vector data model or raster data model based on the data they use to represent and store.

Spatial data modeling is a precondition and key to the design and realization of spatial database which provides means for spatial data organization. The integrality and consistency of geographic data rely on how the data model represents, stores and manages the GIS data (Yen *et al.,* 2006).

The representation of data is done at conceptual level. The conceptual level defines the entities, their properties and relationship between entities, which are important for a particular application domain. The conceptual model is translated into a set of constructs supported by the target database management system (DBMS) at the logical level. At physical level, data are mapped onto the physical structure of the DBMS (Elmasri *et al.,* 2009).

Any GIS data model is implemented in layers. Data is organized by layers, themes, with each layer representing a common feature or its subsets (Zeiler, 1999).The data model represents a set of guidelines to convert the real world (called entity) to the digitally and logically represented spatial objects consisting of the attributes and geometry. The attributes are managed by thematic or semantic structure while the geometry is represented by geometric-topological structure (Lo and Yeung, 2009). The model designed should be geographically and topologically consistent. Geometric inconsistency refers to geometric part of geographical features (shapes and coordinates). Three kinds of geometric inconsistency errors are repeated point: two or more points in the same Geographic Information System (GIS) is a computer based information system used to digitally represent and analyze the geographic features present on the Earth's surface and the events that are taking place on it. Further validation for topological inconsistencies have also to be taken care of.

The present research work deliberates on conceptual and logical designing of the spatial data models. The next section discusses the brief overview of various data models.

ITERATURE SURVEY

CONCEPTUAL MODELS

Conceptual database model represents the real world at a high level of abstraction that is independent of hardware and software. At this level objects/entities, their attributes and relationships are defined diagrammatically (Batini *et al.,* 1992).

CONVENTIONAL CONCEPTUAL MODELS

Entity relationship(ER) model (Chen *et al.,* 1976), is used to represent the relationship between entities and is a basic tool in database design. This model does a good job of capturing and representing the basic semantics of many different situations. However , the model, is not capable to capture more domain semantics for modern applications(Badia, 2004, Peckham et al., 1988), hence more domain semantics are included in EER models(Badia, 2004) where an enhancement has been made through representation of generalization/ specialization, aggregation and classification in ER model. E-R models have a layered approach to organizing information in that the basic components of an E-R model, attributes, entities and relationships can only be combined in certain ways , on the other hand,the extended entity-relationship mode (Elmasri *et al.,* 2009) is decomposed according to a set of basic entity-relationship constructs, and these are transformed into candidate relations via entity relations, extended entity relations and relationship relations which reduce the number of data dependencies and maintains data integrity through normalization.

It has been observed that the above mentioned ER, EER models can represent traditional database design for conventional commercial applications and are not effectively suitable for GIS applications as they are incapable to represent spatial aspects.

GIS SPECIFIC CONCEPTUAL MODELS

MADS is a spatio-temporal data model. It is a framework suitable for vector data for use at different resolution levels. The MADS(Parent et al., 1999)(Christine et al., 1999) data modeling, data matching from different data sets, and data utilization supporting multiple representations. It belongs to the family of entity relationship data models extended to supports the main concepts of object oriented and spatio-temporal features to be represented in conceptual database design. Remodeling of ER models into MADS has reduced the number of object and relationship types by a factor of 23% compared to ER models.

Chrono GeoGraph(CGG)(Sandrine et al., 2004) is another spatio-temporal model that pairs the classical features of the EER model with a large set of spatial and temporal constructs . It introduces spatial attributes that take their value over a geometry type and can be associated with spatial and non-spatial entities. CGG model is being extended so that multiple representations of topological relations can be dealt with (Donatella et al.2008). Topological relations allow us to constrain the relationship between the geometries of pairs of spatial entities. Moreover it makes it possible to pair the spatial entity with multiple viewpoints, shapes and resolution by means of suitable primitives for cartographic specialization. Both MADS and CGG Model lacks to incorporate either the topological or the network or both the aspects of GIS applications.

Several models E.g. GeoOM(Tryfona et al.,1997), MODUL-R(Yvan et al., 1996), and SPATIAL E-R model(Li et al., 2006), Spatially Enhanced EER Model(SEER)(Firn, 1994) only supports the representation of spatial information, similarly temporal model e.g. Temporal Entity-Realtionship Model(TERM), Temporal EER Model(TEER)(Yvan et al., 1996),Relationships, Attributes, Keys and Entities Model(RAKE)(Ferg et al., 1985) supports the association of time with objects, relationships and attributes. Whereas, in a real life for a GIS application, apart from Spatial , temporal and spatio-temporal scenario, topological and network scenarios are also frequently encountered. GeoOOA(Kosters et al., 2006) Object-oriented Analysis for GIS overcomes the deficiencies of conventional spatio-temporal and object oriented analysis model by adding suitable domain tailored primitives such as topological, network etc. but is applicable for object – oriented analysis only.

In conclusion, none of the above mentioned spatial and temporal models satisfied the representation of topological and network Geo-primitives for relational GIS applications appropriately. This prompted the development of Topo-Net Spatial Entity Relationship model for representing topological, network and generalization features fulfilling the simplicity and comprehensiveness criterias, where simplicity of the model talks about easiness of use and understanding and comprehensiveness means the direct representation of topological and network aspects in the model. The Topo-Net spatial ER model (Bahl *et al.,* 2011) has been designed through the proposed notations for a GIS application.

LOGICAL DATA MODELS

At logical level, the conceptual schemas are translated into logical schemas. These schemas are represented through the logical models. These models give the designer a formal methodology and framework for the correct specification of the geographical information. Implementations at this level are based on conventional relational, object-oriented or object-relational approaches being discussed below:

RELATIONAL DATA MODEL

The power and elegance of the relational model stems from the fact that it uses a single construct, the relation(Gubiani et al., 2007). Five functional closed operations are defined in relations, namely, union, difference, selection, projection and Cartesian product.

For spatial applications, however, the resulting representation is inadequate.

For example, if layers are represented with plain relation, operations such as overlaying and reclassification cannot be derived from the fundamental relational databases.

In the relational model these operations are hidden in the physical level. As a result important information is lost and the system is tied to some specific implementation. Thus relations are inadequate as the sole modeling construct for geographical applications.

GEORELATIONAL DATA MODEL

Data representation for GIS applications includes the spatial and attribute component (Dangermond et al., 2008). Spatial data describes the location of spatial features, whereas attribute data describes the characteristic of spatial features. The Geo Relational data model stores spatial and attribute data separately in a split system. Spatial data is stored in graphic files and attribute data is in a relational database. A Geo Relational data model uses the feature label or ID to link the two components as shown in figure below. The two components must be synchronized using some ID so that they can be queried, analyzed and displayed in unison.

OBJECT BASED DATA MODEL

A fundamental requirement for spatial database design is the ability to model spatial properties, i.e., to associate parts of space with an attribute (Tadakaluru et al., 2005).

Parts of space are usually represented by points, lines and regions and are known as geometric features. Spatial applications deal with two, orthogonal, generalizations of spatial properties. One is association of the whole of space with

an attribute and the other is associations of sets of attribute and geometric feature. The former is modeled with concepts oriented towards objects (Sauchyn et al., 2008). Object Based Data Model has been used as a means of conceptual structuring of geographic information. In particular it models real-world objects (or entities) with a precise and 'crisp' spatial location and extent.

The object based data model differs from the Geo Relational data model in two important aspects. First, the object-based data model stores both the spatial and attribute data of spatial features in a single system i.e. an object rather than a split system. Second, the object-based data model allows a spatial feature to be associated with set of properties and methods. Since both spatial data and attribute data is stored in a single system the problem of data synchronization is eliminated that is found in split system Geo relational data model.

VECTOR LOGICAL DATA MODELS

Vector data represents discrete features and its data types points, lines and polygons are stored and managed using vector data model. Various vector logical data models viz: the Spaghetti Model (Dangermond, 1982), Topology Model (Dangermond, 1982), Polyvrt (Peuker and Chrisman, 1975), Bi-level (Choi and Lub, 1991), Geo-relational (Morehouse, 1985&1989) and Geo-database (Twumasi, 2002) have been studied and explained below:

THE SPAGHETTIE MODEL

In spaghettie a digital cartographic data file is constructed referred to as a spaghattie file which is a collection of coordinates, strings heaped together with no inherent structure (Dangermond, 1982). This model is inefficient for most types of spatial analysis, since any spatial relationships must be derived through computation. On the other hand the lack of stored spatial relationships, which are extraneous to the plotting process marks the spaghetti model efficient for reproducing the original graphic image. Thus they are used for simpler forms of computer assisted cartographic production.

TOPOLOGICAL MODEL

In topological modelthe information allows the spatial definitions of points, lines, and polygon type entities to be stored in a non-redundant manner (Dangermond, 1982). The GBF/DIME (Geographic Base File/Dual Independent Map Encoding) model is built upon the topological concept. The model represents a directed graph. ,in which an explicit direction is being assigned by recording a from-node and to-node which automatically check for missing segments and other errors in the file. In this model the basic logical entity is a straight line , where street, river, etc is represented as a series of straight line segment which are spatially defined. The main problem with this model is that the individual line segment do not occur in any particular sequence order, so to retrieve all line segments which define the boundary of a polygon, an exhaustive search must be done as many times as there are line segments in the polygon boundary.

POLYVRT

Peucker and Chrisman (1975)developed POLYVRT(Christine et al., 1999). This model had overcome the very major retrieval and manipulation inefficiencies seen in simpler topologic structures by explicitly and separately storing each type of data entity in a hierarchical data structure. It made distinctions between types of entities both logically and topologically meaningful, so that a chain is denoted as the basic line entity. It facilitates easy search and retrieval and there is partitioned storage. Leads to storage overhead (pointers) and integrity of pointers. It is a multipurpose database model .

GEO DATABASE DATA MODEL

This model is built on arc-objects. It uses the geometries of point, polyline and polygon to represent vector-based spatial features (Egenhofer et al., 1994). The data structure of geo database distinguishes the feature classes and feature datasets. A feature class stores spatial data of the same geometry type and its datasets stores feature classes that share the same coordinate system and area extent. In this model, feature classes can be standalone feature classes or members of a feature dataset. The geo database constitutes a uniform repository of both spatial and attribute data in a single database system. Objects in the geo database can have behavior associated with them. Integration with object-oriented concepts and COM technology allows great level of customization and reuse of the model to create application-specifications, which may (in the figure) provide the framework for interoperability. The main problem we encountered was the custom domains, but this was not investigated. In addition, although the Arc Objects Library is extensive, more functionality needs to be added to allow high level of customization.

BI LEVEL DATA MODEL

There are two separate layers (Choi et al., 1991) in this model as mentioned below:

Higher level data model (Geographic object data model): This level consists of the geographic objects and a set of semantic spatial functions through which the topological relationships among objects can be defined or derived.

Lower level data model (Geometric object data model): This level consists of geometric objects which are actual spatial representations of the geographic objects. It also has a set of functions for retrieval, manipulation, computation of geometric objects. In this model, relationship between geographic and spatial objects is investigated, Spatial object is not PART-OF a geographic object , but is just a representation of the geographic object , similar to the mapping from one object to any other object(s). Where as Triangular pyramid model, the proposed model has three abstraction levels represented using three components – the object component, Geometric component and the location component. The details of the same have been discussed in the next section. In this model “uses” relationship type has been introduced, where the common reference table is used for representing the

location component for various maps.

SPATIAL DATA QUALITY ISSUES

Spatial data quality like data accuracy, precision, consistency, completeness and so on are the key issues in Geographic Information System (Jeffrey et al., 1994) (Wand et al., 1996). Lot of research has been done in this direction. Various models, techniques, methodologies, tools and framework have been developed to meet the data quality dimensions(Wang et al., 2009). Dimensions are applied with different roles in models, techniques, tools, and frameworks. With reference to inconsistency dimension, it has been found that Geometric and topological inconsistencies have been handled either by using algorithms like node snapping(Liu et al.,2001) or through software written in AutoCAD LISP(Egenhofer et al.,1990). They are mainly discussing Geographical boundary inconsistency (Xie et al., 2010) caused when the geographical data are from different data sets or results of spatial analysis. The inconsistencies between two adjacent geographic boundaries are either because two boundaries have same number of vertices but not the same coordinates and secondly they have the different numbers of vertices. To resolve the mentioned inconsistency, node snapping generalized algorithm is used for finding matching vertexes, and standard formalizing of inconsistent boundaries by vertical projection. Topological inconsistencies like intersection ,separation and interlaced intersection have been corrected by using Delaunay triangulation (Ai et al., 2000). It is used for obtaining adjacent areas to remove topological inconsistencies.

Topological error correction of GIS vector data (Gubiani et al., 2008) has been accomplished by Autocad VE Autolisp. It eliminates Floating or short lines, overlapping lines, overshoots and undershoots, Unclosed and weird polygons , dangle nodes, nodes and pseudo nodes , slivers and gaps error etc. The software automatically checks the mentioned errors and makes the necessary corrections for accurate spatial analysis.

A Geo Expert- framework (Tadakaluru et al., 2005) has been proposed for data quality in Spatial database . It is a cleansing tool for spatial data that integrates the spatial data visualization and analysis capabilities of the ARCGIS Engine for an expert system.

All above mentioned anamolies refers to the inconsistencies that can be resolved either algorithmically or through the software design. However, the inconsistencies arising while digitization and due to multiple inputs may be best suited to be resolved at the data model level. The concept though has been recommended (Xie et al., 2010), its implementation details were not evident.

MODELS FOR TOPOLOGICAL RELATIONS:

Binary topological relations between two objects, A and B, are defined in terms of the four intersections of A's boundary(A) and interior(A) with the boundary (B) and interior (B) of B(Egenhofer and Franzose 1991). This Model is concisely represented by a 2*2 matrix, called the 4-intersection and is the basis for accessing the proposed Triangular Pyramid framework.

As mentioned in literature, for analytical capability of any system, data models have vital role. The appropriate data modeling will lead to efficient results. Hence, to overcome the mentioned gaps in the literature, the focus of the present research work is on the designing of an effective spatial data model at conceptual and logical levels and is being explained in the next section:

OTIVATIONS FOR THIS RESEARCH WORK

Literature shows that various spatial and temporal models are available but none of them satisfied the representation of topological and network Geo-primitives for relational GIS applications appropriately. This prompted the development of Topo-Net Spatial Entity Relationship model (Bahl et al., 2011) for representing topological, network and generalization features fulfilling the simplicity and comprehensiveness criterias, where simplicity of the model talks about easiness of use and understanding and comprehensiveness means the direct representation of topological and network aspects in the model. The Topo-Net spatial ER model has been designed through the proposed notations for a GIS application.

One of the major challenges the Geographic Information System applications face today relates to quality of data. Better the quality of data, efficient is the application. Quality of data have multiple dimensions like completeness, validity, consistency, timeliness and accuracy, that makes data appropriate for a specific use. The rationale of quality refers to the degree of excellence exhibited by the data in relation to portrayal of the actual scenarios. Inconsistency issues in spatial databases have major concern for quality data as it results in data integrity. It has been observed that most of the inconsistencies are addressed through either algorithms or software's. However, the aspects arising at data collection and preservation phase is much recommended while designing the database and thereby handling the geometric and topological inconsistencies. Hence, the research also deliberates on quality concerns and its assessment through the tool development.

At Logical level various data models like spaghetti, polyvrt, bi- levels etc. are available but they suffer from one or another drawbacks as discussed above in the literature review. Hence, an approach to design a data model is evolved which can overcome the identifies gaps of various models being studied to overcome the identified gaps of various models being studied for a GIS application. An enhanced object relational dynamic data model has been proposed in which reusability and dynamicity has been introduced for the database. Reusability concept allows storage of distinct objects having same spatial representation onto a single storage space and dynamicity allows creation of relations on user's requirement. The conceptual data model for the same has been designed named Triangular Pyramid framework.

To prove that the proposed model can be used by the GIS community for vector data storage, its performance with respect to response time and quality parameter aspects related to inconsistencies have been compared with the similar type of existing bi-level data model which has been implemented using a manual digitizer tool named "Digitiz"(Bahl et al., 2011).

Large amount of spatial data is derived from map digitizing. In spite of availability of a large number of packages available for digitization, there is no complete automatic digitization software available, since every image is different and it has its own properties. In view of this, the practice of acquiring vector data continues to be by manual digitization. Existing Digitizers like Algolab R2V Toolkit, Vextractor and WinTopo are automatic raster to vector conversion software's but they suffer from drawbacks like inability to add data in the vector format, inability to handle queries, making modifications and storage of all the data in global database. Hence, to overcome the above mentioned drawbacks and to understand the structure of existing bi-level object oriented model, "Digitiz" tool based on bi-level model has been developed.

High level topological information about spatial objects can be described in terms of a set of binary topological relations between the objects, also called a scene description. The objects of interest are spatial regions, which are bounded objects that have a distinct identity. The consistent integration of topological information relies inherently on the algebraic properties of the relations between the objects. Properties such as the converseness of pairs of relations and the composition of relation must be fulfilled for any combination of relations in order to guarantee that a scene description is free of internal topological contradictions. To prove that the proposed model is free of internal topological contradictions a rigorous computational method has been adopted to reason about topological relations between spatial regions and to infer consistency of topological information. The proof validates the proposed Triangular Pyramid Framework (Bahl et al., 2011) based on 4-intersection model which is considered as the basic model for representing binary topological relationships between two objects.

The research proceeds to understand how the In-Memory Data-Grid solution (Bahl et al., 2012) for storing the GIS databases is better than the conventional method of storing the database in the secondary storage.

MPORTANT ACHIEVEMENTS

PROPOSED MODELS

Topo-Net Spatial ER Model

The Topo-Net Spatial ER model for Geographic Information Systems has been proposed at conceptual level for representing topological, network and spatial features for GIS applications Indeed, an analysis of existing models shows that topological and network features are weakly defined. The proposed Topo-Net Spatial ER model supports topological ,network and Generalization features effectively. The model is far more flexible, simple than what many other models offer. Finally, Topo-Net Spatial ER model led the application designers to discover the importance of topological , network and generalization features within their application. The usage of the same to represent Optical Fiber Cable Network is shown below:

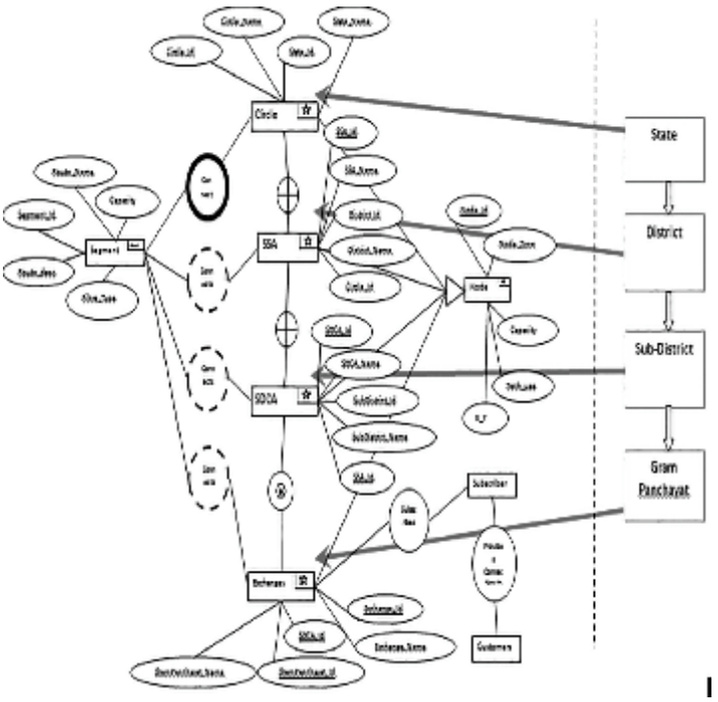


Figure 1. Topo-Net Spatial ER Model for Optical Fiber Cable Network (From Bahl et al., 2011)

Proposed Triangular Pyramid Framework for Enhanced Object Relational Dynamic Data Model for GIS

The objective of Triangular Pyramid Framework for Enhanced Object Relational Data Model (Bahl et al., 2011) is to develop a framework for enhanced object relational dynamic vector data model, for representing the complete information being required for representing the data for GIS based application.

The Data Model being developed has three levels of abstraction. They are: The Object Component (Highest Level), the Geometric Component (Middle level), and the Location Component (Lowest Level). The diagrammatic representation of the same is shown in fig 2.

The Object Component (Highest Level)

Map is a combination of different types of layers. These maps and layrs are called objects as they are real life entities having both attribute and behavior. Attribute corresponds to the nature of the phenomenon the data represents and behavior specifies the manipulation processes. This is the highest level of abstraction, and at this level geographic data is represented by layers representing the relative position of spatial objects.

The Geometric Component (Middle Level)

The Geometric component is the middle level as it is the interface between the object and its actual spatial existence on the earth. Each geographic object at the higher level has its corresponding geometric object. The information at geometric level represents the shape of the geographic object, which is categorized into three: - point, line, polygon.

The first is point data where each object is associated with a single location, Example a city, district, school, hospital etc.

The second is line data where the location is described by the string of points, Example: - road, river, drainage, national highway etc.

The third is polygon data, where the location of object is represented by a closed string of coordinates. They are thus associated with areas over defined space, Example: -blocks, villages etc.

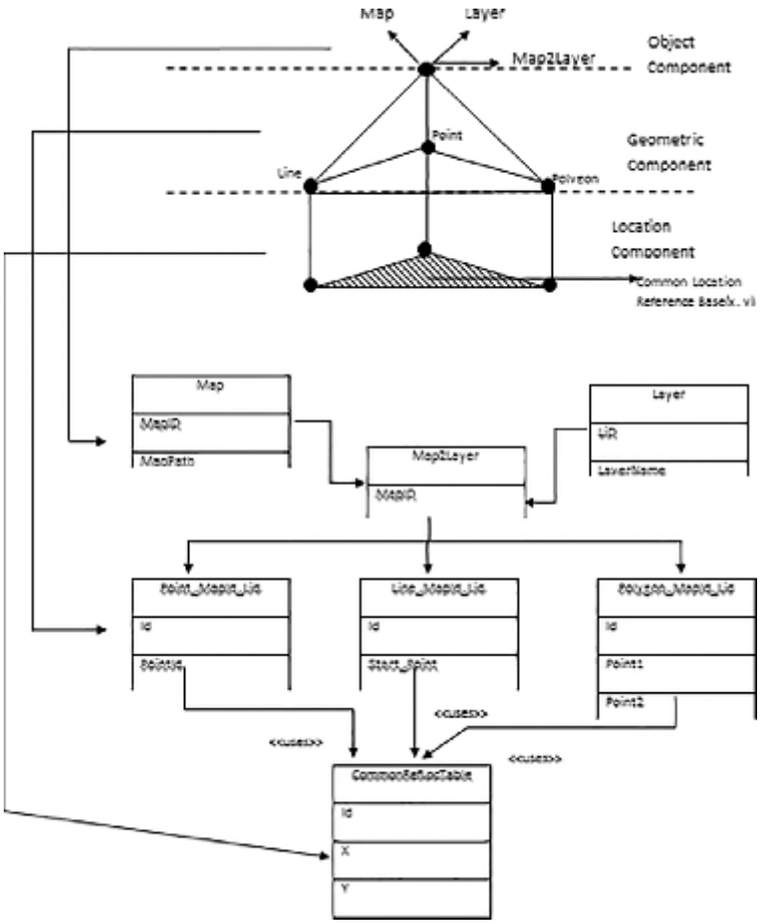


Figure 2. Triangular Pyramid Framework

The Location Component (Lowest Level)

The lowest level of proposed data model is location component which represents the actual screen coordinate values of the geometric objects at the middle level.

The proposed model has been designed in a way that it is liberated from various topological inconsistencies caused due to topological relations that arise at the time of digitization and data storage. It introduces Reusability and Dynamicity for the database. Reusability concept allows storage of distinct objects having same spatial representation onto a single storage space and dynamicity allows creation of relations on user's requirement. The third level being introduced to store the common location data in the framework is the basis for inconsistency removal of the spatial data.

Methodology Adopted For Developing Terzatto Tool

The tool is developed using top down approach implementing Triangular Pyramid Framework. It is developed by incorporating functionality of MapWinGIS ACTIVEX CONTROL in VB.NET which helps to Load Shape file and perform various functions like Add label, Clear Label, Zoom In, Zoom Out, Zoom to Shape, Zoom to Previous Shape, Panning and many other features. The database is being designed in Postgres SQL considering various aspects like referential integrity, unique data types, extensibility and plug-in. By using Plug-in shape files are imported, which are required to be transformed. The system thus developed is user friendly with a simple GUI which allows user to interact with system, with no or minimal help. It performs insertion and retrieval of data successfully for all the three types of geometric shapes (point, line & polygon).

XPERIMENTAL RESULTS

Comparative Performance graphs corresponding to retrieval time being taken when data is stored using bi-level data model and Triangular Pyramid Framework have been shown in Figure. 3 & Figure. 4 below:

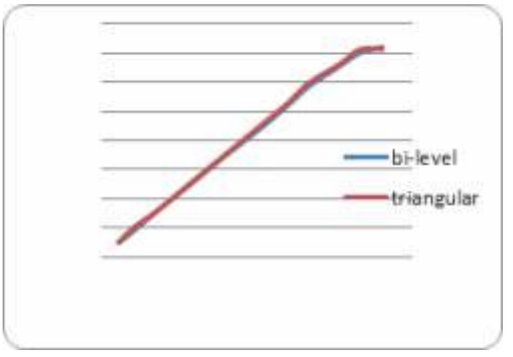


Figure 2: Retrieval Time Graph

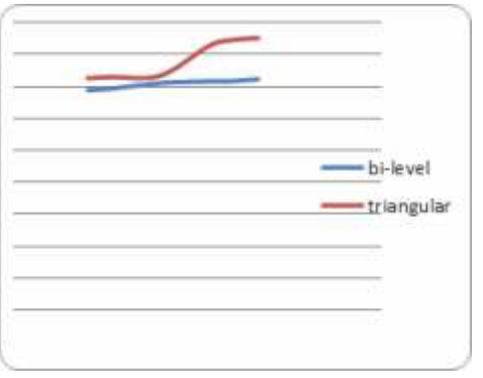


Figure 3: Retrieval Time Graph

Figure. 4 shows the comparative graph with the constant number of rows and varying number of columns as per the retrieval time values being shown in table below:

Table :Retrieval Time (Varying No. of Col.)

No. of Col.	10	9	8	6	4	3
Bi-level (retrieval time in ms)	14.416	14.314	14.293	14.203	13.894	13.795
Triangular Pyramid Framework (retrieval time in ms)	16.999	16.895	6.54	14.693	14.597	14.536

Table : Retrieval Time (Varying No. of Rows)

No. of rows	2718	2500	2300	2000	1800	1500	1200	1000	800	500	300
bi-level Triangular	14.416	14.008	13.091	11.712	10.436	8.663	7.031	5.877	4.727	3.043	1.843

Figure 4 shows the retrieval time with the constant number of columns and varying number of rows.

The result shows that there is marginal difference in the retrieval time when the data is being stored using the bi-level data model or using the Triangular Pyramid Framework. But when the digitized data is being stored using Triangular Pyramid Framework, it resolves geometric and geographic inconsistencies dynamically. Apart from that Triangular pyramid framework has introduced enhanced object relational data model. It is known as enhanced as it has introduced dynamicity for storing digitized data and than resolving inconsistencies in the model. It has also introduced "uses" relationship type for establishing relationship between two entities.

Bi-level data model is object oriented and it uses PART-OF relationship type to represent relationship between two entities.

A bi-level object – oriented data model defines the spatial and non-spatial geographic and geometric object layer for representing GIS application's data. New OFQL query language was also defined to provide high computational power by using nested or complex functions called super-functions. Whereas, Triangular Pyramid framework has been specially designed for data representation and its focus is on the quality parameters of spatial data. Quality concern being referred to, are Geometric and geographic inconsistencies. Experimental results show that although there is marginal difference in the data retrieval time between the two models i.e., marginally less time is being taken in bi-level model as compared to triangular pyramid framework but Quality parameters being resolved while designing the database using triangular pyramid framework makes this model more suitable for spatial data storage for GIS applications. Therefore, GIS community can use this model for spatial data storage.

Resolving Inconsistencies

Existing vector data available in shape file format available at National Informatics Centre, GIS department, India, has been transformed to Triangular Pyramid Database Model using "Terzatto Tool". Now the tool provides a method to acquire, manage, and display information with no geometric and topological inconsistency.

Initially the sample data of Gautama Budh Nagar, Noida, Uttarpradesh, India,is loaded with MAPWINGIS active X control and the map is drawn. On click of the map, the data is transformed to Triangular Pyramid Framework resolving both the types of inconsistences dynamically.

Resolving Geometric Inconsistency

Geometric inconsistency refers to geometric part of geographical features (shapes and coordinates). Three kinds of geometric inconsistency errors are repeated point: two or more points in the same position of a feature (line or polygon), repeated segment: two or more segment in the same position of a feature (line or polygon), overlapping boundaries without the same coordinates: there are different vertexes of the shared boundary of features, including different number of vertexes, or different coordinates of vertexes.

A solution has been proposed for inconsistency removal which is handled dynamically keeping in mind the storage and time constraints. Geometric inconsistencies have been handled with the inclusion of common reference table in the Triangular Pyramid Framework and MapWinGIS ActiveX control. Common location table stores the screen coordinates(x,y) of the location wherever user clicks on the map. With the help of mapWin GIS ActiveX control we are able to generate a uniqueId for every object which acts as a primary key for the common location table. Once the location for a particular object on any layer has been saved, it is not saved again in the database irrespective of repetitive selection of that same object either on same (x,y) or different (x,y) location because of the uniqueId generated for the object. Repeated line and Repeated polygon inconsistenices have been discussed below and experimental results are shown with help of data available for Gautam Budh Nagar.

"NO REPEATED LINE"

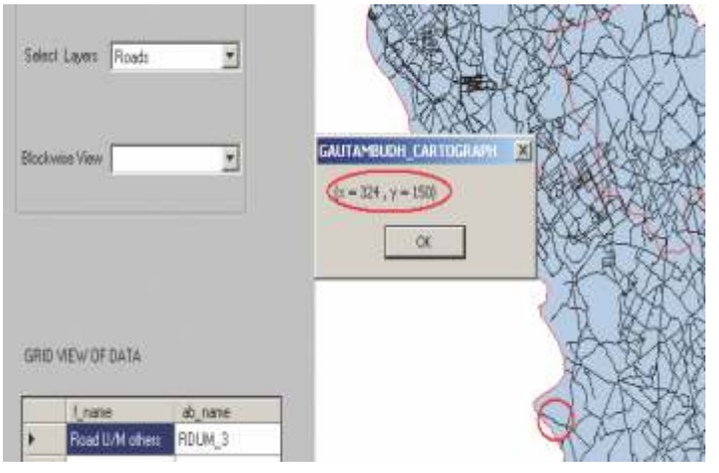


Figure 5(a) : 1st click on the road layer.

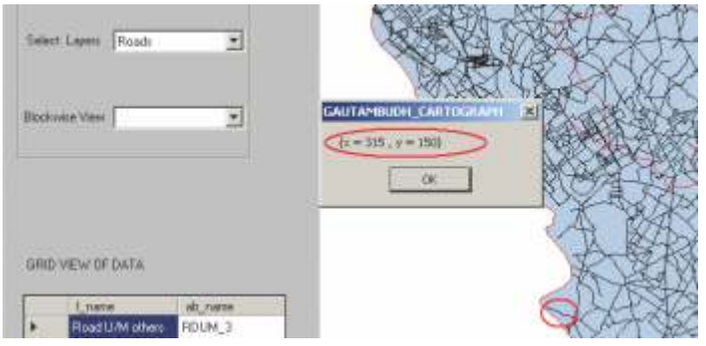


Figure 5(b): 2nd click on the same road

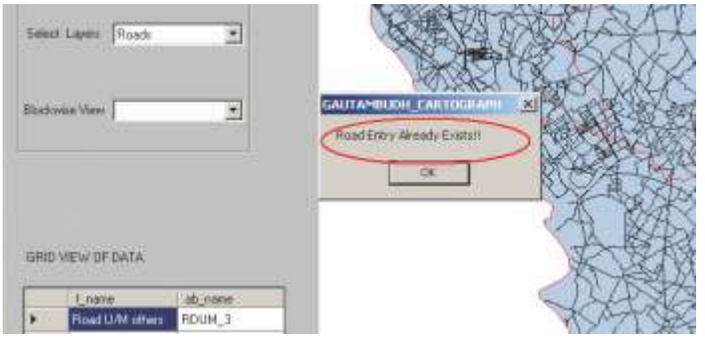


Figure 5(c): Error Message displayed

Cid, X, Y generated in comloc table as shown below:

	cid [PK] integer	x double precis	y double precis
1	11	121	58
*			

Table COMMOM LOCATION TABLE

In Layer table entries are as shown below:

	layerid [PK] integer	layername character vai	layershape character vai
1	7	Drainage	Line
*			

TABLE LAYER TABLE

In map 2 layer table entries are as shown below:

	id [PK] integer	mapid integer	layerid integer
1	8	1	7
*			

"NO REPEATED POLYGON"

Repeated polygon geometric inconsistency has been resolved using the proposed Triangular Pyramid Framework and is called as "No Repeated Polygon" consistency. For Gautam Budhnagar map, when user selects blocks from Select Layers option, block (polygon) layer will be loaded. On click at (x = 262 , y =323) the data for block has been extracted from the spatial file available and will appear in grid as show in Figure 6(a).At the same time a uniqueId (cid = 405 for this case) is assigned dynamically to the block with blk_name as "Dankaur" which will be saved in common location table with its (x,y) values. Now, clicking again on the same road but with different location (x = 254, y = 418), the same unique Id will be generated for the Dankaur and due to primary key constraint of the table the data will not be saved. An error message is displayed as shown in figure 6(b) and figure 6(c). Its data entries in the corresponding table are shown below.

The screen shot of block Dankaur showing no repeated polygon is represented in Figure 5.

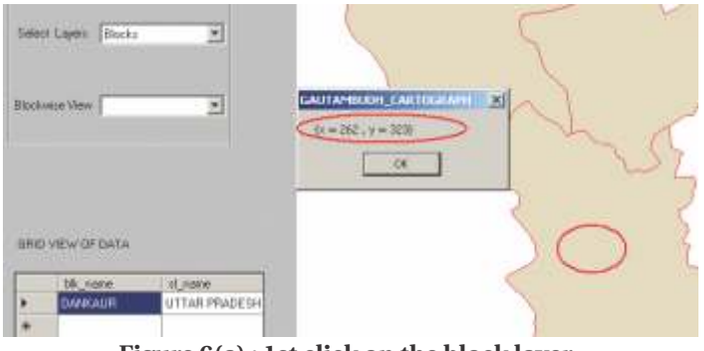


Figure 6(a) : 1st click on the block layer.

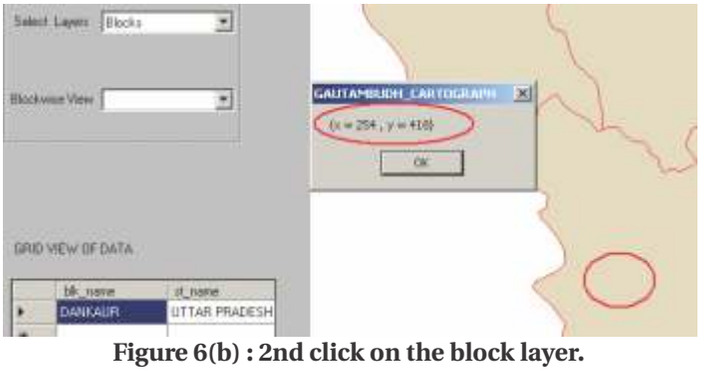


Figure 6(b) : 2nd click on the block layer.

Figure 6(c) : Error Message Displayed.

	layerid [PK] integer	layername character vai	layershape character vai
1	3	Villages	Polygon
*			

Table 1: Layer Table

	id [PK] integer	mapid integer	layerid integer
1	4	1	3
*			

Table 2: Map 2 Layer

This cid, id generated will go in row of "layer" table (block layer) where "Dankaur" information is stored. When User again clicks on block Dankaur, there will be no repeated entry in common location table as well as in row of block table in database The table in database on clicking again is shown below:

	cid [PK] integer	x double precis	y double precis
1	405	124	29
*			

Table 3: Common Location Table

This shows that there is NO REPEATED GEOMETRIC INCONSISTENCY in Database.

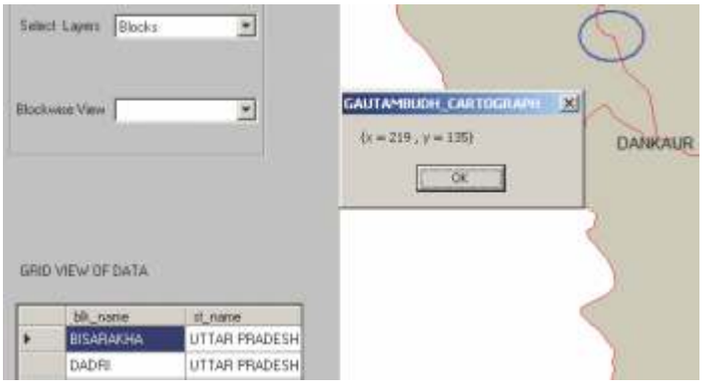
Resolving Topological Inconsistencies

Eight inconsistencies have been resolved.

Equals and disjoint inconsistency

In the proposed framework separate database relations have been created dynamically for each of the three layers namely point, line, and polygon; hence the disjoint inconsistency is being handled automatically. Moreover, for each object on a particular layer a unique Id has been assigned, which uniquely identifies the object. Hence the equal inconsistency is also being automatically resolved. For an example, Bisarkha has a uniqueId = 5 which is not assigned to any other object on the same layer as well as on different layer. So Bisarkha equals Bisarkha i.e. if user wants to retrieve object with Id = 5 then only Bisarkha will be shown and no other object from same layer or different layer will be shown.

Meet Inconsistency



Evaluation of the Topological Inconsistencies

To assess a set of binary topological relations between spatial regions a scene for Gautam Budh Nagar has been designed and using the computational table it has been evaluated. Evaluation is based on 4-intersection model (Egenhofer and Sharma, 1993). The eight topological relations being examined are disjoint, contain, inside, equal, meet, cover, overlap and covered between two spatial regions. Above mentioned five topological relations have been evaluated using the computational table. Rest of the relations have been deduced automatically using the converse property.

Boosting GIS's Performance Using In-Memory Data Grid (Bahl et al., 2012)

A GIS application (Samet, 2004) requires low response time, very high throughput, predictable scalability, continuous availability and information reliability which can be provided by In-Memory Data Grid.

In-Memory Data Grid is a Data Grid that stores the information in memory in order to achieve very high performance, and uses redundancy - by keeping copies of that information synchronized across multiple servers in order to ensure the resiliency of the system and the availability of the data in the event of server failure (Colmer, 2010).

Over the last few years, In-Memory Data Grids have become an increasingly popular way to solve many of the problems related to performance and scalability, while improving availability of the system at the same time. In-Memory Data Grid allows eliminating single points of failure and single points of bottleneck in the application by distributing the application's objects and related processing across multiple physical servers.

One of the easiest way to improve application's performance is to bring data closer to the application, and keep it in a format that the application can consume more easily.

Most enterprise applications are written in one of the object-oriented languages, such as Java or C#, while most data is stored in relational databases, such as Oracle, MySql or SQL Server. This means that in order to use the data, the application needs to load it from the database and convert it into objects. Because of the impedance mismatch between tabular data in the database and objects in memory, this conversion process

is not always simple and introduces some overhead, even when sophisticated O-R mapping tools, such as Hibernate or Eclipse Link are used.

Caching objects in the application tier minimizes this performance overhead by avoiding un-necessary trips to the database and data conversion. This is why all production-quality O-R mapping tools cache objects internally and short-circuits object lookups by returning cached instances instead, whenever possible.

Customer expectations from GIS systems have evolved significantly over a period of time (Colmer, 2010). Today customers are expecting better and faster online experience.

Several architectures have been proposed to retrieve necessary, interested and effective information efficiently and at the same time provide scalable platform for GIS application. However, the results of these architectures generally become unsatisfactory and prone to performance loss over the period of time. As soon as the customer base increases, the performance starts retarding.

Implementation of distributed cache for a GIS application will not only boost performance of application but will also provide many more features to it.

If distributed cache is being incorporated in an GIS application the following features achieved would be - Low response time, High throughput, Eliminate bottlenecks, Predictable scalability, Continuous availability, Failover support and Information Reliability.

An effective caching mechanism is the foundation of any distributed-computing architecture. The focus of improving the performance of using in memory data grid has been finally implemented. It has been observed that retrieval time of GIS application's data saved using in memory data grid method is much less as compared to when the data is saved using the conventional database storage method. Thus, the use of distributed cache technology for spatial data storage will boost the performance of GIS application.

ONCLUSION

The present research is focused on the GIS specific data modeling domain wherein the data models are evolved at conceptual and logical levels. The research makes two main contributions in terms of data models for geographic information systems at two different levels: Topo-Net Spatial ER model at conceptual level and Triangular Pyramid Framework at the logical level.

Data models have a significant role in any GIS product. Fundamental aspects of these models at conceptual and logical levels for vector data have been explored during the present research. A sound foundation of data model needs sufficient representation of data at conceptual level and its storage at the logical level. Vector data model triangular pyramid framework for enhanced object relational dynamic data model for GIS has been proposed. Conceptual data model topo-net spatial ER model for GIS applications has also been proposed and designed for optical fibre cable network. Tools around bi_level data model and triangular pyramid data models viz DIGITIZ and TERZATTO have been developed and compared with respect to execution time for retrieving the records from the database tables .Performance of GIS database can be improved by keeping the database in the in memory data grid has been tested .

GIS community can use the proposed conceptual Topo-Net Spatial ER data model for representing the topological and network features being required by the GIS applications. Proposed vector logical data model “Triangular Pyramid Framework” for storing the digitized data available in shape file can be adopted by GIS application's developers either by using the developed tool named “Terzatto” or otherwise by using the proposed framework for designing their database. The validation of the proposed model on the basis of 4-intersection model using compositional table further strengthens its utility for GIS databases. Performance of the GISs can be improved further by keeping the database using the in-memory data grid.

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