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CONTENT

A Comparison of Reflective/Formative Second Factor Models with the Schmid Leiman Factor Structure

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INTRODUCTION

A common issue in structural equation modeling is the use of second order factor models (e.g. Agarwal et al. 2009). A second order factor is one that has no indicator variables. In a second order factor model, typically, there is correlation amongst some first-order factors and this correlation is attributed to the fact that these are driven by something above, a "super factor" or what is usually termed a second order factor (Kline 2005) that is theoretically superior (Rindskopf and Rose 1988). Within the genre of second order factor models, one has a choice of using reflective or formative second order factor models (e.g., Bennett and Ali-choudhury 2009). However, in reality, most work uses standard reflective first order models as indicated in Figure 1.

Figure 1 - Formative vs. Reflective First Order Models

Jarvis et al. (2003) discuss the possibility of formative second order factors, yet few have actually explored it empirically. In fact, although a viable alternative to the traditional reflective second order factor model, a formative second order model has its own share of problems (Howell, Breivik, and Wilcox 2007). For example, some argue that formative measurement uses conceptions of constructs, measures, and causality that are difficult to defend, the presumed viability of formative measurement is a fallacy, and the objectives of formative measurement may also be achieved using alternative models with reflective measures" (Edwards 2011). Interestingly, the Schmid-Leiman Factor Structure (SLS) may offer a better solution in many cases (Wolff and Preising 2005). Hence, this paper tries to:

a) Empirically compare and contrast reflective vs. formative second order models.

b) Demonstrate the use of the SLS approach empirically as a viable alternative to the formative second order model structure.

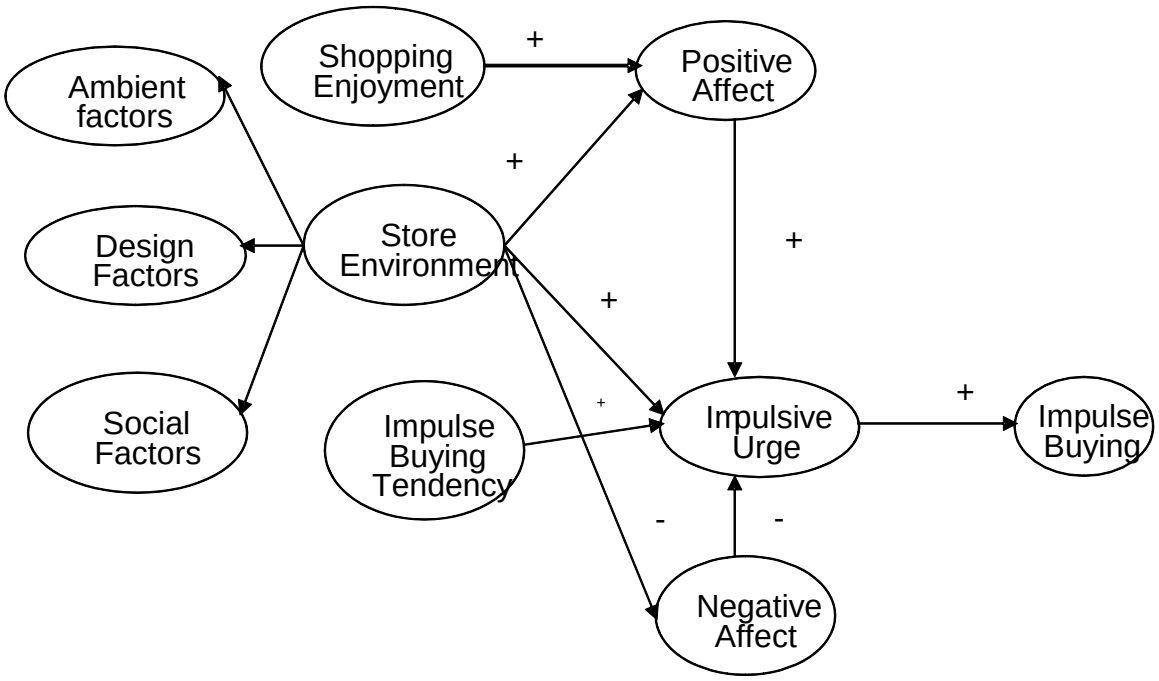
Specifically, we compare reflective vs. formative second order factor models vs. Schmid-Leiman Factor Structure with data from a mall survey in India that tested the impact of store environment on impulse buying.

MODEL DEVELOPMENT

Model 1 - Reflective Second Order Factor Model

In line with Baker et al. (2002), we define store environment as consisting of ambient (e.g. lighting, scent and music), design (layout, assortment) and social factors (presence and effectiveness of salespersons). Thus, store environment is a second order factor. Drawing upon extant research in psychology and retailing, we came up with a model. Figure 2 offers the standard reflective second order factor model that is the "default" option where the first order factors, social, ambient and design factors are reflective of the second order factor, store environment.

Figure 2 - Reflective Model - Store Environment and Impulse Buying

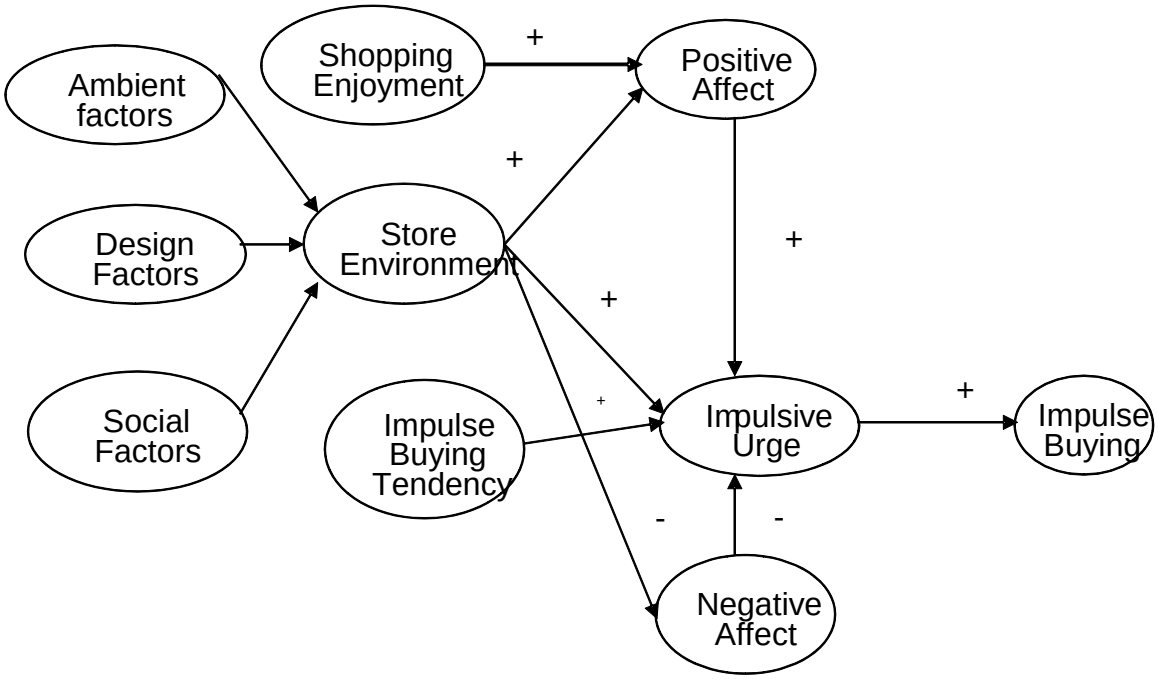


Model 2 - Formative Second Order Factor Model

According to Jarvis et al. (2003, pp.203), it is conceptually preferable to use reflective indicators if the direction of causality "flows from the construct to the measures" and formative indicators if the direction is in the opposite direction "from the measures to the construct". In the case of store environment, the perceptions of ambient, social and design factors drive overall perceptions of store environment rather than the other way round.

Specifically, shoppers may evaluate a store's ambient factors (e.g. if the music is nice in the store), social factors (e.g. the store employees are friendly) and design factors (e.g. the layout is good). Based on these perceptions, they may form an overall impression of the store's environment. It is unlikely that a shopper would first overall form a positive impression of the store and then because of this, conclude that its music was nice. Hence, in this case a formative second order model structure (Figure 3) may be appropriate.

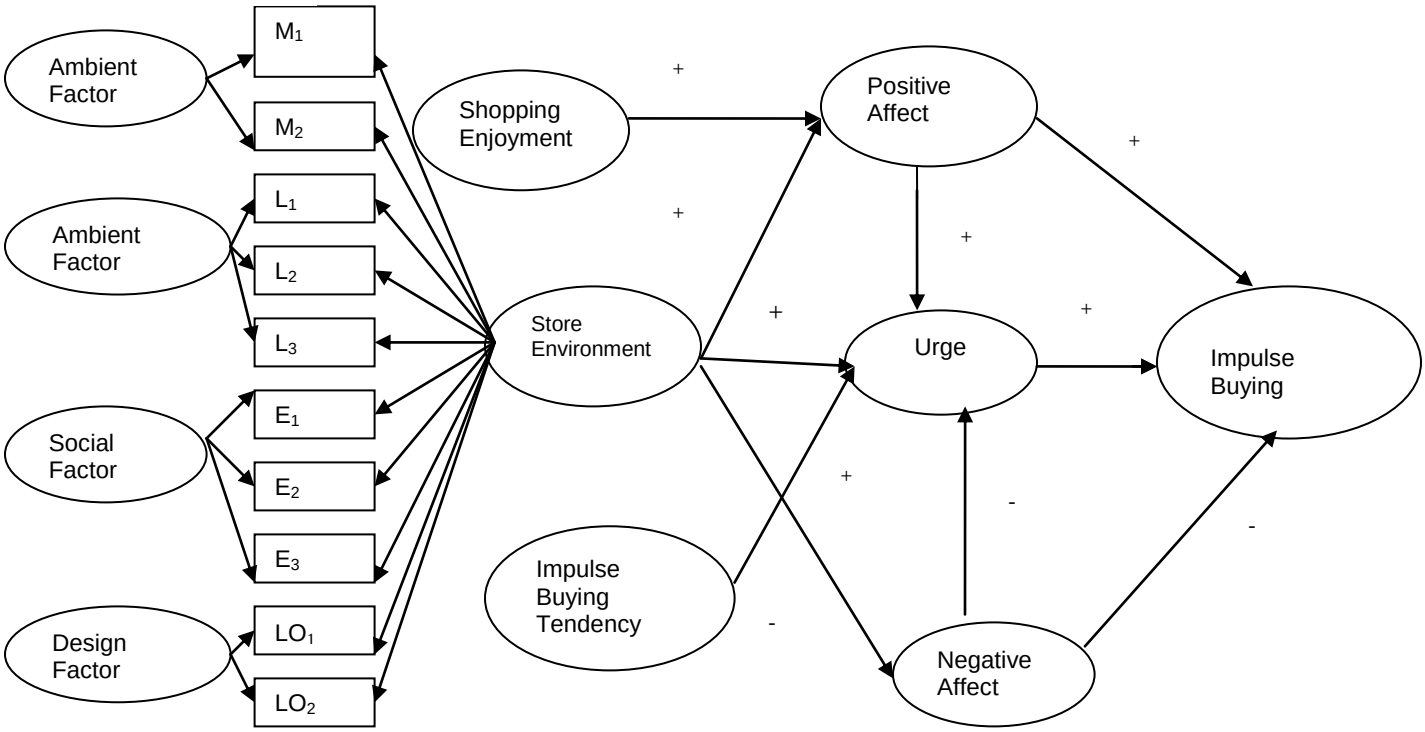
Figure 3 - Formative Model - Store Environment and Impulse Buying



Model 3 - Schmid-Leiman Factor (SLS) Structure

When there is a second order factor structure and the concerned constructs have multi-item measures, the Schmid-Leiman factor structure can be used instead of the second factor structures. In this structure, the first order factors as well as the factor considered to be the second order factor in a standard second order factor model are both considered exogenous. The indicator variables are considered to be driven by both the first order factors and the erstwhile second order factor, as shown in Figure 4.

Figure 4 – Schmid-Leiman Structure - Store Environment and Impulse Buying



In the standard second order factor structure, for instance, the indicator variable, "LO_1" is considered driven by the factor "design". In the new Schmid-Leiman factor structure, the same indicator variable is considered to be driven by both store environment (the erstwhile second order factor) and "design factors". We argue that this is more reflective of reality as well, since when a shopper thinks about "design", it is likely that apart from thinking of the store's design, (s)he will think about the store overall as well.

METHODOLOGY

We used a single stage mall intercept (in 44 leading outlets in Chennai, India) method to collect data (Sample size = 733, response rate = 46%). We used established scales for all constructs, which showed good reliabilities (Table 1). Only clearly unplanned purchases that could not be classified as reminder items were recorded as impulse purchases (Beatty and Ferrell 1998). The number of such impulse purchases was counted for each shopper.

TABLE 1

Scale	Source/s	Alpha	Mean	SD

Music	(Morin 2005)	.885	2.63	1.06
Light	(Areni and Kim 1994; Smith 1989; Summers and Hebert 2001)	.660	3.53	.68
Layout	(Dickson and Albaum 1977)	.628	3.63	.74
Employee	(Dickson and Albaum 1977)	.838	3.56	.77
Positive Affect	(Watson, Clark, and Tellegen 1988)	.770	3.25	.72
Negative Affect	(Watson et al. 1988)	.830	2.32	.80
Urge	(Beatty and Ferrell 1998)	.684	3.06	.93
IBT	(Weun, Jones, and Beatty 1998)	.714	3.12	.69
Shopping Enjoyment	(Sproles and Kendall 1986)	.881	3.17	.86

To test our model, we followed a 2-step approach using structural equation modeling, first refining the measurement model before analyzing the structural one (Anderson and Gerbing 1988). We tested Common Method Variance and found no evidence of this. Having purified the measurement model, we first analyzed a base model without the second order factor, store environment. We had direct paths from ambient, social and design factors to the mediators. The fit was poor.

Next, we analyzed the model with the standard reflective factor structure. The structural model yielded the following:(χ^2 = 860.33, *df* = 372, χ^2/df = 2.3, RMSEA = .07, SRMR = .05, CFI = .91). While the fit improved considerably, it was still below par. We then analyzed the model in Figure 3, the formative second order model. We found that the fit improved further (χ^2 = 388.52, *df* = 155, χ^2/df = 2.51, RMSEA = .05, SRMR = .05, CFI = .95) with all the fit-indices better than the recommended cut-off values (RMSEA < .06, SRMR < .08, CFI > .95). Finally, the Schmid**-**Leiman Factor Structure provided the best fit (as expected) compared to the models without a second order factor structure and a reflective second order one (χ^2 = 664.96, *df* = 356, χ^2/df = 1.9, RMSEA = .04, SRMR = 0.03, CFI = 0.95).

TABLE 2

	Fit Indices				
Model	**CFI**	**IFI**	**NFI**	**SRMR**	**RMSEA**
First Order Factor	.81	.81	.76	.19	.06
Reflective Second Order Factor	.91	.91	.86	.05	.07
Formative Second Order Factor	.94	.95	.91	.05	.05
Schmid-Leiman Factor Structure	.95	.95	.94	.03	04

In another study in Singapore and Hong Kong, we demonstrate the use of the SLS approach where the reflective model is apparently better in the context of consumer impulsiveness.

DISCUSSION

In this research, we evaluated four models, one a base model with no second order factor; two, a model with the default reflective second order factor model; three, a model with a formative second order factor model and finally a model with the SLS factor structure. We demonstrate the efficacy of using a formative second order and SLS factor structure. Hence, researchers using a second order model should not jump to the conclusion that a reflective second order factor is the only option.

We empirically demonstrate that a formative second order model works better if there is a conceptual basis to believe that the first order factors drive the second order factor. However, if some of the problems present in formative second factors are anticipated, researchers may use the SLS factor structure. Based on the findings in this paper, future researchers may ask the following questions:

- Is the use of the second order factor model appropriate? If there are inter correlations amongst the first order factors, or there is a common conceptual basis for the existence of the first order factors, the answer would be yes.

- If yes, would a reflective second order model work better or would a formative second order model work better? If the flow of the directionality is logically from the second order factor to the first order ones, the former would be more appropriate. If the directionality is from the first order factors to the second order factor, the formative second order model would be the right one to go with.

- If the use of formative second order causes problems with the conceptualization of constructs, operationalization of their measures or causality among various constructs, then using the SLS factor structure may be recommended.

Our research would thus be a useful pointer to others in Marketing and allied areas that use second order factor models. We empirically demonstrate when researchers should reflective or formative or SLS factor structures.

From a substantive standpoint, we add to the literature on second order factors. While Jarvis et al. (2003) mention the possibility of using formative second order factor structures, we take up their suggestion and empirically demonstrate the same. We also demonstrate the use of the SLS factor structure in Marketing for the first time. Finally, we compare and contrast the use of various alternatives (reflective vs. formative vs. SLS factor structures) all in one piece of work.

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Rethinking Marketing And It Relationship

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ABSTRACT

Information Systems (IS) and Technology (IT) enables most if not all business functions. Applications are typically designed for business functionalities in such business domains as manufacturing, supply chain and human capital management.

There are several classes of business applications that were designed for marketing functionalities and for addressing marketing problems, such as

- CRM applications enabling and supporting customer relationship management process
- Sales applications enabling pre-sales and sales processes from opportunity identification to closing a sale
- Campaign management applications to manage the marketing campaign processes
- Among others.

These applications relate to the traditional view of marketing operational models. However, as the marketing thought and marketing operational model and profession evolves, newer applications are emerging which relate to the current thinking in marketing. Examples are:

- Customer experience design and management applications
- Social network and social media management applications
- Customer self service applications
- Among others

This paper goes beyond these areas to identify and discuss a set of IT applications and associated data, which can be used by marketers to address specific marketing problems.

Four such application or tooling groups are:

1. Identity Management Applications and related Entity Analytics tools
2. Usability and User Experience Design and Management tools
3. Service Management tools
4. Social Business Architecture and enabling Applications

All four application groups helps with integrated view i.e. cross brand and cross business unit view and life time view of customer and customer data analysis for customer specific decision making including a) individual customer awareness, promotion, access and selling tactics, b) personalization and mass customization of products and services at the individual customer level and c) individual customer service and relationship tactics, among others.

A) Treating customer as an entity and his/her family or closely related groups as another entity and gathering,) tracking and analyzing (real-time) temporal SO-LO-MO (social, local and mobile) entity data from a shopping, consumption & usage as well as buyer-seller relationship perspective can significantly improve decision making related to individual customer level brand, promotion and awareness related tactics, location and access related tactics as well as traditional sales tactics.

B) Mass customization of products and services based on individual customer data is gaining in popularity across many industries. Emerging technologies and technology platforms such as SO-LO-MO (Social, Local and Mobile) technology platforms, and analytical tools such as social networks analytics, web analytics, text and semantic analytics, embedded analytics and entity (entity being the customer here) and individual customer level analytics platforms are accelerating the process of mass customization and enabling its application across industries.

C) Data driven designing and managing customer interactions, experience and relationship through a new set of applications (application architectures) that focus on systems of customer engagement rather than systems of customer transactions (both are needed). Systems of records are needed from a book keeping and accounting perspective as well as demand and revenue management perspective, while systems of engagements are needed for relationship management and improving value propositions and customer outcomes.

Identity Management Suites and Entity Analytics: (Customer as an Entity, in this case) that can be used for a myriad of marketing problems such as deeper understanding of the customer and customer behavior patterns, tracking cross business unit and cross brand (within a conglomerate) relationship with the customer, personalization and mass-customization of services at the individual customer based on customer data and customer life cycle events and entity analytics, amongst others.

Use Case: One of the largest financial services firm has several business units including retail banking, online banking, investment brokerage, mortgage and lending, real estate brokerage among other business lines. Some of these business units were acquisitions made by the company in the past. The company suspects that a significant portion of its customers are using services from two or more business units and would like to identify these customers and track their cross brand and cross business unit service purchase and usage behavior. Identity management solutions along with entity analytics helps with identifying these customer who may also have multiple online identities.

Mass-customization or personalization applications: Individual identity and related data (profile, preferences, habits, stage in life cycle, social life, health data … among others) used for mass customization of services. Example: In Airline service knowing individual preferences and current condition and using that data for beverage service. Premium (100K) passenger has acquired a flu (data available to airline from passengers health record system as he was prescribed a flu medicine within the last 24 hours before boarding) so recommend hot ginger tea to the client or even further, the airline knows that the client drinks cayenne pepper tea as a cold and flu remedy and hence offer the same to him.

Note: Identity Management and Entity Analytics originated in the Security Management space.

Usability and User Experience Design and Management tools: User experiences and usability are two closely related NFR dimension in the IS and IT management space. In fact, many enterprises treat user experience and usability management as dedicated IT process. However, it does directly relate to service enhancements through customer experience design and customer experience management (as a marketing process) and can be treated as a sub-set of customer experience management. Both disciplines can learn from each other to better design and manage customer and user experience i.e. service and e-service experience.

Usability and User Experience Management (UUEM) is an IT process which deals the design and implementation of non-functional requirements related to sub-dimensions such as easy of use, presentation logic patterns, user interface, user interactions, among others. Customer Experience Management (CEM) on the other hand is a marketing process that deals with the sum of experiences (experience during shopping, purchase, consumption, post sales service, among others) that the customer has with the service provider, over the duration of his or her relationship with the service provider, through one or more customer engagements.
CEM is a relatively more mature field than UUEM, and there are significant inter-relationships between the two processes.

Use Case: Customer of a global telecommunication company can interface with the company via multiple interfaces such as retail stores, call centers, online stores and online self help tools. The company management decides on embarking on an integrated customer experience management program which includes the design of both online and off line (face to face with front line employees, over the phone with call center employees among others).

Integrated planning, design and implementation of customers online experience (user experience) with the companies myriad online tools and customers offline experience (customer experience) with the companies myriad offline customer interfaces such as retail stores, customer service call centers, among others via such tools as common branding, common systems of engagements which gives common views of the customer to an online CSR (Customer Service Rep.) versus a retail CSR.

Note: User experience design and management tools originated in the software design and engineering and user interface design space.

Service Management tools: Service management tools such as service catalog integrated via enterprise service management bus to service fulfillment tools and service financial management tools can help with better understanding customers and better estimate customer life time value at the individual customer level. Service management architecture can not only provide tools for presenting service offerings but also include data warehouses that collect service and customer data for specific periods of time. Such data (historical and real time) can not only help with

estimating the value of a given customer to the enterprise based on his past transactions and engagements, but also help with estimating the future value of the customer by applying predictive analytics to the same data set.

Service management architecture and tool set are currently focused internally on technical services and IT service (as part of IT Service Management programs) and is being increasing applied to IT enabled business services and generic business services (as part of Business Service Management programs). Together, they can provide invaluable customer, customer interaction & customer experience data to enable and fine tune business strategy

Use Case C: IS and IT tools and systems such as Service Demand Management Systems, Service Catalog, Service Workflow Engines, Integration tools and IT Finance tools can go a long way to enable the measurement and reporting on such key metrics as Customer Profitability, Customer Lifetime Value (CLV) and Customer Equity (sum or aggregation of CLVs), especially in a conglomerate where the customer relationships span multiple business units and multiple service and product lines.

Note: Service management tool set and integrated service management tool set originated in the IT management and IT service management space.

Social Business Architecture and enabling Applications: As more and more enterprises embark in their respective social business journey with enabling applications such as social networking applications (example: IBM connections for social networking processes), Web 2.0 & collaboration tools, integration tools and analytics tools (such as social network analysis, affinity and sentiment analysis, text and semantic analytics and entity analytics). These social business enabling applications can help address multitude of marketing issues such as better describe customer social and professional relationships and affinities, group purchase and usage behavior patterns, personalization as well as better understand customer life time value (CLV) and customer social value (CSV).

Use Case D: Social Networking, Messaging and Collaboration Tools and Services from an enterprise ISD or Information Systems Division (some time defined as IT Services or IT Service Building Blocks) can significantly enable marketing communication to move from propaganda and mass marketing communication capabilities toward a one on one dialogue and conversation oriented capabilities and capture and store these conversations and dialogues for real time and future use via text and semantic analytics.

Mass-customization or personalization applications: Social business (social network) and related data (profile, preferences, habits, stage in life cycle, social life, health data … among others) used for mass customization of services. Example: In Airline service knowing individual preferences and current condition and using that data for beverage service. Premium (100K) passenger has

acquired a flu (data available to airline from passengers health record system as he was prescribed a flu medicine within the last 24 hours before boarding) so recommend hot ginger tea to the client or even further, the airline knows that the client drinks cayenne pepper tea as a cold and flu remedy (from a wall posting in his social network) and hence offer the same to him.

Note: Social business architecture and enabling application originated in the business modeling and business model innovation space

All of the four application domains, discussed above help enterprises move from inter-related and integrated systems of customer records (common today) to inter-related and integrated systems of customer engagement, a system part of the marketing vision as it relates to service dominant logic, e-service and rethinking marketing (see references below).

All four application domains can help with the design of systems of customer engagement for customer acquisition to cultivating customer relationship to working on retaining customer and building customer loyalty and to repeatedly delighting the customer.

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A Study On Customers Profiling, Competitors Mapping And Usage Pattern Analysis From Various Users Segments Of Anti-Rabies Vaccine With Specific Reference To Brand Raksharab From Indian Immunologicals Limited In Canine Practicing In India

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1) INTRODUCTION

1.1 About The Indian Immunologicals Limited

The National Dairy Development Board, popularly known as NDDB, was established by the Government of India in 1965 to develop the dairy and agriculture sector by adopting the cooperative pattern of ownership.
Indian Immunologicals Limited is a wholly owned subsidiary of National Dairy Development Board and was set up in 1983, under the "Operation Flood" programme, with the objective of making Foot and Mouth Disease vaccine available to farmers at an affordable price.
.In summary, IIL pursues its mission of making "immunity affordable" to both the animal and human health segments and in the process creates a vibrant biotechnology base for the country and a leadership position in the international arena

1.2 About Raksharab

'Raksharab' is the brand name of the Anti-rabies vaccine produced by Indian Immunologicals Ltd. for Canine, Small ruminant and large ruminant. It is available in three type of presentation i.e. 1ml vial, 5 ml vial and 10 ml vial in market.
Composition: Raksharab vaccine contains tissue culture Rabies virus, CVS strain, produced on BHK21 cell line, and inactivated with aziridine compound. Aluminium hydroxide gel is used as adjuvant. Each ml of Raksharab contains antigen potency > 2.5 I.U. as per the standards specified by WHO.
Raksharab is recommended for immunisation of dogs and other domestic animals against rabies for prophylactic and post-exposure therapy (PET).
Dosage: 1ml by subcutaneous or intramuscular route.
Prophylactic use : At 3 months of age and above. In case primary vaccination is given below 3 months, a booster dose should be given at 3 months age.
Post - Exposure Therapy (Pet): Administered on 0, 3rd, 7th 14th, 28th, 90th days of exposure
Immunity is conferred for a period of 3 years. However, annual vaccination is recommended in endemic areas.

1.3 Competitor Brands

brand	Name of the company	Logo	Country origin	presentation	Strain
Defensor	Pfizer		USA	1ml, 10ml	Pasteur
Rabigen	Virbac		France	1ml, 10ml	Pasteur
Nobivac R	Intervet		Netherlands	1ml, 10ml	Pasteur
Rabvac	Fortdoge		USA	1ml, 10ml	Pasteur (feline cell line)
Rabivac	Brilliant Pharma		India	1ml, 10ml	Pasteur
Biocan R	Bioveta		Czech Republic	1ml, 10ml	Strain SAD Vnukovo-32

Table 1: Overview of competitor brands

2. Research Overview

2.1 *Products:*

Vaccines For Live Stock	Canine Vaccines	Animal Health Formulations		Human Health Vaccines
1. Raksha	1. Raksharab	1. Ivectin	22. Gyroflox Inj.	1. Abhayrab (B.P)
2. Raksha Monovalent	2. Megavac-6	2. Vetalben 2.5%	23. Gyroflox tab.	2. Abhay RIG
3. Raksha Bivalent	3. Megavac-P (Inact)	3. Vetalben 10%	24. Gyroflox 10%	3. Abhay-Vac 3
4. Raksha Trivalent	4. Megavac-CC	4. Vetalben T	25. Inimox	4. Abhay-M
5. Raksha Ovac		5. Vetalben 300	26. G-cin Inj.	5. Abhay-M (I.P.)
6. Raksha Ovac Monovalent		6. Vetalben 600	27. Sulfamin	6. Elovac-B
7. Raksha Ovac Bivalent		7. Vetalben Forte	28. Vetylosin 5% Inj.	7. Abhay-TOX
8. Raksha Ovac Trivalent		8. Vetfen	29. Lithiomony	8. Abhay-DAG
9. Raksha Biovac		9. Vetfen - B	30. Inigesic	9. Abhay-TAG
10. Raksharab		10. Prazital	31. Nimovet	
11. Raksha - SP		11. Prazital Plus	32. Pesurea Bolus	
12. Raksha HS		12. Levaxinide	33. Calgonate	
13. Raksha BQ		13. Rafonide	34. Miphocal	
14. Raksha HS+BQ		14. Trichloben	35. Bovoplex - CC	
15. Rakshavac-T		15. Prozal	36. Mastect	
16. Raksha Anthrax		16. Trepanol	37. Xylaxin	
17. Bruvax		17. Tikkil Powder	38. Trophovet	
18. Bruvax REV1		18. Tikkil Solution		
19. Raksha ET		19. Oxytetracycline 5% Inj.		
20. Raksha PPR		20. Tetroxin - DS		
		21. Tetroxin - LA		

Table 2: Product overview of Indian Immunologicals Ltd.

2.2 Marketing Objective:

"A Study on customer profiling, competitors mapping and usage pattern analysis from various users segments of Anti-Rabies Vaccine with specific reference to brand RAKSHARAB" from Indian Immunologicals Limited in Canine Practising in India.

2.3 Research Objective:

- Demographic and psychographic segmentation of Anti-Rabies users.
- To know the volume and frequency and usage behaviour of various segment of customers for brand Raksharab.
- To find out attribute wise preference for Anti-rabies product category.
- To map the perception of customers towards different brands of Anti-rabies.

2.3 Key Information Areas:

We studied the following Key Information Area's to ascertain the findings have maximum desired coverage, to extract final deliverables and the results of the research to be valid and accurate.

2.3.1 Demographics –This is used to cater to two objectives

- To determine segments or subgroups frequently use Anti-rabies Vaccines particularly Raksharab.
- To create a clear and complete picture of the characteristics of a typical member of each of these segment.
- We wanted to classify the customers on their demographic characteristics in order to find out market segments based on geography, occupation, income level of clients, clinical experience, number of cases treated per month etc.

2.3.2 Psychographic –Through this Key Information area, we uncover and understand the decision-making processes from those that precede the purchase of vaccine to the final experience of using the product.

A number of variables like usage behaviour, product adaption, frequencies, brand disposition, brand preference, influence, relation with marketing officers etc. can be taken into account while classifying the customers

2.3.3 Brand Perception –In order to capture the perception in the mind customers for the various brands of Anti-rabies vaccine, this key information area provide a complete picture of brand Raksharab compared with other competitors brands. This will help us understanding positioning of brand Raksharab.

2.3.4 Latent Factors – We wanted to understand the attributes which influence consumer's decision and often what factors influences in a higher degree of their decision making process. Although a product can be described through numerous number of variables, there are some latent or hidden factors exists consisting of group of attributes. This will help us to reduce the data and also to avoid parsimony.

Some of the attributes were price, availability, presentation (SKU), potency, immunity period, promotional inputs, relation with sales representative etc.

2.4 Sampling Design:

Target population- All the canine practitioners of Metros, urban and semi-urban areas of Hyderabad, Chennai, Bangalore, Pune, Delhi and Jaipur.
Parameter- Number of canine cases per week.
Sampling frame- Data will be collected from canine clinics and veterinarians.
Primary data- Demographic and Psychographic characteristics of the customers,
Satisfaction level, attribute importance, usage pattern etc.
Secondary data- Market demand for Anti-rabies vaccines, customer base, client base, competitors in markets and their products.

2.5 Sampling Method:

- Stratified random sampling method to collect data from various geographical locations like Metros, urban and semi-urban areas.
- Areas under survey were differentiated into different zones based on parameter i.e. High users, medium users and low users.
- Numbers of customers of different zones were collected and zones are assigned with weights according to numbers of customers present in that zone.
- Then by systematic random sampling method it is decided which customers are to be considered for sample selection.

- 115 customers' interview and one Focused group discussion carried out during the survey period.

2.6 Methodology:

Primary data- Veterinarians (canine practitioners)
Secondary Data- These are collected from Super stockists, Distributors and stockists
Exploratory methods- Telephonic interviews, in person interviews, in depth interviews using indirect questions, open ended questions and unstructured questions to probe into the reasons of reasons.

Survey Methods-

- After getting the data from exploratory methods, in consultation with Dr. Gangasingh Shekhawat, I formulated a test questionnaire considering objective to be achieved.
- Formulating the final questionnaire based on feedback from test questionnaire
- Interviewed target sample with help of final questionnaire
- Cross sectional survey was conducted during the months April -June 2011.

Data Analysis Methods:

1. No of Customer segments exists in the market for Anti-rabies Vaccine based on different Demographic, Psychographic using Cluster analysis of SPSS package.

2. Data on usage, frequency, behaviour were captured through regression analysis.

3. Taking the variables 'considered while selecting an Anti-rabies vaccine' and their importance level we can identify the number of 'Factors' emerging out from the Factor Analysis using SPSS package.

4. Relative Distance method of Multi-dimensional scaling (in SPSS) is used for mapping the customer's perception across the competitors in Anti-rabies vaccines market.

3. DATA ANALYSIS

3.1. Cluster analysis:

3.1.1. Demographic Cluster Analysis

Eight variables are taken into account during the demographical segmentation of the customers of anti rabies vaccine survey. The variables are Age, gender, geography, income, Experience, Density, Total number of canine Cases per month and Total Number of Anti rabies Vaccination per month.

Table 3: SPSS output of Final cluster solution for demographic segmentation

Final Cluster Centers			
	Cluster		
	1	2	3
Age	2.25	2.32	2.81
Gender	1.5	1.1	1.12
Geography	2.25	3.67	3.79
Income	2.25	3.47	3.47
Experience	3.25	2.7	3.33
Density	3.75	1.62	2.93
Cases	2.25	2.03	3.63
Vaccination	1.75	3.28	3.91
No of respondents	4	60	43

Each variable data is validated in scale of 1 to 4 in interval scale in the survey questionnaire
Case 4, 18, 1, 6 formed a cluster of having 4 cases consisting approximately 4% of total samples, hence this cluster is not considered while market segmentation.

The data run through SPSS package for Hierarchical cluster analysis, from the icicle plot, agglomeration table and Dendogram (Appendix-1) it is observed that the customers forming three clusters based on the variables. Then by using K-Means method of Quick Cluster with reference of three clusters the Final Cluster centres derived. The Segment characteristics are defined according to the average value of variables.

Demographic cluster 1
Number of Cases-60
Characteristics of cluster-1 are as follows:
Belongs to Age group:30 to 40 years
Having Clinical experience of 7 to 12 years
Clinics based in areas having Customer density approximately 4 canine practitioners within 5km
Metro cities and urban locations
There is no significance variation in income level of client group
They treat 200-400 numbers of canine cases per month
Anti-rabies vaccine usage: moderate

Demographic cluster 2
Number of Cases-43
Characteristics of cluster-2 are as follows
Relatively higher age group than cluster 1
Clinics based in areas having Customer density more than 6 canine practitioners within 5 km
Metro cities and urban locations
There is no significance variation in income level of client group
Customers attending more than 600 canine cases per month
Anti-rabies vaccine usage: high users

3.1.2. Psychographic Cluster Analysis

Thirteen variables in form statements in the questionnaire are taken into account during the Psychographic segmentation of the customers of anti rabies vaccine survey. The variables are

- Attractive packaging
- Inclination towards Multinational brands
- Orientation towards Customer service
- Influences of Promotional inputs
- Price sensitivity behaviour
- Brand disposition behaviour
- Influence of peers on decision making
- Raksharab usage in post bite
- Relation with marketing officers
- Brand switching behaviour
- Raksharab usage in prophylactic cases
- Product adaptation
- Perception on role off marketing officers

Table 4: SPSS output of Final cluster solution for psychographic segmentation

Final Cluster Centers			
	Cluster		
	1	2	3
Attractive package	1.47	1.89	1.83
Inclination to foreign brands	2.53	3.59	1.58
Customer service	1.14	1.41	1.25
Promotional inputs	2.59	3.14	2.62
Price sensivity	1.61	1.84	1.5
Brand dispostion	2.27	1.54	2.5
Influence of collegues	2.69	3.3	3.04
Using Raksharab for post bite	1.2	1.54	4.38
Relation with marketing officers	2.12	1.68	3.12
Brand switching	2.22	3.16	2.67
Using raksharab for prophylactic	2.78	1.59	4
Product adoptation	1.98	4	2.58
Role of marketing Officer	1.59	2.05	1.58
No of Customers	**49**	**37**	**24**

Each variable data is validated in scale of 1 to 5 (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree in ordinal scale in the survey questionnaire

The data run through SPSS package for Hierarchical cluster analysis, from the icicle plot, agglomeration table and Dendogram (Appendix-2) it is observed that the customers forming three clusters based on the following variables. Then by using K-Means method of Quick Cluster with

reference of three clusters the Final Cluster centres derived. The Segment characteristics are defined according to the average value of variables given in form of statements.

Psychographic Cluster 1
Number of cases: 44%
Cluster characteristics: **(Innovators)**

- They look for attractive packaging of the product
- More inclined towards the Multinational brand products
- They are ready to spend more price for good quality products
- Promotional inputs has some influence their decision making
- They prefer a particular brand and sometimes insist others about the brand they are using.
- They use Raksharab mostly for Post exposure vaccination cases
- They have used many brands of Anti-Rabies Vaccine during past years
- They were interested in using New Brands

Psychographic Cluster 2
Number of cases: 33%
Cluster characteristics: **(Late adaptors)**

- They are relatively less concerned for attractive packaging
- They have less inclination for the Multinational brand products
- They can spend more price for good quality products
- Their decisions were indifferent to Promotional inputs
- They insist others about their preferred products
- They prefer Raksharab for both Post exposure and prophylactic anti-rabies vaccination case usages.
- They don't prefer using new brands

Psychographic Cluster 3
Number of cases: 21%
Cluster characteristics: **(Early Adaptors)**

- They look for attractive packaging of the product
- They prefer multinational brands
- They are less price sensitive
- Promotional inputs are less significant for them
- They prefer a particular brand but rarely insist others
- They don't prefer using Raksharab neither for prophylactic or post exposure vaccination
- They have used many brands of Anti-Rabies Vaccine during past years

3.2 Factor Analysis

Factor analyses are performed by examining the pattern of correlations (or covariance) between the observed measures. Measures that are highly correlated (either positively or negatively) are likely in influenced by the same factors, while those that are relatively uncorrelated are likely influenced by different factors.

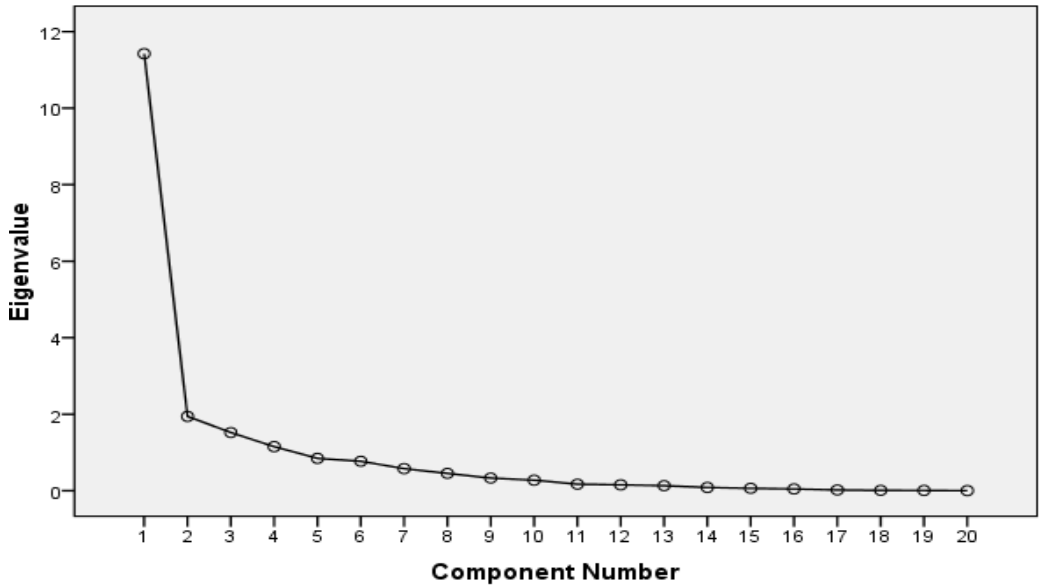
Here, Exploratory factor analysis (EFA) techniques been used with objective of
1. The number of common factors influencing a set of measures.
2. The strength of the relationship between each factor and each observed measure.

The initially data studied under principal component matrix and four factor are emerging out from the data containing 20 variables taken in questionnaire to know the attributes considered while selection of Anti-Rabies Vaccine. To get more accurate correlation between the attribute the 'Varimax' method off rotation been implemented.

Table 5: SPSS output of rotated component matrix for Factor analysis

Rotated Component Matrix				
	Component			
	1	2	3	4
price	0.571	0.015	0.218	0.498
Availability	0.723	0.354	0.42	0.039
Presentation	0.361	0.072	0.825	0.143
Potency	0.836	0.266	0.377	-0.151
Immunity	0.825	0.194	0.344	-0.182
Packaging	0.179	0.341	0.647	0.119
Brand image	0.306	0.037	0.755	0.17
Relationship with M.O	0.368	0.097	0.199	0.772
Promotional inputs	-0.334	0.047	0.11	0.816
Timely delivery	0.842	0.326	0.27	0.101
Customer care	0.787	0.373	0.272	0.149
Cold chain maintenance	0.821	0.404	0.333	0.116
Brand acceptance among pet owners	0.097	0.785	0.386	-0.221
adjuvant	0.466	0.624	0.199	-0.234
Quality of vaccine	0.779	0.454	0.334	0.13
Self life	0.634	0.598	0.056	0.206
Technical updates from company	0.527	0.736	0.045	0.068
Knowledge of M.O	0.285	0.731	-0.081	0.233
No allergic reaction	0.821	0.459	0.094	0.076
Morden and contemporary	0.3	0.723	0.278	0.18

Fig 1: Screen plot



It can also be evidenced from the Scree plot that only 4 components have Eigen value over 1 hence the number of attribute can be group under these four latent factors. The 'Total variance explained matrix' (Appendix 3) give the value of variance 'Rotated sum of factor loading as 34.55%, 20.77%, 14.3% and 9.7% for components 1, 2,3 and 4 respectively. The interpretability of factor can be improved through rotation, rotation maximize the loading value of each variable in one of the factor whilst minimizes loading in other factors.

Component are selected on basis of factor loading value more than 0.5 and larger the factor loading value in case it exceed 0.5 in multiple components. Latent Factors observed are named after careful analysis and studying the correlation between them.

Table 6: Final Latent Factors within attributes

F1: Product features	**F2: Product Awareness**	**F3: Look and feel**	**F4: Influence**
Price Availability Potency Immunity Timely delivery Customer care Cold chain Quality Self life No allergy	Technical updates of company Brand awareness among the pet owners Knowledge level of M.O Contemporary and modern Adjuvant used	Presentation Stock keeping units Packaging Brand image	Promotional inputs Relationship with M.O

3.3 Multi Dimensional Scaling (Mds):

Data collection- The respondents were asked to give pair wise scores to the brands on basis of dissimilarity between them according to the overall perception for the brands. No product attributes were mentioned before allotting dissimilarity scores.

Matrix formation: The data of individual scores were recorded in excel sheet and average score of each pair wise data of the sample is being calculated then a 7*7 matrix formed which is input for the SPSS.

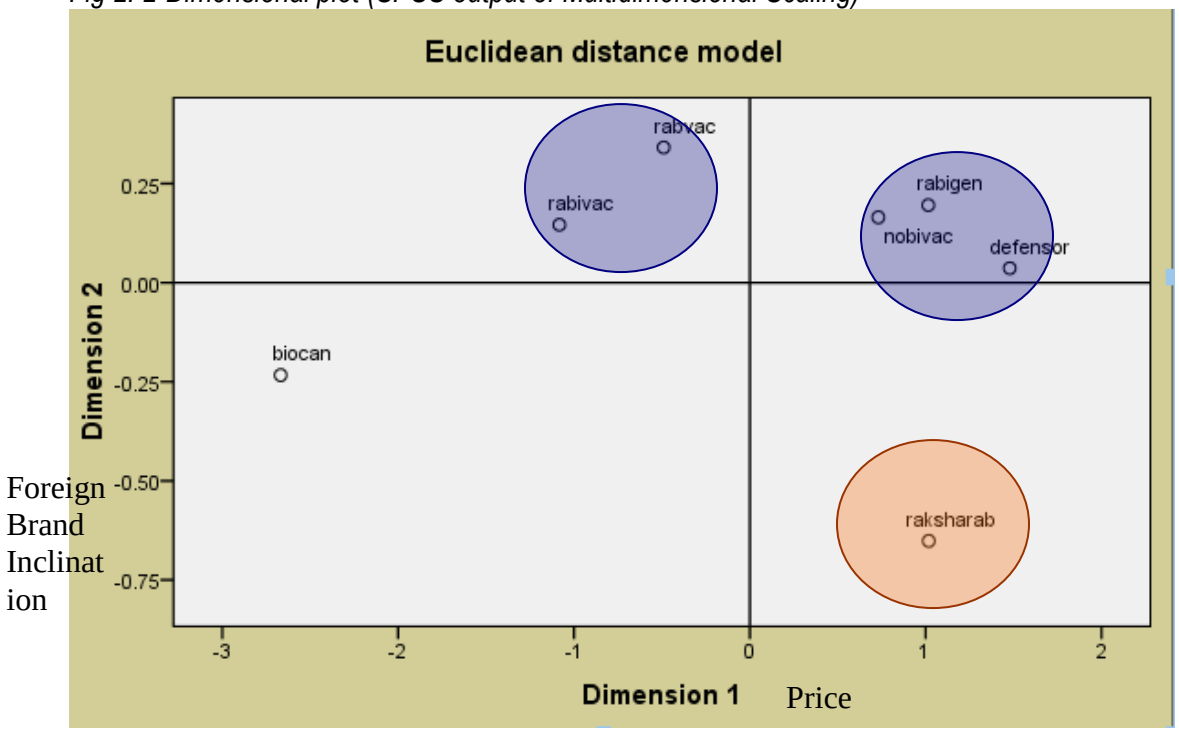
Method: Metric distance of Multidimensional scaling method is used for research method comprising of seven pair of variables i.e. different Anti-rabies vaccine brands; Rakksharab, Defensor, Nobivac, Rabigen, Rabvac, Rabivac and biocan-R.

Choose a configuration dimension: Both 2-dimentional and 3-dimensional configuration run in SPSS. Initial optimization and animation of the configuration progression of the 'Stress' or 'Strain value' is observed. When the shape of the configuration stops changing slow the optimization down by lowering the step size interactively.

Interpret the configuration: The underlying dimension in the customer mind were interpreted considering facts about the product, product characteristics, nature and origin of the product and product attributes etc.

The attribute dimensions emerge out from the multidimensional scaling
Dimension 1(X axis) - **Price**
Dimension 2- (Y axis) - **Foreign brand inclination**

Fig 2: 2-Dimensional plot (SPSS output of Multidimensional Scaling)



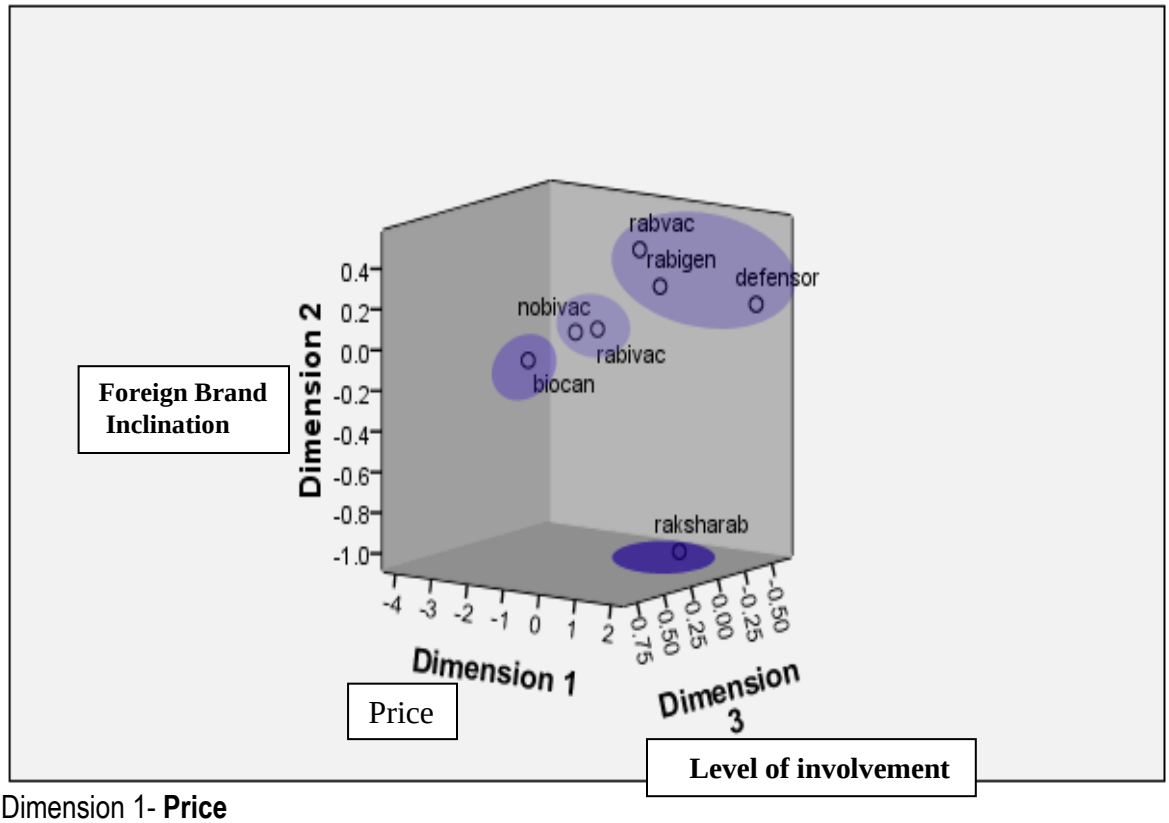
From the above 2-dimentional perceptual map, the position and distance between the brands being analysed which give rises to emergence of dimensions like price and foreign brand inclination.

There is a cluster forming consisting Defensor, Nobivac & Rabigen having most similarities among themselves than compared to other brands. On the Price dimension Raksharab is also lies approximately close to the distance (X-coordinate) value of the this cluster. Whereas the 2nd dimension i.e. foreign brand inclination, Raksharab perceived low score compared to other six brands. Raksharab is the product of subsidiary of NDDB, which create a indigenous perception in customer mind, the brand name 'RAKSHA' refer to Hindi origin & in addition to that it is being perceived as public sector company by customers.

Biocan R, a product of Bioveta, Czech Republic operates in mostly price sensitive areas and offer a low price product compared to other major brands. In Dimension 2 ie foreign brand it scores higher than Raksharab but less than other brands because of low price it is less perceived as foreign brand. In general, it is there in customer psychology that a foreign brand costs high than domestic brand.

Ironically, Rabivac (Brilliant Pharma, Hyderabad) is perceived as a foreign brand and having score close to Rabvac (Forte dodge, USA). Such findings may be due to homophonic nature of both Brand names creating a confusion in customer mind and may be due to confusion during data collection from the clients while questionnaire survey.

Fig3: 3-Dimensional plot (SPSS output of Multidimensional Scaling)



Dimension 1- **Price**
Dimension 2- **Foreign brand inclination**
Dimension 3- **Level of involvement (company with customers)**

We have discussed the perceptual map of different brands of Anti rabies vaccine in two dimensions. Let us draw the perceptual map considering three dimensions in to account. Observing the three dimensional map (shown above) 'level of involvement' is emerging out as the 3rd dimension, more predictably it is the relation between the customer and the company. Brand Raksharab and Biocan R bears low scores than other brands in the 3rd dimension. This data is being validated by the qualitative study done in form of in depth interviews and semi-structured interviews apart from the quantitative data.

Many customers are not being visited regularly by the field staffs of the company, in some case customer complaint is not taken care of in a proactive way. Whilst company like Pfizer and Virbac continuously on relation with the clients creating a push for their product. In some the instances, although clients were regularly visited by marketing officers but they are unable to create a awareness regarding the product and the ongoing activities and campaigns of company.

3.4. Multiple Regressions

Regression line formula

$$Y'_i = b_0 + b_1X_{1i} + b_2X_{2i} + \ldots + b_kX_{ki}$$

Where Y* is expected value of dependent variable (No of Anti-rabies cases), X is independent variables (Age, Gender, Geography, Income of pet owners, Density of customers, Total no of canine cases per month) and b is coefficients of respective independent variables.

Table 7: Summary of different regression models by additive methods

	independent variables									
Dependent variable	constant	age	gender	geography	income	density	cases	R sqr	R	Sig.
	2.435	0.097	-0.705	0.57	0.28	0.009	0.365	0.65	0.43	0
	1.482			0.127	-0.107	0.002	0.369	0.579	0.336	0
	1.211			-0.126	0.35		0.357	0.563	0.317	0
ARV usage	1.164			-0.128			0.336	0.56	0.313	0

Coefficients

In multiple linear regression, the size of the coefficient for each independent variable gives you the size of the effect that variable is having on your dependent variable, and the sign on the coefficient (positive or negative) gives you the direction of the effect. In regression with multiple independent variables, the coefficient tells you how much the dependent variable is expected to increase when that independent variable increases by one, *holding all the other independent variables constant*.

R Square

R square is actually the percentage of the variation in y that is accounted for by the x variables. This is also an important idea because although we may have a significant relationship we may not be explaining much. From the yield example the more variation we can explain then the more we can control over the yield or dependent variable.

The additive multivariate regression model in SPSS is taken for analysis. There are four outputs of the regression being shown in the table and the output from the first model considering six variables i.e. age, gender, geography, density, total number of cases and total number of

vaccination cases gives better result than other models. We can infer from the output that "65% of the variation in anti-rabies vaccine usage is explained by the demographical parameters age, gender, geography, density, total number of cases and total number of vaccination with level of significance zero".

It can be inferred; Rest of the variation may be explained by psychographic variation or other market forces like competitors influence, client bases of canine practitioners, clinic timings and duration of working hours etc.

3.5. Usage Pattern Analysis:

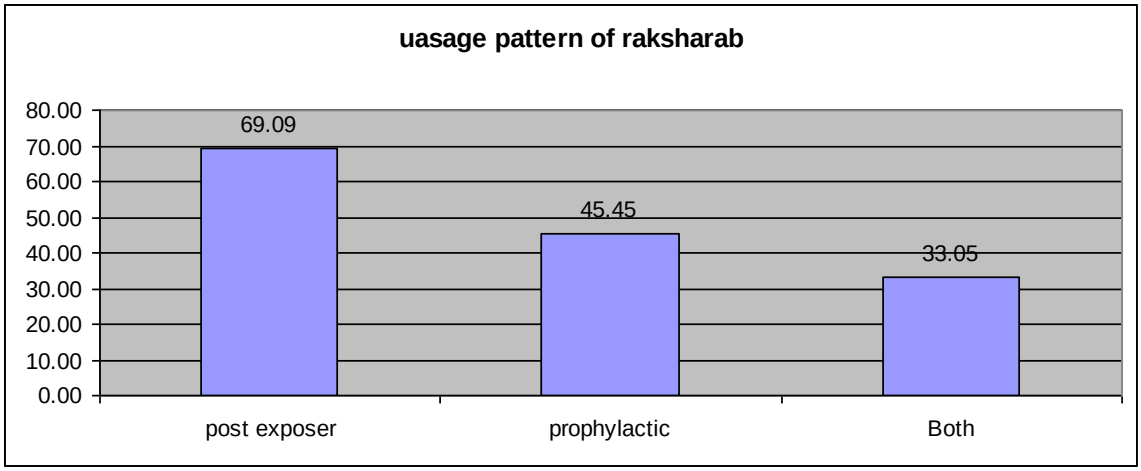


Fig 4: Bar diagram of usage pattern of Raksharab

We have seen the perception of customers towards various brands of products and this also reflected in their usage pattern too. This data collected from sample to know their preference in usage of Raksharab for post exposure and prophylactic. Approximately 70% of the sample uses Raksharab for post bite cases and also some instances prophylactic uses. From the Above graph it can be inferred that 36% of customer using Raksharab for post exposure cases only and 12.5% of customers for prophylactic usage only.

3.6. Awareness On Promotional Campaigns Of Indian Immunologicals Ltd.

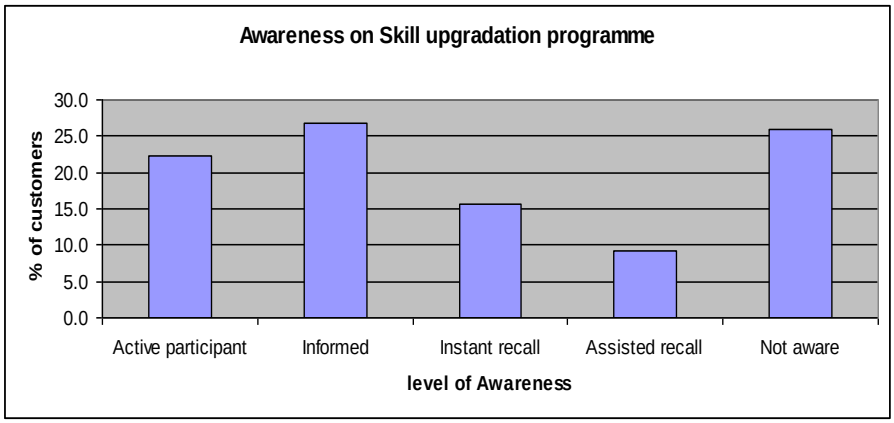


Fig 5: Bar diagram of level of awareness in skillup-gradation programme

In the year 2010 Indian Immunologicals ran a promotional campaign focused on canine practitioners titled 'Skill up-gradation programme' at premier Veterinary institutes of India. Research being done to know the reach and awareness level of customers this particular programme, interviewees asked whether they have participated, whether they were informed about the programme, if not attended what is the efficacy of spread of information. For those who unable to recall, hints about the place, time, subject, name of colleagues those who attended were given to assist them to recall. There were 22%, 27%, 16%, 9% and 26% of the 'active participants', 'informed', 'install recall', 'Assisted recall' and 'not aware' categories respectively.

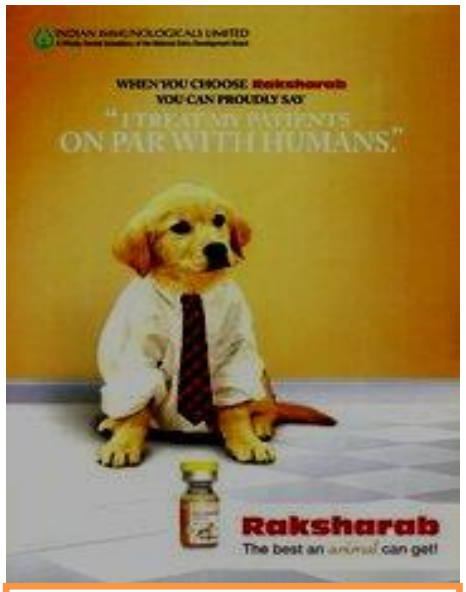


Fig 6: Print ad of the campaign

Indian Immunologicals Ltd also promoting brand Raksharab through another campaign named "treat your animal on par with human" by highlighting on the WHO specification standard manufacturing process. This campaign illustrates that animal patients are taken same care as humans. E.g.1.Doctor holding his baby on one shoulder and his pet in other shoulder, 2. 'A pet wearing a white shirt and tie' which shows the dignity felt by the pet after treated with Raksharab.

Research tried to find out awareness level of customer on the 'treat on par human' campaign. 34.3% of customer are aware about the campaign and they able to recall the details, 27.8% of customers are able to recall after some assistance like some description on the visuals, describing the manufacturing standard etc. 38% of customers are not aware of campaign and also unable to recall after assisting them to recall. Company have to work on this campaign to increase the awareness.

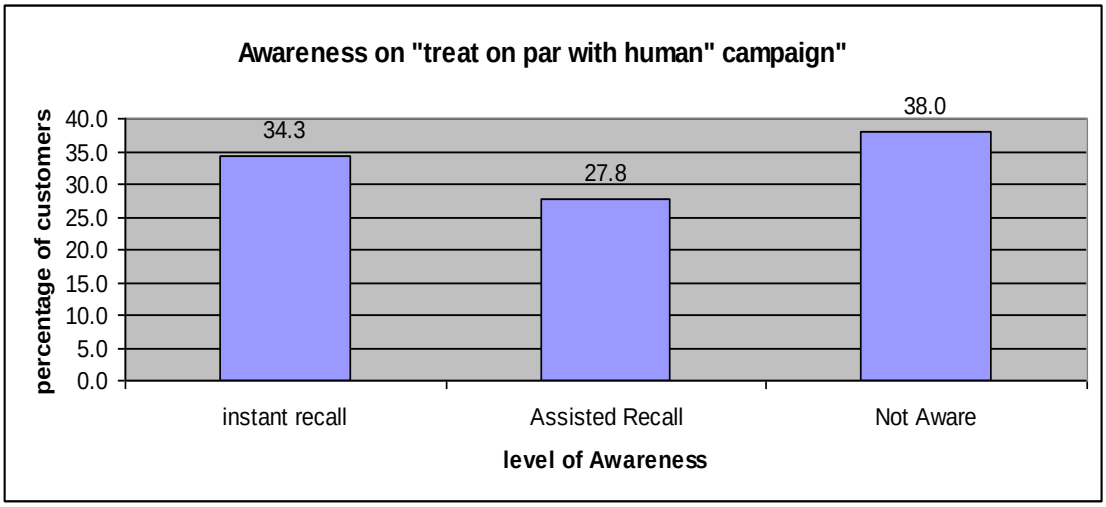


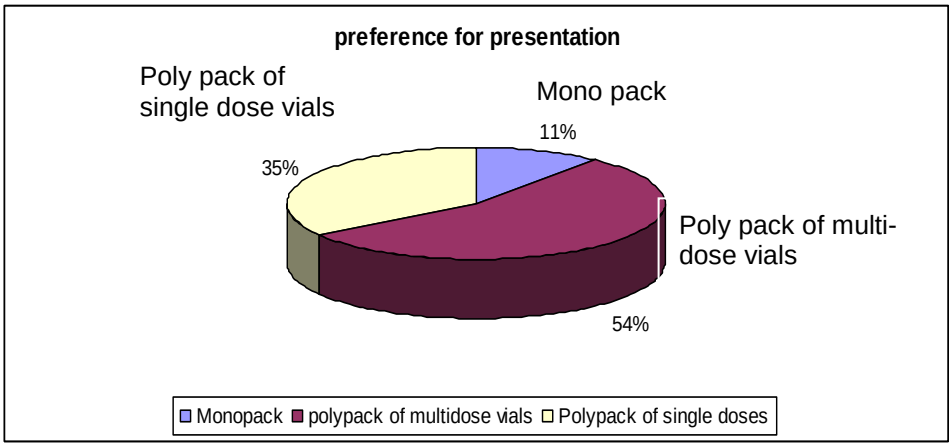
Fig 7: Bar diagram of Awareness on treat on par with human campaign

3.7. Preference For Stock Keeping Units Of Vaccine:

Rakksharab available in 10 ml vials poly pack and 5 ml vials poly pack, Single dose vials, in addition to that some brand Mono packs (along with 1ml syringe and attractive packing) available in market.
Customer demands that the vaccine to be presented in various Stock keeping units in accordance to their usage pattern. The study being done to find out their preference to different presentation form like 'Poly pack of single doses', 'poly pack of multiple doses' and 'Mono packs'

Fig 8:
1 ml Monopack

It is revealed that 54% of customer prefer poly pack of multi dose vials, 35% preferred poly packs of single doses and only 11% of customer use Mono packs. Less usage of Mono packs is due high price of product and less price margin to physicians.



3.8. Regularity In Customer Visits By The Marketing Officers:

Often customers can't tell you what they really want. Yet unspoken needs not only drive buying behaviour, they are a powerful source of new product innovation. Product developers who know how to tap into these needs are steps ahead of the competition.

Specifically in pharmaceuticals and biological industry visits to the Doctors, physician and practitioners plays a vital role in rapport building and maintain a long term relationship which leads to sales of products and continuous market presence. Selling or delivering product when MO visit customers may have some short-term benefit, but understanding customer needs and market problems will provide much more value in the long term. Hence regularity in customer visits taken into account while studying the product usage pattern and finding a relation between them.

Survey shows that 58% customers are visited once in a month and 11% customers visited twice in a month regularly by the Marketing officers of the company while a significant number of customers i.e. 30% of total customers were not visited regularly or at instance occasionally.

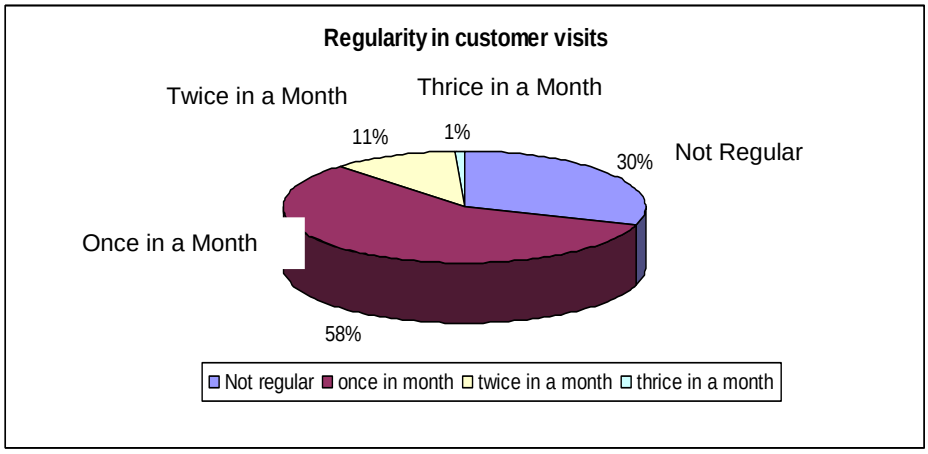


Fig 11: Pie chart showing percentage of customers on basis of visits

3.9. Brand preference of customers:

Brand preference by definition

- Measure of brand loyalty in which a consumer will choose a particular brand in presence of competing brands, but will accept substitutes if that brand is not available.

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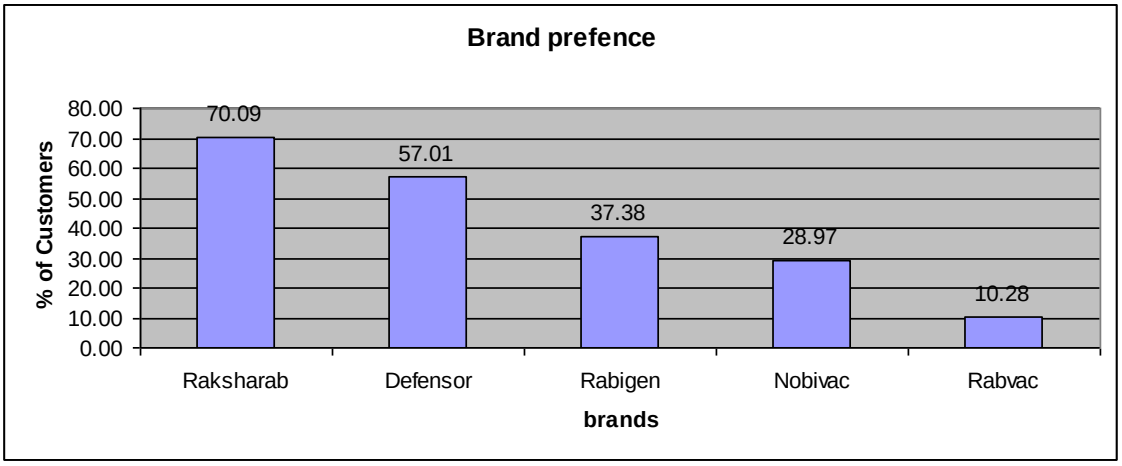


Fig 12: Bar diagram of brand preference of customers

For this study purpose particularly, percentage of customers preferring that brand , it may possible that he is using other brands as well, So here in the table brand name shows the set of preferred brands including the particular brand name given. For example 70 % of 'Raksharab preferred set' signifies 70% of customers prefer Raksharab and they have other brands anti rabies vaccines in their preferences basket as well. Raksharab is the mostly preferred brand among the customers

followed by Defensor at 2nd position with 57% of customer preference set. Rabigen and Nobivac have preferred set of 38% and 28% respectively and Rabvac operates in a niche market.

4. SUGGESTIONS AND IMPLICATIONS:

1. The numbers of customers in Cluster 1 (medium age group, 7-12 years of clinical experience & moderate users) of demographic segmentation are more i.e. 60% of total sample, compare to cluster 2. Hence this segment can be targeted during mass promotional campaigns in order to achieve a effective reach of the programme.

2. Cluster 1(Innovators) comprising of 44% of the population having following characteristics may be targeted for launching new products or variants of existing products.
    - Look for attractive packaging of the product
    - Usually prefer Raksharab for Post exposure cases
    - Inclination for the Multinational Brand
    - Ready to spend more price for good quality products
    - Promotional inputs have influence on decision
    - Used many brands of ARV during past three years
    - Interested for using new products

3. Cluster 2 (late adaptors) of psychographic segmentation comprising of 33% of customers having following characteristics are may be targeted for strengthening brand Raksharab.
    - Brand loyal
    - Less price sensitive
    - Doesn't prefer using new brands
    - They insist others for their preferred product
    - Prefer Raksharab for both prophylactic and post-exposure immunization

4. 30% of the customers are not being visited regularly by the field functionaries of the company which is reflected from the awareness level on promotional campaigns i.e. 26% of the customer are not aware on Skill up-gradation programme and 38% of the customers not aware about "treat on par with humans" campaign. Hence, regularity in visits may be considered, to maintain customer relation and disseminating technical updates

5. Out of four factors emerged; Product features, Product awareness, look and feel and influence, variance due to these factors in decision making are 35%, 20%, 14% and 9% respectively.
   Considering low flexibility in product features because heavy amount of fixed cost involvement, company can focus on factor "product awareness" in order to increase product demand.

Attributes of product awareness are

- Technical updates of company
- Brand awareness among the pet owners
- Knowledge level of Marketing Officer
- Contemporary and modern

Fig 13:
Packaging of Fort Dodge's Biological products

6. **Packaging:** Plastic tray packs are most preferred by customers and distributors
   Packing is designed to capture a customer's attention and it can directly affect whether they buy the product or not. Innovation and creativity come into play when it comes to packaging. Major significance of packaging can be detailed as follows:
   - It makes a product more convenient to use or store, easier to identify or promote or to send out a message.
   - Packaging plays a key role in brand promotion and management. Packaging is of great importance in the final choice the consumer will make, because it directly involves convenience, appeal, information and branding.
   - The paramount concern of packaging is the reach-ability of the product without any damage. No matter where and how the products are transported or shipped, they should arrive at the customer's door in working condition

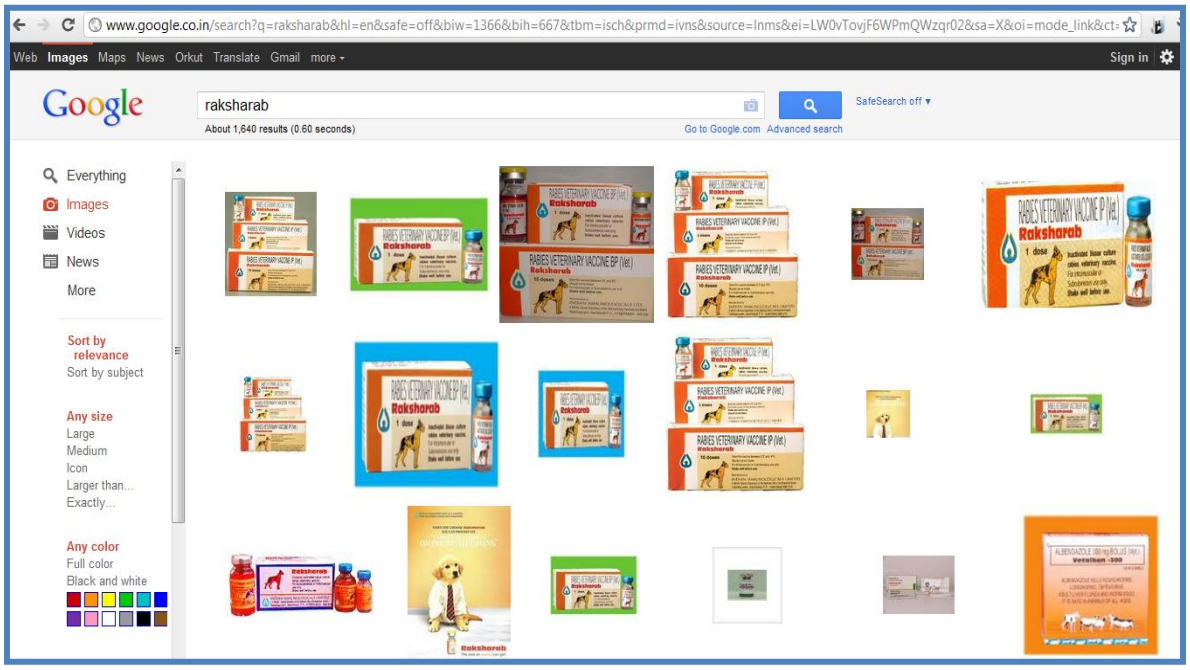
Fig 14:
Plastic tray pack

This study found that packaging of vaccine in plastic tray packs were mostly preferred by vets and distributors. The vaccines are stored in refrigerator along with other brands of vaccines or other category of vaccines. The packs are replaced from rack to rack and man handling cause wear and tear of the packets if handled for long time. Raksharab vials presented in cardboards packets which are more prone to wear than the product brands presented in plastic packs. In addition plastic pack has more customer appeal than cardboard packs.

7. Improving presence in Internet:

Following picture is a screen shot of 'Google image search' for "Raksharab" which shows only repetition of one image on package and one image on 'treat on par with human campaign' with very low resolution. Besides that it provides insufficient information about the product and less likely to create a demand pull.

Fig 15: Screenshot of Google image search on keyword "Raksharab"



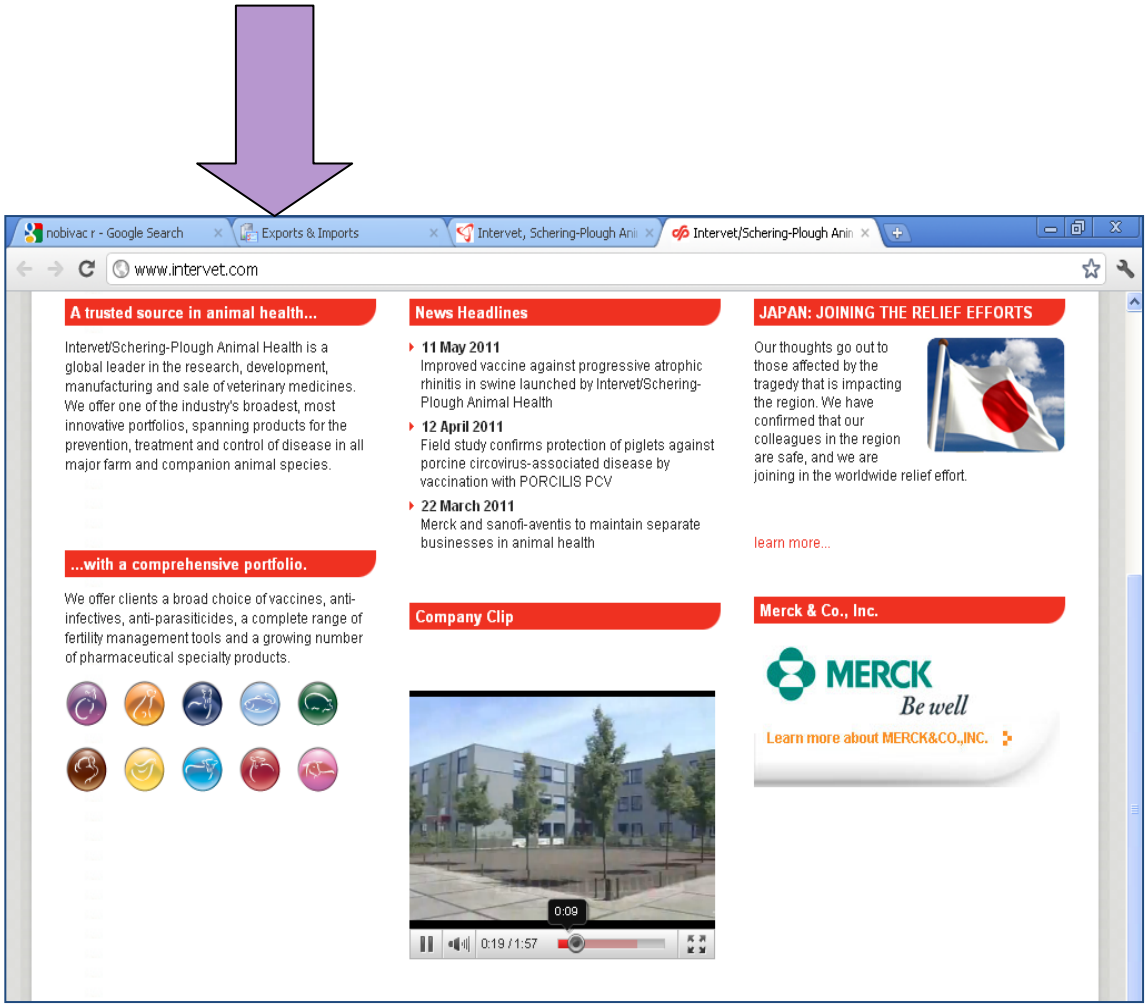
Need of mentioning here is that many activities related to Raksharab like campaigns, skill up-gradation programmes, honorarium, public awareness events can be uploaded to increase the outreach

8. Social Marketing via YouTube and Face book

When it comes to marketing, videos on social web will be a great way to interact with potential customers, but you must do it correctly in order to attract new customers and not chase them away. They must see your video as providing them with interaction as well as value in order to be an effective means of social media marketing. We may asked for people to share their no-cost and low-cost tips and techniques for usage , awareness & interest towards Anti rabies vaccines in a common thread is social media marketing, particularly Facebook.

Brand building and Quality assurance through illustrative videos on company website can produce impact on customers and pet owners of urban and metro cities. These customers generally go through review of the product they are using for their pets, some instances they seek information prior to the consultation of physician also. Example of such initiative shown below is from www.intervet.com which explain quality manufacturing process unit.

Figure 16: Showing flash video on Intervet web site



Annexure I

5. KEY REFERENCES:

Business Research Methods by Donald R Cooper and Pamela S Schindler

Marketing Research:An applied approach by N K Malhotra and David G Birks

Fundamental of Statistics by S.C.gupta

www.marketingpower.com

www.marketresearchworld.net

www.ijmr.com

SPSS version 17.0 update by David S.Moore,Susan Nolan

QUESTIONNAIRE

Personal details:

Name ……..Place……

Contact No….. ……....emailID……..

A. DEMOGRAPHIC DETAILS

1. Age 20 to 30 years 31 to 40 years

   41 to 50 years above 50 years

2. Gender A.Male B.female

2. Geographical location

   1-Rural 2-Semi-Urban

   3-Urban 4. Metropolitan

4. Income class of client base (per month)

   A. Upto 10000/- B.10001-20000/-

   C. 20001-30000/- D. Above 30,000/-

5. clinical experince

   A. 0 to 5 years B.5 to 10 years

   C. 10 to 15 years D. Above 15 years

6. Customer density per 5 kms: A. 2 B. 3 C. 4 D. >4

7. Total no of cases treated per month on an avarage basis

   A. Less than 200 B. 201 to 400

   C. 400 to 600 D. More than 600

8. Number of animals vaccinated for Anti-Rabies (per month)

   A.Less than 20 B. 20-40

   C. 40-60 D. Above 60

9. Number of vials of Antirabies vaccine used per month of following SKU

   1 ml ……. 5 ml ……..

   10 ml …….. Others……

10. Which brands of Anti-Rabies vaccine you usually prefer

……

11. Which type of packaging you usually prefer

☐ Monopack ☐ Polypack of multiple doses vials

☐ Polypack of single dose vials ☐ Others

12. How many times marketing officers from Indian Immunologicals visiting in a month

☐ Never ☐ Once ☐ Twice ☐ more than twice

B. PSYCHOGRAPHIC

Rate the following statements on basis of 1=strongly agree, 2=agree, 3=neither agree or disagree, 4=disagree, 5=strongly disagree

Sl No		***1***	***2***	***3***	***4***	***5***
1	The Product catalogue should be attractive & eye catching					
2	I feel foreign made products are always superior in quality					
3	The company should focus on customer services					
4	Promotional inputs play important role in Decision making					
5	I don't mind paying a high price for quality					
6	I believe, one should recommend about good products to colleagues					
7	Peer groups are an important factor for my decisions					
8	I prefer Raksharab for post-exposure cases					
9	I personally know the marketing officers of companies					
10	I have used many brands of Anti-rabies vaccine during past years					
11	I believe Raksharab is gives better result in prophylactic uses					
12	I prefer experiencing new brands					

13	Marketing officers of companies plays a vital role for the selling of their products					

4. Please mention some of the factor you consider while choosing a Anti-Rabies vaccine ……..., ……

C. Please rate the following attributes of Antirabbies vaccine, those you consider while selecting (1-least imopotant and 5-most important)

Sl.no	**Attributes**	***1***	***2***	***3***	***4***	***5***
1	Price/ margin					
2	Easily available					
3	Presentation (SKU)					
4	Antigenic potency					
5	Immunity period					
6	Packaging (look and feel)					
7	Brand image					
8	Relation with marketing officers					
9	Promotional input					
10	Timely delivery					
11	Customer care					
12	Cold chain maintanance					
13	Brand acceptance among pet owners					
14	Adjuvants used in vaccine					
15	Quality of vaccine					
16	Self life of the vaccine					
17	Technical updates from company					
18	Knowledge level of marketing officers					
19	No alleregic reaction					
20	Contemporary and modern					

21	Convenient to carry					

D.Please mention the difference between the brands as percieved by you on overall basis shown in the following Matrix (min score-0, Maximum score-10)

	Raksharab	Defensor	Rabigen	Nobivac	Rabvac	Rabivac	Biocan R
Raksharab	**0**						
Defensor		**0**					
Rabigen			**0**				
Nobivac				**0**			
Rabvac					**0**		
Rabivac						**0**	
Biocan R							**0**

E. Are you aware of any of campaign run by Indian Immunologicals ?

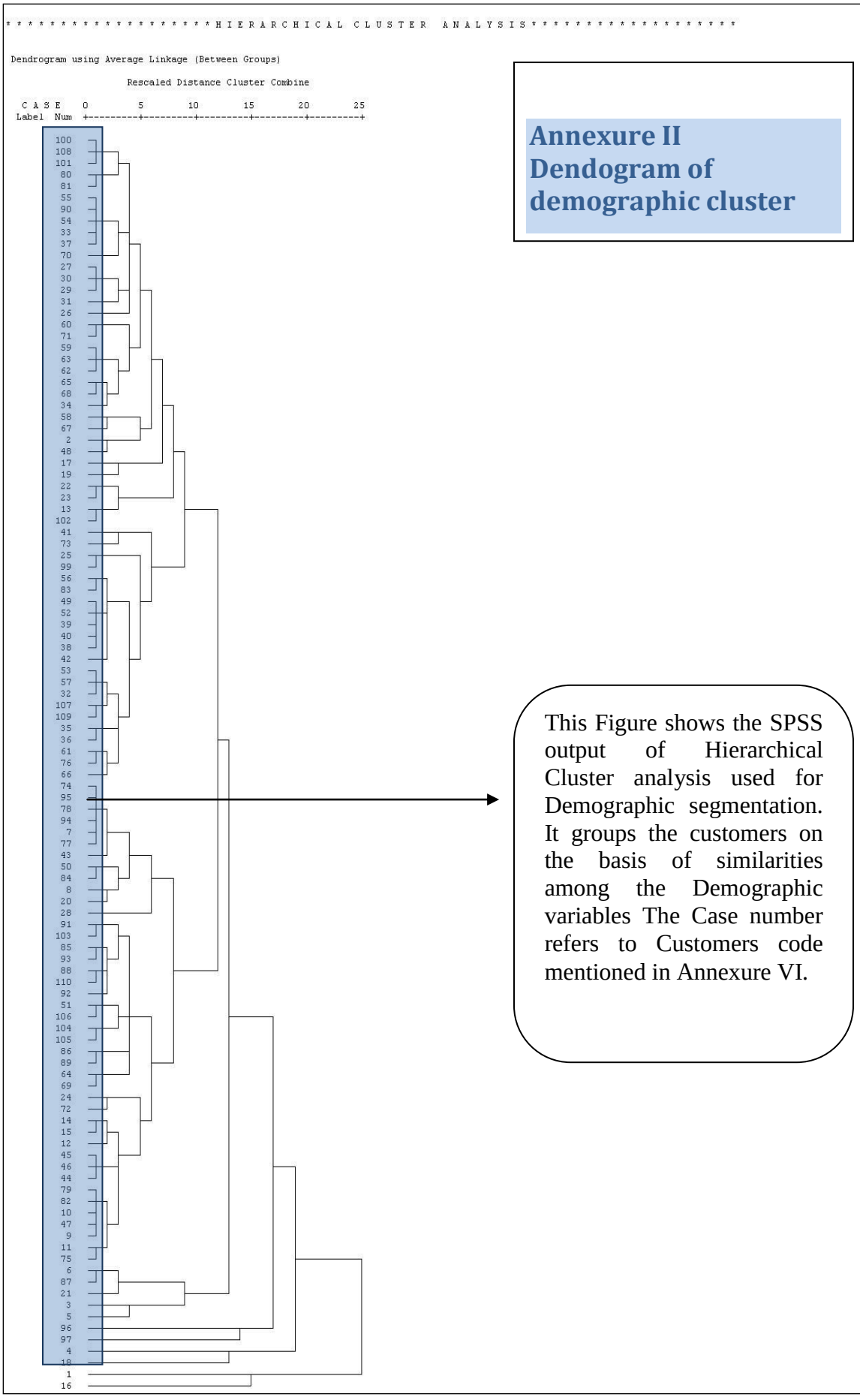
1. Yes 2.No

F. Are you aware of the Raksharab's campaign "Treat on par with human"

1. Yes, I was a part of that campaign.
2. Yes, I Know about the campaign.
3. I heard it from my collegues.
4. Not sure of this campaign.
5. Never known any sort of ILL campaign.

G.Are you aware of the IIL's "Skill upgradation programme"

1. Yes, I was a part of that campaign.
2. Yes, I Know about the campaign.
3. I heard it from my collegues.
4. Not sure of this campaign.
5. Never known any sort of ILL campaign.



Annexure II
Dendogram of demographic cluster

This Figure shows the SPSS output of Hierarchical Cluster analysis used for Demographic segmentation. It groups the customers on the basis of similarities among the Demographic variables The Case number refers to Customers code mentioned in Annexure VI.

Annexure III
Cluster solution for demographic segmentation

(SPPSS output)

Final Cluster Centres

	Cluster		
	1	2	3
age	2.25	2.32	2.81
gender	1.50	1.10	1.12
geography	2.25	3.67	3.79
income	2.25	3.47	3.47
experience	3.25	2.70	3.33
density	3.75	1.62	2.93
cases	2.25	2.03	3.63
vaccination	1.75	3.28	3.91

Number of Cases in each Cluster

Cluster	1	4.000
	2	60.000
	3	43.000
Valid		107.000
Missing		1.000

Cluster solution for psychographic segmentation (SPSS output)

Final Cluster Centers

	Cluster		
	1	2	3
Attractive	1.47	1.89	1.83
Foreign	2.53	3.59	1.58
customerservice	1.14	1.41	1.25
Promotion	2.59	3.14	2.62
Price	1.61	1.84	1.50
Recommend	2.27	1.54	2.50
Peer	2.69	3.30	3.04
Postexposure	1.20	1.54	4.38
Morelation	2.12	1.68	3.12
Brandswitch	2.22	3.16	2.67
Prophylactic	2.78	1.59	4.00
Newbrand	1.98	4.00	2.58

Number of Cases in each Cluster

Cluster	1	28.000
	2	26.000
	3	21.000
	4	35.000
Valid		110.000
Missing		.000

Final Cluster Centers

	Cluster		
	1	2	3
Attractive	1.47	1.89	1.83
Foreign	2.53	3.59	1.58
customerservice	1.14	1.41	1.25
Promotion	2.59	3.14	2.62
Price	1.61	1.84	1.50
Recommend	2.27	1.54	2.50
Peer	2.69	3.30	3.04
Postexposure	1.20	1.54	4.38
Morelation	2.12	1.68	3.12
Brandswitch	2.22	3.16	2.67
Prophylactic	2.78	1.59	4.00
Newbrand	1.98	4.00	2.58
Morole	1.59	2.05	1.58

Number of Cases in each Cluster

Cluster	1	28.000
	2	26.000
	3	21.000
	4	35.000
Valid		110.000
Missing		.000

Annexure IV

Factor Analysis (SPSS output)

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.424	57.120	57.120	11.424	57.120	57.120	7.091	35.454	35.454
2	1.943	9.715	66.835	1.943	9.715	66.835	4.155	20.775	56.229
3	1.523	7.614	74.449	1.523	7.614	74.449	2.861	14.306	70.535
4	1.153	5.765	80.214	1.153	5.765	80.214	1.936	9.679	80.214
5	.847	4.234	84.448						
6	.772	3.859	88.307						
7	.578	2.890	91.197						
8	.453	2.265	93.462						
9	.332	1.662	95.124						

10	.277	1.383	96.507						
11	.172	.862	97.369						
12	.154	.770	98.139						
13	.133	.665	98.804						
14	.086	.431	99.236						
15	.063	.315	99.550						
16	.047	.235	99.785						
17	.021	.106	99.891						
18	.010	.051	99.942						
19	.008	.041	99.983						
20	.003	.017	100.000						

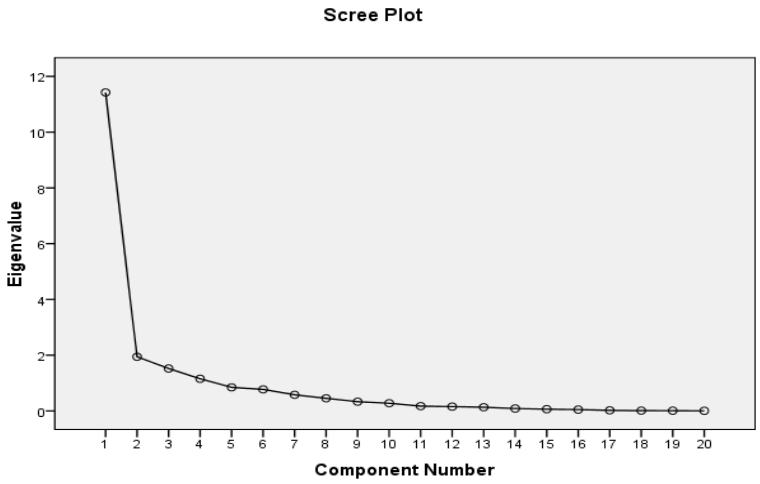
Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component			
	1	2	3	4
Price	.571	.015	.218	.498
Avail	.723	.354	.420	.039
Present	.361	.072	.825	.143
Potency	.836	.266	.377	-.151
Immune	.825	.194	.344	-.182
Package	.179	.341	.647	.119
Brandimg	.306	.037	.755	.170
Relation	.368	.097	.199	.772
Promoinput	-.334	.047	.110	.816
Timely	.842	.326	.270	.101
Custcare	.787	.373	.272	.149
Cold	.821	.404	.333	.116
Brndaccep	.097	.785	.386	-.221
Adjuvant	.466	.624	.199	-.234
Quality	.779	.454	.334	.130
Selflife	.634	.598	.056	.206
Techupdate	.527	.736	.045	.068
Moknowledge	.285	.731	-.081	.233
Allegry	.821	.459	.094	.076
Morden	.300	.723	.278	.180

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

a. Rotation converged in 9 iterations.



Annexure V

Multidimensional data

Raw (unscaled) Data for Subject 1

	1	2	3	4	5	6	7
1	.000						
2	1.982	.000					
3	1.791	1.445	.000				
4	1.827	1.882	1.136	.000			
5	2.773	2.855	2.264	2.191	.000		
6	3.182	3.573	3.045	2.764	1.791	.000	
7	5.027	5.645	5.045	4.773	3.155	2.418	.000

Optimally scaled data (disparities) for subject 1

	1	2	3	4	5	6	7
1	.000						
2	1.223	.000					
3	.747	.539	.000				
4	.791	.791	.275	.000			
5	1.887	1.938	1.563	1.312	.000		
6	2.215	2.538	2.094	1.822	.747	.000	
7	3.685	4.128	3.685	3.406	2.215	1.591	.000

Annexure VI : Sample Details			
City	**Respondent Code**	**Name Of the Veterinarian**	**Place**
Hyderabad	1	Dr. G Shambhulingam	VD Uppal
	2	Dr. M.S. Krishnakant	Shantinagar
	3	Dr. P. Aruna	Nanakramguda
	4	Dr. K. Sanjal Kumar	Keesaret
	5	Dr. S. Arunasree	Malkajgiri
	6	Dr. B Janardan	Serilingampally
	7	Dr. S. Giri	Srinagar
	8	Dr. Laxmi Nivas	Banjarahills
	9	Dr. Subharao	Sitarambagh
	10	Dr. V Reddy	Sitarambagh
	11	Dr. Srinivas	Srinagar
	12	Dr. Niharika	Kukutpally
	13	Dr.Atul	Vetnpet
	14	Dr. L Shivadarshan	Vety.College
	15	Dr. Srividya	Vety.College
	16	Dr. Bhaskaran	Uddeuarry
	17	Dr. T Rao	Defence Colony
	18	Dr. A Saritha	Pocharan
	19	Dr.M Vivekanand	Alwal
	20	Dr. Mamataha	Madhapura
	21	Dr. Anil Murari	Quthabullapur
	22	Dr. Kuldeep	Banjarahills
	23	Dr. Abhisekh	Banjarahills
Pune	24	Dr. Vijay Gorhe	Kothrud
	25	Dr. R Y Dhage	Kothrud
	26	Dr. Swagat Sekhar	Hadapsar
	27	Dr. Narendra Pardesi	Baner
	28	Dr. Pradeep Inamdar	Sukrubarpeth
	29	Dr. Swagat Deshkar	Baner Road
	30	Dr. P. Power	Oregaon
	31	Dr. A. Nerelkar	Hatichowk
	32	Dr. C M Lele	Karvenagar
	33	Dr Pooja Tulpule	Wahanwadi
	34	Dr. Abhijeet Wakhede	Aundh
	35	Dr. Tribhuban Karte	Vivebadi
	36	Dr. Vivek Pandey	Yerwada
	37	Dr Ashok Tulpule	Wahanwadi
Bangalore	38	Dr. Laxminarayan	Shivajinagar
	39	Dr. Prasanna C.N	Rajaji Nagar

	40	Dr. B.T. Krishna	Rajaji Nagar
	41	Dr. G. Chandrasekhar Rao	Malleswaram
	42	Dr. Kantarajan	Malleswaram
	43	Dr. C.Ansari Kumarn	Hebal
	44	Dr. Sriram	Mysore Road
	45	Dr. Suresh H.S	Queens Road
	46	Dr. A.V Reddy	Queens Road
	47	Dr. Temiah	Mysore Road
	48	Dr. Murli	Mathikeri
	49	Dr. Shiv Shankar Murthy	Jayanagar
	50	Dr.Capt. Pradeep Rao	Mathikeri
	51	Dr. Kshyama	Hebal
	52	Dr. G. Nagendra	Jayanagar
	53	Dr.Ramakrishna	Kormangala
	54	Dr. Vasant. M Setty	Malleswaram
	55	Dr. Sadoshi Gayakwad	Malleswaram
	56	Dr.(Col) NN Gupta	Mowgli
	57	Dr. H A Upendra	Hebal
Jaipur	58	Dr. Rajesh Mishra	Apollo
	59	Dr. Sitaram Gupta	Apollo
	60	Dr. Ruchi Tripathy	Apollo
	61	Dr. C. S Sharma	Apollo
	62	Dr.Sitaram Gupta	Apollo
	63	Dr. Yogesh Sharma	Apollo
	64	Dr. Raish	Panchavatti
	65	Dr. Puspendra Kaloria	Jothwara
	66	Dr. Arvind Jetti	Sanganeri
	67	Dr. Rajendra Yadav	Apollo
	68	Dr. Gulvindar Choudhury	Pet Hub
	69	Dr. Ritu Raj	Apollo
	70	Dr. Shiv Kumar	Apollo
	71	Dr. Pratistha Sharma	Sashtrinagar
	72	Dr. Hansraj Gupta	Panchvatti
Chennai	73	Dr. Senthil Kumar	Madhavaram
	74	Dr. Nambi	T Nagar
	75	Dr. A. V.Krishnan	Kilpuk
	76	Dr. Ravi Sundar Gerge	Anna Nagar
	77	Dr. P. Sehraj	Vety College
	78	Dr. Jaiprakash	Vety College
	79	Dr. Nagarajan	Madhavaram
	80	Dr. Ayub Khan	Saidapet
	81	Dr. Sheyed	Hebal
	82	Dr. A Murthy	Madhavaram
	83	Dr. M Sekhar	Vety College
	84	Dr.S. Vairamutthu	Vety College

	85	Dr. Chandrasekhar	Vety College
	86	Dr. Sriram	Vety College
	87	Dr. Suresh	Pallavaram
	88	Dr. Vijayvarathi	Alwarpet
	89	Dr. Safi	Vety College
	90	Dr. Ramesh	Periamet
New Delhi	91	Dr. Vinod Sharma	Rajokhri
	92	Dr. Choudhoury	Vasantkunj
	93	Dr. Vinaya. Chabra	Lajpat
	94	Dr. Gandhi	Gk1
	95	Dr M M Sharma	Gk1
	96	Dr. S Sharma	Gk1
	97	Dr. Pawan Singh	Sushantlok
	98	Dr. Gagan Gaudi	Pitampura
	99	Dr. S Sashadri	Gurgaon
	100	Dr. Ashok	Gurgaon
	101	Dr. S Singh	Vasantvihar
	102	Dr. Ammar Rana	Gk2
	103	Dr. Rohit Mathur	Motibagh
	104	Dr. Promod	Motibagh
	105	Dr. Bharadwaj	Motibagh
	106	Dr. Meenakshi	Motibagh
	107	Dr. B. Sharma	South Motibagh
	108	Dr. Vijay Kumar	Ramesh Nagar
	109	Dr. R K Khana	Janakpuri
	110	Dr.Ajay Guliani	Greenpark

Order-splitting Vs. The Postponement Strategy For A Third-party Managed Global Supply Chain

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Keywords: global supply chain, supply chain manager, order splitting, product customization

Abstract

Retailers' desire to meet specific demands of smaller customer segments results in a substantial increase in product customization and new product designs (Lee, 1996). It is noted that developments in communication, production, and information technologies have accelerated the pace of new product introduction and customization (Gao and Hitt, 2004). This not only shortens product life cycle but creates problems with demand estimation, controlling product inventory and its availability (Su, et.al., 2010). Introduction of new and innovative products and other factors (such as incentives from competitors and economic conditions) add to demand uncertainty (Bruce and Daly, 2011).

Supply related uncertainty is another problem in the supply chain. To procure and produce the products as cheaply as possible, many retailers are seeking global suppliers. As much as global sourcing of raw materials and manufacturing facilities provides cost advantage, it lengthens supply lead time due to additional transit time of raw materials and finished goods. Further, supply volatility due to unpredictable factors such as geopolitical issues and natural disasters, machine breakdown, labor unrest, and exchange rate fluctuations also add to the supply side uncertainty and make the global supply chains more difficult to manage. These key sources of uncertainty and their potential impact on supply chains are discussed in the literature [see Peidro, et. al. (2009) and Acar, et. al. (2010), among others].

A global supply chain, that is impacted by both the demand and supply uncertainties, is becoming too complex for a retailer to manage. Hence, many firms have shifted away from a hierarchical, one-dimensional supply chain entity to a fragmented network. This has created opportunities for a whole new set of supply chain services. Bitran, et. al., (2006, 2007) argue that such a fragmented state is not sustainable and the period of disintegration will be followed by reintegration facilitated by an independent third party. This independent third party, working as a buffer between the retailers (or brand managers) and the suppliers (i.e, raw material sources, manufacturing facilities and logistical companies), manages the complexities and mitigates the uncertainties in the supply chain. Such companies have also been referred to as virtual supply chain integrators (Lam and Postle, 2006) or supply chain managers (SCM) (Banerjee and Golhar 2012). A SCM, such as Li & Fung of Hong Kong, maintains a network of more than 7500 suppliers from 26 countries, but it

does not own any manufacturing facility. Another SCM, Flextronics, has vertically integrated electronics design, engineering and manufacturing facilities in six industrial parks in low-cost regions around the world. A SCM's access to a vast network of suppliers and manufacturers reduces supply related uncertainties. Hence, many retailers like Gymboree and Rainforest rely on the SCMs to effectively manage their supply chains with short production lead time.

A SCM would like to reduce his cost by procuring raw materials and booking manufacturing facilities early. A late order from retailer forces the SCM to initiate the production process early to meet his contractual demand. So, the SCM has to devise an optimal production strategy that takes into account his cost escalation, due to potential delays in production scheduling, and balances it against the cost of over/underestimating demand from retailers. There are two strategies that a SCM can adopt to maximize his profits: a) ordering only the base product early on and postponing product customization as late in the production process as possible and b) order-splitting (ordering base product as well as customizing some of the base products early).

Several studies examine the issue of postponement. For example, Lee, et. al. (1993) explore the differentiating factor for HP printers where the power supply is introduced at the last stage of packing in the country where the product is to be sold. Other reported cases of delayed differentiation include fashion retailer Benetton switching their sweater production sequence from dye first stitch later to stitch first and dye later. To better align the demand with production, they postpone coloring the sweater at a later stage (Lee 2002). There are many analytical models exploring different aspects of delayed differentiation (DD) strategies under different conditions. For example, Su, et. al. (2010) compare the DD strategies against customer waiting time. Gupta and Benjaafar (2004) calculate optimal stocking level for a given service level constraints. Shao and Ji (2008) formulate a cost minimization model and conclude that it is not beneficial to delay the point of differentiation when the considered stage is a high value-added process. Dominguez and Lashkari (2004) develop a mixed integer programming model where the postponement refers to the delay in the movement of finished product in supply chain to efficiently manage the inventory and distribution. These postponement strategies represent delaying design finalization, production, customization or logistics part of a supply chain. A comprehensive review of delayed differentiation strategies is presented by Swaminathan and Lee (2003).

Our model differs significantly from the studies reported in the literature in that it identifies the best production decision for the SCM whose cost parameters and profit function differ from his supply chain partners. In this paper we posit that, while delayed ordering may be the best strategy for retailers, it may not always be the most desirable one for the SCM. A profit maximization model is developed for the order-splitting strategy where some products are customized immediately and the rest are customized later.

In our model, the shortage cost represents the incremental cost of producing additional customized product if the SCM underestimates the demand, and the order from retailer is more than the sum of the base and customized products in store with SCM. If the order quantity is more than the customized products available with SCM but the shortage can be met by customizing available base products, the SCM pays a higher price for product customization due to shorter lead time available for customization. This is reflected in our model as the unit penalty for delayed customization. If SCM overestimates the demand, unsold base items can be salvaged in the secondary market, if permitted by the retailer. We also assume that the demand for the base product in the secondary market is infinite. A customized product needs to be de-customized before being sold in the secondary market as a base product. Thus, for overestimated demand, the SCM has the following choices:

- For the base product, the excess inventory may be sold at a discount (the *salvage value*) in the secondary market. If the retailer is opposed to selling the base product in the secondary market, then the salvage value will be zero.
- For a surplus customized product, the SCM can either de-customize the product by incurring additional cost and sell the base product at a discount or destroy the excess customized products with a salvage value of zero.

To meet delivery requirements, the SCM must start the production process before receiving a firm order from retailers. We assume a two-stage production process: in stage one a base product is produced and in stage two the base product is customized. The SCM absorbs the penalties associated with over and under estimating retailers' demand. The dilemma for the SCM then is, in anticipation of the retailers' demand a) how much base product to order from his suppliers and b) how much of the base product is to be customized right away. For the supply chain environment described above, we present an optimization model for order-splitting strategy and compare its effectiveness with the postponement strategy.

First, we show that the expected profit function is concave and, then, develop a profit maximization model for the order-splitting strategy using a non-linear objective function with two decision variables and one constraint. Using Lagrangian multipliers and applying Kuhn-Tucker conditions, optimal solutions are obtained for the two decision variables. Also, formulations are given for two additional strategies: postpone customization of all products and produce customized products only. An example illustrates the use of our model. We also examine the impact of demand variability on the effectiveness of the three strategies.

Our model is easy to use and provides some insights about the impact of different cost parameters on the optimal production and customization decisions. For example, under varying demand uncertainty conditions, the order splitting strategy is found to be superior to the other two strategies, including the postponement strategy. This is contrary to the principle of mass customization, which dictates delaying product customization for all units as late in the production

process as possible. The model can be used as a decision support tool to estimate how much premium a SCM will have to pay for not following the optimal order splitting strategy but instead a) postponing product customization, or b) customizing the whole order without delay. It will also be of significant help to a SCM in negotiating prices for production facilities, and deciding on how much raw materials and production capacity to be booked in advance.

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Forecasting Practices In Agrochemical Industry In India

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Corporate recognition of the importance of SCM is growing rapidly. Agrochemical firms faced with the uncertainty of demand due to unstable agriculture are also moving towards adopting SCM. Supply chain planning, today, thrives on the robustness of demand forecasting. There are not many studies on forecasting in Indian firms, but of late it is recognized that a robust forecasting process is a must for modern day organization to create a responsive, efficient and agile supply chain.

The study recognizes that information leads to effective forecasts. The more the number of factors that predict future demand, the more accurate these predictions can be. In agrochemicals, a host of factors play an important role in making demand forecasting difficult. Only one-third of arable land in India is irrigated. Cropping patterns have become lopsided because of the minimum support prices. Farmers are not allowed to export food grains. Inter-State movements of food grains are restricted. All this adds to the woes of Indian agriculture and agrochemical companies.

Agrochemical companies have grown well in the last few years. However, during the last 2-3 years, agrochemical industry is facing a lot of hardships on account of over-capacities and the resultant fall in selling prices.

It must be realized that agrochemicals are not just chemicals. These are valuable inputs, which contribute to crop productivity. This throws up a number of challenges for the agrochemical companies. They just cannot manufacture any chemical; marketing has to be knowledge-based. Gone are the days when one would say, "we do research to get a product idea, production will make it and marketing should sell."

In the changed world of today, the fundamental concept is to identify what is needed in the market and align supply to the market requirements.

This study will, therefore, look at the practice of forecasting and how forecast is being utilized, to streamline supply chain operations in agrochemical industry.

1.5 Objectives Of The Study

As the study concentrates on the integrated SCM in Agrochemicals Industry in India, the objectives of this study are as follows:

- To study the gaps in the practice of forecasting with special reference to SCM in agrochemicals industry in India
- To study the role of demand planning in SCM

2.2 Review of literature

Forecast of future demand, forms the basis for all strategic and planning decisions in the supply chain. According to Andraski (1998), "If supply chain management begins with a forecast that is substantially in error, in terms of timing or quantity, the ramifications will be felt throughout the entire process. The consequences are many: manufacturing will have to adjust and run at less capacity or work overtime to meet customer demands; logistic expenses will be less than optimal; product will be at the wrong place at the wrong time, impacting customer service; the list could go on ad infinitum."

Wheel Wright and Clarke (1976) conducted a survey of the forecasting practice in corporate America and found that the effectiveness of a forecasting system in any organization depends on:

- Understanding the management problem;
- Identifying the important issues in a forecasting situation;
- Choosing the best forecasting technique; and
- Identifying new forecasting situations

Carlo Smith (2001) presents a chronology of issues and advancements that have contributed to the development of forecasting and the factors that influence forecasting performance. This understanding has transitioned from an early focus on forecasting techniques, to include the organizational and individual behavior that affects forecasting practices. He divides the scope of forecasting into four quadrants:

- Evaluating model performance;
- Forecasting implementation and management;
- Model performance - implication for the supply chain; and
- Forecasting management performance in the supply chain

Table 2.2: Broadening scope of forecasting research

Source: Carlo D Smith, 2001

II Evaluating Forecasting Management Performance (Mentzer, Bienstock, & Kahn, 1999; Smith, 1999) Model Implementation and Management (Closs, Oaks, & Wisdo, 1989; Mentzer & Schroeter, 1994; Schultz, 1984)	*IV* Evaluating Supply Chain Forecasting Management Performance

I	*III*
Model Performance and Application, Implications for Business Functions (Bowersox et al, 1979; Gardner, 1990) Model Performance and Application (Dalrymple, 1975, 1987; Mentzer & Cox, 1984; Mentzer & Kahn, 1995a) Model Development and Testing (Makridakis et al., 1982; Makridakis & Hibon, 1979)	Demand Process and Model Selection, Implications for the Supply Chain (Chen et al., 1999; Chen, Ryan, & Simchi-Levi, 1998a, 1998b)

The review of forecasting literature which follows in the subsequent sections is thus classified on the basis of:

- Model selection,
- Accuracy of forecast, and
- Forecast management

2.2.1 Methods And Models Used In Supply Chain Forecasting

There is no universal forecasting technique, which is good for all different needs of an organization. There are three commonly used forecasting models:

- Judgmental methods,
- Time series models, and
- Causal methods

Wheel Wright and Clarke (1976) found that companies are applying a number of different methods. The reasons for using these models are user's technical ability, cost, problem-specific characteristics and statistical characteristics desired from these models.

A number of studies in the last two decades have been carried out in the US and Europe, to gauge the change in the use of forecasting methods. Mentzer and Cox (1984a, 1984b) found that the majority of respondents were familiar with all the techniques except Box-Jenkins' time series methods. They found a great deal of bias towards subjective techniques. Subjective techniques were used for short-range forecast (less than three months). Jury of executives' opinion was favored across all-time horizons and corporate levels of the forecast. They found that accuracy decreased significantly as the time horizon increased. Accuracy also decreased as the forecast level moved down to individual product forecast.

Fildes and Lusk (1984) found that the majority of respondents were familiar with all the techniques including Box-Jenkins method. But they found that more sophisticated the technique is; lower is the level of usages. Executive opinion was most widely used by those familiar with it. Box-Jenkins was ranked as the most accurate for short lead-times, whereas trend analysis ranked first for longer lead-times. Exponential smoothing was considered more accurate than adoptive smoothing. Familiar techniques were judged more accurate.

Sparkes and McHugh (1984) found a strong bias towards more subjective techniques. They found a general lack of use of Box-Jenkins time series, Delphi method and impact analysis. Judgmental methods, according to them, were the most important method.

Dalrymple (1987) found survey and opinion methods to be the most important method, followed by the jury of executive opinion. Wilson and Daubeck (1989) found multiple regressions to be the most accurate followed by survey and opinion polling. Drury (1990) found that management judgment and a variant of that remains the highly used method of demand forecasting.

Mentzer and Beinstock (1987) studied the use of forecasting methods over time horizons. Time horizon studies can be broadly categorized into three periods. They are: (i) less than three months, (ii) 3 months to 2 years, and (iii) more than two years. In their study, a comparison was made over two phases. First phase relates to pre-90 and phase two corresponds to post-1990. According to them, most forecasters moved towards concentrating on time horizons between three months and 2 years. During these time horizons, majority of forecasters preferred using exponential smoothing techniques for forecasting sales. They also used executive opinion, sales force composite, regression and trend analysis. In the greater than two years time horizons, majority of respondents preferred jury of executive opinions. Price and Gilland (2001) found that the focus of forecasting is moving towards short-time horizons, in order to increase the responsiveness in the supply chain. There are large numbers of newer studies which also indicate and validate this trend in forecasting.

2.2.2 Forecast Performance

Forecast management performance across the supply chain is based on forecast accuracy, credibility and application of the forecast without modification (Smith, 1999). Accurate and timely forecasts are vital components of supply chain forecasting. Inaccurate forecasts would often result in supply imbalances when it comes to meeting customer demand. Accuracy in demand forecasting seems like a fairly straightforward concept, but it gets a little more complicated when organizations try to implement it. The straightforward part is that the organizations just want to know how much they missed the actual demand in a given time period, with their forecast of sales for that period. The complicated part is, interpreting exactly what the accuracy numbers mean when they get them (Mentzer and Beinstock, 1999). There are various methods of measuring forecast accuracy. They are mean absolute deviation, mean-squared deviation, mean-squared

error deviation, percentage error, forecast ratio, inventory static standard deviation and others. The most widely used measure of forecast accuracy is the percentage method. Mean percentage error is the average of the absolute percentage error. This method is rarely used. Mean absolute percentage error (MAPE) is the sum of absolute errors divided by the sum of the actual errors. This is the most widely used method. Though MAPE is very unstable and the measure gets skewed by small values, MAPE is simple and elegant, while it is also robust as a computational measure. The MAPE is volume weighted rather than value weighted. It assumes that absolute error on each item is equally important. It can show large error on low value item, and can skew the overall error. To overcome this MAPE should be value weighted rather than volume weighted. The advantage is that high value item will influence the overall error and can be highly correlated with safety stock requirements and hence could be used in setting safety stock strategies (Chockalingam, 2001).

The solution to problem of accuracy of forecast is multifarious. According to Jain (2001), there are three sources of error:

- Data error,
- Assumption error, and
- Model error

Mentzer and Beinstock (1999), Geurtz and Whitlark (2000), Jain (2001) and Schultz (1984) have suggested several ways to improve the accuracy of the forecast. They are:

- Find new leading indicators,
- Obtain better real demand data,
- Reduce variance in the sales pattern,
- Use market research,
- Gather information from the supply chain,
- Manage human biases, and
- Use appropriate measure of accuracy

2.2.3 Forecast Management

According to Schultz (1984), management of forecast has been a neglected area in both, practice and theory of forecasting. It has often been missed that forecasting implementation draws from the many of the same factors that affect the implementation of other types of decision support and operation management systems.

Schultz (1984), Wheel Wright and Clarke (1976), and Smith (2000), have suggested that the firms in order to maximize the outcome of forecasting need to define:

- Current processes and systems supporting forecasting,

- Measure factors that contribute to implementation success like user-forecaster communication and participation, top management support both, financial and human resources,
- Develop an implementation plan,
- Build an implementation team, and
- Establish a mechanism of feedbacks and control during the implementation process

At times, it is not the external factor that affects the performance of the forecast but the internal business dynamics as well as organizational variable which create variability and thus put a question mark on the viability of the forecasting exercise. The next section deals with variables internal to the business and how they pose a problem for forecasting as a whole.

CHAPTER 4. FINDINGS AND DISCUSSION OF THE STUDY

4.1 Introduction

The findings mentioned here, are the results of both, the qualitative as well as the quantitative analysis of the responses. As mentioned in Chapter 3, Research Methodology, the survey was conducted in a question and answer form with the help of semi-structured schedules, personally carried out by the researcher.

This chapter is organized in the following manner:

- First the findings of the study are presented along with data tables,
- The interpretation of the data follows the findings, and
- The results are discussed in the end

4.2 Survey Findings – Forecasting

The findings of the survey and the attendant data tables are presented in this section.

4.2.1 Number Of Staff Involved

In order to understand the status of forecasting and its strategic dimensions, the research focused on two groups of managers who are charged with increasing the effectiveness of planning and forecasting, and coping with the expanding uncertainties surrounding business decision. In all the 40 firms, the level of involvement in forecasting is significant. The number of staff involved in forecasting is summarized in the following table:

Table 4.1: Number of staff involved in forecasting

No. of People	*No. of Responses*	*N*	*% Response*
1 – 2	33	40	55
3 – 5	16	40	45
5 – 10	0	40	0
10 or More	0	40	0

From the table above, it is clear that in 55% of the companies there are 1 or 2 people involved in forecasting and in 45% of the companies 3 to 5 people are involved. Forecasting still is not a separate functional area in the sample firms. Forecasting is now getting recognized as an essential process in agrochemical firms.

4.2.2 Models And Methods Used

To assess how individual companies are doing in their use of forecasting, the study first looked at the use of forecasting methods in the sample firms; the summary of the same is summarized below:

Table 4.2: Usage of the forecasting technique

Technique	*N*	*% response*
Qualitative		
Customer Expectations	40	0
Jury of Executive opinion	40	50
Sales force Composite	40	65
Quantitative		
Box-Jenkins	40	0
Decomposition	40	0
Expert System	40	0
Exponential Smoothing	40	10
Life Cycle Analysis	40	0
Moving Average	40	30
Neural Networks	40	0
Regression	40	10
Simulation	40	0
Straight Line Projection	40	0
Multiple Responses		

It is clear from the table that the widely used methods of forecasting are Jury of Executive opinion (50%) and Sales Force Composite (65%). The uses of qualitative techniques exceed those of quantitative techniques. Only about 10% of the firms use exponential smoothing, 30% use moving averages and 10% of them use regression techniques. Moving averages seems to be the most

widely used quantitative techniques. Asked about familiarity with various models of forecasting, most respondents were unfamiliar with advanced techniques like Box-Jenkins and Neural Network. None of the forecaster was trained in forecasting methods and models; they had picked up forecasting essentials on their job only.

Looking at the use of forecasting techniques over various time horizons, the researcher found that:

- Jury of Executive opinion, sales force composite and moving averages are widely used methods for time horizons less than 3 months
- The majority of the respondents said that they preferred Jury of Executive opinion (65%) and regression (15%) methods over other techniques in the three months to 2 years' time horizon
- In the greater than 2 years' time horizon, the majority of the respondents preferred Jury of Executive opinion. Only 25% of the respondents forecast for time horizon more than 2 years

There is a clear indication that shorter horizon forecasting is on the cards and that forecasters are moving towards adopting SCM using self reported demand.

4.2.3 Factors Considered For Forecasting

Agriculture-based businesses are dependent on agricultural macro-economic environment. Uncertainty is an inherent part of their business operations. Firms need to take cognizance of the causal variables, which can help track uncertainty arising out of the very nature of the agricultural economy. The respondents said that they take into account causal variables like weather, cropping pattern details, pest incidence and prices into consideration while formulating and finalizing the final forecast. But it is not clear as to how they use these variables in their forecasting technique, how and from where they collect data on the above macroeconomic variables.

Table 4.3: Factors considered for forecasting

Factors	*N*	*% Response*
Rainfall	40	85
Cropping pattern	40	80
Incidence of Pest	40	85
Support (Procurement Prices)	40	80
Market Scenario/Competition	40	25
Multiple Responses		

4.2.4 Forecasting Accuracy

Accuracy remained a top criterion for evaluating sales forecasting effectiveness. Majority of the respondents (40%) calculated accuracy by calculating the % error. 2.5% of the respondents used MAPE and other 2.5% used Mean Squared Error. 5% of them used Standard Deviation to

calculate accuracy. They appeared to be inadequately trained in understanding the importance of proper method of forecast accuracy. Almost all of them believed that percentage error is the only and the best measure of evaluating sales forecasting effectiveness.

Table 4.4: Forecasting accuracy

Method	*N*	*% Response*
MAPE	40	2.5
Mean absolute deviation	40	-
Mean squared error	40	2.5
Deviations	40	-
Percentage error	40	90
Forecast ratio	40	-
Inventory statistics	40	-
Standard deviation and others	40	5
Multiple Responses		

Table 4.5: Criteria for evaluating sales forecasting effectiveness

Criterion	*N*	*% Importance*
Accuracy	40	92
Customer Service Expectations	40	60
Ease of use	40	55
Inventory turns	40	60
Amount of data required	40	40
Cost	40	20
Return on Investment	40	25
Multiple Responses		

92% of the respondents when asked about the criterion for evaluating forecasting effectiveness said that accuracy is of prime importance to them. Accuracy, as pointed out earlier, remains a top criterion for evaluating sales forecasting effectiveness. Nevertheless most of the respondents also said that customer service expectations (60%), ease of use (55%), inventory turns (60%), and data requirement (40%) are considered while evaluating sales forecasting effectiveness. The least ranked was cost (20%) and ROI (21%).

It is thus clear that forecasting is used in Supply Chain Planning in the organizations. The traditional mindset of treating forecasting as cost and trying to calculate ROI on it has given way to a more realistic concern of forecasting accuracy and it's uses in increasing efficiency.

4.2.5 Forecasting Approaches

In order to investigate how the sales forecasting process is managed, respondents were asked which of the four fundamental approaches to forecasting management were used by their company (as outlined in the table 4.6). It is a measure of improved sophistication of sales forecasting management that few companies still follow an independent approach (12%). However, almost half (48%) of the responding companies have one department responsible for developing sales forecast. A number of companies are trying some form of negotiated or consensus approach.

Table 4.6: Basic approach to forecasting

Approaches used to develop sales forecasts	*N*	*% Response*
Each department develops and uses its own Sales Forecasts (Independent Approach)	40	12
One department is responsible for developing Sales Forecasts	40	48
Each department develops its own forecast but a Committee co-ordinates a final forecast	40	30
A forecast committee/task force is responsible for developing sales forecasts (Consensus approach)	40	20
Multiple Responses		

4.2.6 Satisfaction With Forecasting Approaches

Asked about how satisfied they were with current forecasting approach, the average rank, which was arrived at was 2.5 on a scale of 5. This shows that satisfaction with the current forecasting practices is far from desired.

4.2.7 Functions Involved In Forecasting

Forecasting, according to the responses received, is the prime responsibility of the logistics department (95%). The other departments, which are significantly involved in forecasting, are: Marketing (35%) and Sales (25%). Respondents have also indicated involvement of Finance, Planning, Production, Research and Development and Forecasting departments. This also seems to be in line with the responses received for the approach to forecasting. There is recognition of the importance of subjective inputs from marketing, sales and operations to the forecast.

Table 4.7: Functional department involved in forecasting

Department	*N*	*% Response*
Finance	40	40
Marketing	40	35
Logistics	40	95
Sales	40	25

Planning	40	5
Production	40	10
Research or Development	40	5
Forecasting	40	5
Multiple Responses		

4.2.8 Ratings Of Users And Preparers

As a first step in identifying the factors that may explain the status attributed to forecasting, the users and preparers were asked to rate themselves, and their counterparts in their company, on several dimensions on a scale of 1 to 5 (5 being most and 1 being least important). The following table gives the differences in users and preparers' ability on several dimensions of forecasting. The grouping was based on classifications suggested by Wheel Wright and Clarke (1976). The difference in rating was calculated by taking the percentage of user's rating (good or excellent) minus percentage of preparer's rating (good or excellent), divided by percentage of preparer's rating (good or excellent). The result is summarized in the table 4.8.

Table 4.8: Differences in ratings of users and preparers

	N	% Rating
Preparer's ability to		
Understand sophisticated forecasting technique	40	+ 2
Understand Management problems	40	-15
Identify important issues in forecasting situation	40	-25
Provide cost effective forecast	40	-34
Provide forecasting in new situation	40	28
Identify best techniques for a given situation	40	-39
User's technical ability to		
Understand essential of forecasting techniques	40	+28
Evaluate appropriateness of forecasting techniques	40	+22
Understand sophisticated mathematical forecasting techniques	40	+10
Identify new applications for forecasting	40	+ 5
Effectively use formal forecast for planning	40	- 6
User's & preparer's interaction skills & ability to		
Work within organization in getting forecast	40	+ 2
Users communication with the preparer	40	- 3
User's management ability to		
Work within organizations in getting forecast	40	- 3
Effectively use formal forecast	40	- 6
Describe important name in forecasting situation to the preparer	40	- 8

The first major grouping is the preparer's ability, which includes providing forecast of different situations in the time required and choosing the best techniques for the given situation. Preparers rated their own ability much more highly than the users rated their own ability. As to the user's technical ability, the second factor just the opposite was true. The users rated themselves more highly than the preparers rated them, in regard to their ability to understand forecasting techniques and to evaluate the appropriateness of a given technique.

On interactive skills, the third factor identified the preparers again rated their own ability to work within the organization and to understand the management problems much more highly than the users did. Finally, in terms of the user's management ability, the fourth factor, users and preparers were in close agreement the difference in these perceptions are noteworthy because they signal what in many instances is referred to as a communication problem.

4.2.9 Ratings Of Users And Preparers

Another element in effective forecasting techniques is making sure that a minimum set of skills is available in the company. The study found that 15% of the survey respondents did not rate themselves better than adequate in understanding the management problems. Around 30% did not understand and were not able to identify the important issues in forecasting situations. 52.1% did not know how to choose the best technique for a given situation. 55.3% were inadequately trained to identify new forecasting situations.

Table 4.9: Elements of effective forecasting

Function	*N*	*% of companies in which neither users nor preparers rated better than adequate*
Understanding the management problem.	40	15%
Identifying important issue in a forecasting situation.	40	30%
Choosing the best forecasting techniques.	40	52.1%
Identifying new forecasting situations.	40	55.3%
Multiple Responses		

Most organizations (50%) were unable to provide forecast in an ongoing situation, choose the right forecasting technique, and identify new forecasting situations. Thus, in spite of commitment to forecasting, the skills that are essential to make it effective, are apparently not necessarily present.

4.2.10 Ratings Of Users And Preparers

As regards to company sales forecasting processes, agrochemical firms are far behind what is desired. The respondents feel that the top management support is increasing over time, but it is not uniform among all the companies. The user preparers communication, lack of formal training, lack of clear understanding of the methods used, lack of recognition of forecasting contribution, and lack of belief in a single forecast by the organization are areas of concern as their mean values in the table 4.10 is quite low on a scale of five and even the standard deviation is low.

Table 4.10: Sales forecasting process

	N	*Mean*	*SD*
The top management is very encouraging	40	3.3250	1.0952
The user & preparer of the forecast, have a cordial relationship	40	2.7750	0.6197
Forecasting is done at a very high level of sophistication/scientific basis		1.6750	0.7642
There is a clear understanding of the methods used	40	2.9500	0.9594
User has a formal training in using the forecast	40	2.2250	0.6975
Accuracy desired is very high	40	1.9000	0.8412
The preparers meet the expected high degree of accuracies of users	40	3.0750	0.5256
The forecast is prepared via a formal/routine process with clear and precise instructions	40	1.3500	0.7696
Forecasting performance is formally evaluated and rewarded	40	2.7750	0.8002
The final sales forecast is believed by all concerned	40	2.3000	0.7579
The sales forecasting budget is sufficient	40	2.5500	0.7828
There are enough people assigned to develop the sales forecasts	40	1.5750	0.7808

It can be concluded here that though the interest in forecasting is gaining grounds in agrochemical firms The processes needed to enable are not in place totally.

4.3 Discussion Of Results - Forecasting

It is clear from the findings that forecasting and interest in forecasting have substantially increased even among agrochemical companies. In all of these companies, the level of commitment to forecasting is substantial. As a result of their commitment to forecasting, agrochemical companies are applying a number of forecasting methods. Most widely used methods of forecasting are sales force composite, jury of executive opinion and moving averages. According to Mentzer et al (2002), their two-phase study in eighties and nineties showed the respondent in nineties were less satisfied with the jury of executive opinion and moving average than the respondent in the eighties. Confirming Lusk's (1984) finding that firms have a better understanding of quantitative forecasting techniques than qualitative forecasting, they found that firms were more familiar with the techniques of moving averages, regression and lifecycle analysis, classical decomposition and in

particular box Jenkins model. This is an interesting trend. Thus, a comparison with similar studies by noted forecasters and academicians would force one to believe that agrochemical companies here are far from adopting sales forecasting practices that are in tune with the requirements of better supply chain coordination.

CONCLUSION

PRACTICE OF FORECASTING IN AGROCHEMICAL INDUSTRY

Most agrochemical firms recognize the importance of forecasting. Their commitment to forecasting has significantly improved. These are about 3 to 5 people involved in forecasting in around 45% of the companies and 1 to 2 people involved in forecasting in other 55% of the sample companies. They are still far away from recognizing forecasting as a separate functional area whose responsibility is to provide forecasts at all levels and for all time horizons that are useful to marketing, sales, finance, production and logistics.

Usage of forecasting methods is in line with the emerging paradigm of supply chain forecasting. Most widely used method of forecasting are sales force composite(65%) jury of executive opinion (50%), moving average (30%), and exponential smoothing (10%).The uses of qualitative techniques exceed those of quantitative techniques. Agrochemical firms seem to be moving towards supply chain forecasting. Their forecasting methods seem to be dictated by the supply chain requirement and the evolution of information technology.

Forecasting is universal among these sample firms. Almost all firms under study forecast for time horizon of less than 3 months. 20% of the respondents said that they forecast in the 3 months to 2 years' time horizon. 20% of them also forecast in the above two years' horizon. In the era of uncertainty due to changing landscape of business, more and more firms are moving towards forecasting for smaller time horizons and are trying to match demand and supply for such periods.

Agrochemical industries like other agribusinesses face unprecedented uncertainties on account of weather, cropping pattern changes, pest incidence and procurement prices. Most respondents said that they take into account causal variables like weather conditions, cropping pattern details, pest incidence and prices into consideration while formulating the final forecast. But, they agreed that they are not able to use causal variables to generate forecast for smaller horizons because of the following two reasons:

- Unavailability of the agricultural data in the short-run and,
- Lack of understanding of scientific methods of forecasting among forecaster.

In such a situation forecaster are not able to desegregate econometric forecast into monthly by applying seasonal factors computed from the monthly raw data. And hence they fail to understand the utility of the causal forecast.

Agrochemical firms measure accuracy by calculating the percentage error. Though percentage methods offers an effective means of assessing individual periods, it can erroneously reflect a more accurate forecast as positive error from one period is averaged out with a negative error from subsequent periods. Worldwide organizations use Mean absolute percent error, which is a function of PE that eliminates the potential bias in the results. As accuracy also happens to be an important criteria for assessing forecast effectiveness, Mean absolute percent error rather than percent error should be used to measure accuracy.

As regards to approaches used to develop forecast, majority (88%) of the companies use concentrated, negotiated and consensus approach with 48% of them having one department responsible for developing sales forecast. Forecasting is largely the responsibility of logistics department but other functional areas were also involved occasionally. The companies have started recognizing the importance of subjective inputs from marketing, sales and operations to the forecast.

Lack of effective communication between user and preparers are apparent through disparity in user-preparers perception about company's forecasting status and needs. It can thus be concluded that though companies recognize the importance of subjective inputs from functional areas as essential input for forecast, they still continue to operate in an environment of functional silos.

Thus, it can be concluded that the agrochemical firms do not forecast demand effectively, neither do they align demand to supply effectively. Thus, the null hypothesis that Agrochemical firms understand and forecast demand effectively in order to align supply to demand is rejected.

The second hypothesis that "agrochemical firms are moving away from demand forecasting and are relying more on supply chain forecasting is also rejected. There is no doubt that most agrochemical firms use concentrated or negotiated approach, which is a primary requirement of any supply chain forecasting process, but they do not have forecasting as a separate functional area. Forecasting is located in a certain area – typically logistics or marketing – which dictates forecast to the other areas. These firms are also faced with poor communication between the users and the preparers and hence continue to operate in their functional silos. Cross functional and cross enterprise teams which are essential for supply chain forecasting are absent in the sample agrochemical firms.

According to Gilland and Prince (2001), the quantitative approach can be very effective in a situation where the demand follows a detectable and a predictable pattern, but they acknowledge that nearly all demand can be considered unpredictable. It seems that it will never be possible to forecast with a degree of accuracy, nor can one know in advance how accurate these forecasts will be. With changing nature of businesses and increasing complexity due to changing dynamics of demand, firms are moving away from quantitative models to qualitative models, which are based on qualitative patterns like sales force composite.

This approach is based on certain prior assumptions such as:

- Find ways to add responsiveness and flexibility to supply chain to reduce lead-times, and
- Develop a supply chain that minimizes reliance on forecasts

Various studies like those undertaken by Fildes and Lusk (1984), Dalrymple (1987), Spark and McHugh (1984), and Wilson and Daubeck (1989) also confirm the trend towards more and more use of subjective forecasting technique. This is in confirmation with what Gilland and Price (2000) call it as supply chain forecasting.

Agrochemical firms faced with uncertainty emanating from uncertainty in Indian agriculture have moved a step ahead, adopting supply chain forecasting method using sales force composite. Their forecasting methods seem to be dictated by the supply chain requirement and the technology.

This fact is confirmed by the fact that jury of executive opinion and sales force composite are widely used methods for forecast horizon of less than three months. Most (60 %) companies forecast only for a time horizon of 3-4 months and these forecasts are widely used to align their supply chains.

Of the 20 % of the companies who forecast for a time horizon of more than 3 months and up to two years, apart from jury of executive opinion, they use regression techniques and they take into account causal variables but are unable to use these causal variable to generate forecast for shorter period because of unavailability of agricultural data in the short-run and also because of lack of knowledge base among forecasters regarding desegregation of econometric forecast into months, by applying seasonal factors computed from the monthly raw data.

Sales or supply chain forecasting performance is measured primarily by accuracy of the forecast. Most agrochemical firms have been using percentage error to measure the accuracy. No doubt PE offers an effective means of assessing individual periods, but it can erroneously reflect a more accurate forecast as positive error from one period is averaged with negative error for the subsequent period. MAPE is a function of PE. That eliminates this potential bias in the results (Carlo D Smith, 2001). The practice worldwide is to use MAPE to measure the forecast accuracy (Mentzer 2000). Agrochemical firms though worried about forecast accuracy, use forecasting as a management tool to enhance supply chain efficiencies.

On a positive note, companies are improving the sophistication of the process by which the sales forecasting function is managed. Only 12 % of the companies use an independent approach to sales forecasting management, with majority using a negotiated or consensus approach. Sales forecasting can be improved by a broader range of input from various other functional areas.

Recognition of this positive cost benefit in such a large number responding company is encouraging.

The firms under study have moved into the second stage of supply chain forecasting (Carlo D Smith, 2001). The major disconnect between marketing, finance, sales, production, logistics and forecasting have given way to consensus forecasting with most functional areas' involvement.

This leads to the next question, as rightly pointed by Zhou (1999), who argues that the co-ordination between department is necessary in order to make sales/supply chain forecasting, a success. Though cross-functional approaches are beginning to find their place in agrochemical firms, the reality is that it is just a beginning of the process where the importance of subjective input from marketing, sales and operations to the forecast is getting realized. The organization processes which help this cross-functional cooperation are not in place. This is clear from the fact that there is a huge disparity in users and preparers' perceptions of the company's forecasting status and needs. These differences in the perceptions of the preparers of forecast and the users of the forecast hinders effective communication and focusing of company's scarce resources on the most pressing needs. Forecasting tends to neglect the forecasting environment, data collected, computer systems and management of forecasting processes as integrated activities, leading to failure of forecasting in aligning supply to demand.

Hence it can be concluded from this discussion that many of the companies have a substantial commitment to forecasting and have truly recognized the importance of supply chain forecasting, but are far behind in creating an organizational enabler in order to develop a clear and progressive and effective plan of action for implementation of a forecasting program.

Impact of Hospital Service Quality Dimensions On Customer Loyalty From The Patients Perspective

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ABSTRACT

The study examined the relation between Hospital Service Quality Dimensions on Customer Loyalty of the patients (customers) in the various hospitals (single specialty vs. multi specialty) located in Bangalore. The theoretical model is developed based on the literature which includes service quality, patient's satisfaction and hospital administration. The study covered patients who visited hospital recently within 3 months as a unit of analysis. In both single specialty and multi specialty 292 samples were collected by convenient sampling technique. The model is tested by using Structural Equation Modeling (SEM) as per the guide lines of source authors of SEM literature (Brown, Kline 2005) The outcome of the study showed significant relationship between Service quality dimensions and customer loyalty. All the Service Quality dimensions showed the expected sign with customer loyalty. Suggestion emphasizes the role of service quality dimension to extend the customer loyalty in the health care sector in the Indian scenario. The changes are noticeable.

Key words: Hospital service quality, Customer Loyalty and SEM

INTRODUCTION

In Indian scenario, especially Health care sectors, sea level changes are occurred in the recent time compared to the yesteryears. In terms of technology, health care facilities, patient's perception on hospitals, everything is changed in drastic way. Service Quality is more subjective, the way how customers are perceived in addition with how service providers made them to perceive. In stiff competition era, business results are backed by loyal customers, new customers from old customers referrals are the key, this is core idea of constructs, namely Customer Loyalty. This paper made attempts to test theoretical model, which incorporates, service quality dimensions and its impact on customer loyalty in health care sectors, Bangalore. Several studies have been conducted in the western context, there is a paucity of such studies in the Indian scenario Especially studies are based on rigorous statistical techniques like structural equation modeling. This study is attempted to fill the gap of testing the theoretical model which is basically built on service quality dimension and its impact on customer loyalty.

REVIEW OF LITERATURE

Parasuraman, Zeithaml, and Berry (1985) have concentrated on quality measure that could be used across a wide variety of service domains. The model provides the most information and the most accurate portrayal of the information. The model was developed in the economics of information by Darby and Karni (1973). The model was refined and was developed in theory for hospital services by Lynch and Schuler (1990). The study of the same authors, (1998) revealed that the quality of hospital services have become important in selection of the hospitals. The three factors such as search, experience and credence are the economics of information theory for analyzing how the consumers judge the quality of hospital services. Boscacino and Steiber (1982) also addressed the issue of hospital choice factor. They examined hospital choice for general care, specialized care and emergency care as distinct choice scenarios and identified the most important criteria for selecting a general care facility to be convenient location, physician recommendation and past experience. The findings of their study are that the consumers rely on signals in forming their judgments about the quality of the hospital facilities.

Mohammed Shahedul Quader (2009) revealed that one of the most important quality dimensions in health care today is patient satisfaction. One way of achieving satisfaction is by understanding and meeting patient expectations in dimension of quality. Once an organisation achieves high levels of satisfaction they will realise the benefits that it brings throughout the organization. The study suggested that, through understanding patient expectations an organisation can improve their services, therefore improving patient satisfaction and ultimately leading to which helps to increased income to improve services. Suleiman et al., (March 2011) assessed the quality level of healthcare service provided by king Abdullah Educational Hospital. As perceived by patients investigating service quality as healthcare, communication, personal caring, equipments and facilities, location and accessibility. The results from the study showed that health care service that patients received from the hospital is well empowered to provide such a quality health service. The opinion of the respondents were of that, the health care service was overpriced because of quality treatment and is performed by qualified professional with long experience, Laila Ashrajun and Mohammad Jasim Uddin (2011) have revealed that quality assurance has emerged as an internationally important aspect in the provision of health care services. The expectations of the patients have also increased day by day and they have started questioning the adequacy of patient care not only for quality of service rendered but also for the quality that is provided by the hospitals. The study found that the powerful predictors for patient satisfaction with hospital services are doctors treatment, services and behavior of nurses and ward boys. N Mekoth, G.P Babu, V.Dalvi, N Rajanala and K.Nizomadinov (2011) identified some of the critical service encounters that the outpatients undergo in a health care facility. The service encounter perceived by the patients leads to patient's satisfaction, repeat visit, and recommendation intention. The study revealed that both the physician quality and laboratory quality have been found to be significantly related to patient satisfaction. Courtesy shown by the outpatient staff, perceived length of waiting time, or even the service scope, did not influence patient satisfaction. The higher the perceived physician related quality of medical service the courtesy of hospital staff, the higher the patient

satisfaction, repeat visit intention of the patient and recommendation intention of the patient. S.M.Irfan and A.Ijaz (2011) have compared the quality of healthcare services delivered by the public and private hospitals to gain in Pakistan. The dimensions used in the study were Empathy, Responsiveness, Assurance, Tangibles and Timeliness. The Assurance among public hospitals is higher than private hospitals. The reason may be that highly qualified experts in surgery are serving in these hospitals. The empirical findings are evident that private hospitals provide quality health services to the patients. It is also evident that the hospitals whether public or private in important cities provide a reasonably quality health care services. Aldana (2001) has explained that the most powerful predictor for client satisfaction with the government services is provider behavior, especially respect and politeness. To the government, for the patients this aspect is much more important than the technical competence of the provider. There is a wide spread dissatisfaction among patients about bribe, gifts and tips culture. This has emerged as an important factor for showing a negative relationship with patient satisfaction.

CUSTOMER LOYALTY

Mahazril Aini Yaacob (2011) investigated that the service quality plays a prominent roles in the organization performance in order to maintain the customer's loyalty. Various studies have been conducted to know whether services quality offers affect the customer's satisfaction. Subhash Lonial, Dennis Menezes, Mehven Tarim, Ekrem Tatoglu and SeliniZaim (2010) in the study have used Servqual proposed by Parasuraman, Zeithaml and Berry (1985), for measuring customer perceptions of service quality across a wide variety of service environments. It was measured on a seven-point scale.

Thomas L. Baker, Steven A. Taylor (1997) provided evidence that the relationship between quality perception and satisfaction judgments in the formation of future purchase intention may be very different in health service setting relative to other service settings. The quality of care and patient satisfaction hold a competitive advantage in today's dynamic health service market. Service quality is presently considered to be the best conceptualized as a long term attitude reflecting perceptions of the relative superiority or excellence in service firm performance. Satisfaction judgments appear super ordinate to quality perceptions of marketing outcomes. This research relates to the still poorly understood relationship between quality perception and satisfaction judgments in the process of forming patient's intentions and subsequent behaviors. The results showed that not much difference for profit and not profit hospitals. The result also identified that patient satisfaction does not appear to moderate the service quality purchase intention relationship in either the for profit or not – for – profit hospitals. Hence satisfaction significantly contributed to the formation of future service purchase intentions.

Simon S. K.lam (1997) in the study has used servqual to measure the quality of service in health care services in Hongkong. Servqual has been used to examine the validity and also analyses its applicability in the Health care sector in Hongkong. The findings suggest that the expectations scores may not be contributing to the strength of the relationship between service quality and the

overall quality rating variables. The study suggested that prompt and competent service are the most important factors patients expect from hospitals, it is also suggested that physical elements are perceived to be least important and the patients are generally satisfied with the aspect of service quality. The result also highlighted areas for attention to improve healthcare service quality. Donald J. Shaemwell and Ugur Yavas (1999) revealed that most important concept in marketing are multifaceted. Practitioners and theories have taken very different approaches and models to the measurement of service quality in hospital services. Pizam and Ellis (1999) indicated that patient satisfaction and perceived quality are positively and strongly related in a health care environment. A measure of one can serve as a proxy measure of the other. The study analyzed the patient's perceptions of overall quality rather than satisfaction and its association with patient loyalty. Patient loyalty is measured in terms of both intentions to repatronise the hospital and feeling towards the hospital services. Shih-Wang Wu (March 2010) studied the service gaps in hospital between physicians and their patients. The physicians are service providers and patients are their customers usually customers expect more and are always dissatisfied. The study was conducted to identify the gap, improvise the service quality and see that customers were satisfied. The result of the study was that the physicians really care about patient's expectations, the public are more knowledgeable and hence their expectation for the service is also higher. The physicians should be rewarded for their service quality. The physicians naturally care for patients so that old patients shall be well kept and new patients shall be solicited. C Padmanaba Siva Kumar and P.T Srinivasan (2010) aimed to address both practitioners and academics to understand that service quality and behavioral outcomes of consumers are linked. The behavioral outcomes of consumers include satisfaction, repatronage intention, and positive word- of- mouth. The authors investigated what dimensions of service quality affect hospital consumer's satisfaction, their loyalty, their indulgence is positive word-of-mouth communication in a specific service industry, hospital.

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C. Boshoff and B. Gray (2004) investigated whether superior service quality and superior transaction specific customer satisfaction will enhance loyalty (as measured by purchasing intentions) among patients in the private health care industry. The research design allowed an assessment of the relative impact of individual dimensions of service quality and transaction-specific customer satisfaction on two dependent variables, namely loyalty (as measured by intentions to repurchase) and customer satisfaction, the latter measured as 'overall' or cumulative satisfaction. The results revealed that the service quality dimensions Empathy of nursing staff and Assurance impact positively on both Loyalty and Cumulative satisfaction. The service quality dimensions Empathy of nursing staff, Assurance and Tangibles impact positively on Loyalty. Patients are also more likely to return to a hospital (loyalty) if they perceive the fees is fair, reasonable and the service has good value for the money .

Stephen O corner, Richard Shew Chuk examined the patient satisfaction and intention to return. Satisfaction is concerned with the broad overall positive emotional state a patient has from his or her last hospital visit. The hypothetical model was developed to test the hypothesis surrounding the issue of service quality in the health care environment. The research results gave a clear picture of

consumer perception of service quality and the relationship of those perceptions to patient satisfaction and future intention to return.

Based on the review of previous literature from both service quality domain and health care sector, it is understood that, in the Indian scenario especially using the hospital service quality instrument, very little research has been done. Though some studies are attempted but using rigorous statistical techniques' like structural equation modeling is seldom. So this study is attempted to measure the relation between dimension of hospital service quality and customer loyalty using techniques like SEM which is taking care of both measurement and structural model.

OBJECTIVE OF THIS RESEARCH:

- Evaluating the dimension and their concerned items on construct of Service quality in health care sector
- To know the degree of impact of Hospital service quality on customer loyalty

RESEARCH HYPOTHESIS

H_1: Hospital Service Quality, as a construct, consists of distinguishable dimensions (Reliability, Responsiveness, Assurance, Empathy and Tangibility) that define its domain.

H_2: HSQ dimensions (Reliability, Responsiveness, Assurance, Empathy and Tangibility) are positively related with customer Loyalty

RESEARCH METHODOLOGY

This study used Quantitative research approach, which has embedded paradigm, has positivism, used deductive method of logic in order to test the theory which is largely based on the previous literature work. Survey research strategy is employed; Structured Questionnaire is used to collect the data from both single and multi specialty hospital in Bangalore, India. The Data was collected at the hospital which consisted of minimum 100 beds. Patients who have recently undergone treatment and who stay for minimum 1 week in hospitals treated as unit of analysis. Totally 292 filled samples are used for the data analysis. Sample units are derived with help of convenient sampling method. Each patient is interviewed by trained data collection team members, interview went on for 35 to 45 minutes.

STUDY MEASURES

Based on the previous literature from the service quality domain, health care, patient's satisfaction, the variables are identified. By and large, study used two measures at first, Service Quality (Parusuraman, Zeithmal and Berry 2000) this measure contained both expected and perceived items of 22 each, totally 44 items. Secondly, customer loyalty which is consisted 4 items which included items like recommendation, present experience, future preference and price justification All the items of the both the measures used 7 point rating scale, 1 is strongly disagree and 7 is strongly agree.

DATA ANALYSIS

To prove the above said hypothesis, collected data are tested for theoretical model (refer diagram 1), all the measures are summarized by using descriptive statistics, to test the theoretical models, structural equation modeling (SEM) is used as per the guidelines of (Brown and Kline, 2005) SEM literature.

Sample composition is described in terms of frequency distribution which is shown in the table1. Out of 292 samples, 46.5% from multi-speciality and 53.5% from single speciality hospitals, 68.84% of the hospitals are containing above 350 beds. Nearly 50.3% of treatments are surgical oriented. 59.25% of the respondents are more than 40 years, close to 69.1% are < 3 lakhs as annual income, minimum 35.62% are graduates, nearly 54% of sample consisted of the Business persons, Professionals, Government employees as their occupation.

Descriptive statistics - Measures such as service quality dimensions and Customer loyalty are summarized in the form of descriptive statistics which is shown in the table 2. All the measures showed that their standard deviation is less than one-third of the mean, skewness is close to zero and kurtosis is less than 3 which indicate all the measures distributed in normal and permissible level. It also showed the cronbach alpha of each construct, all the construct gained more than .7 which is quiet satisfactory and indicated the goodness of data.(Schumacker and Lomax, 2001) SEM tests the theoretical models using the scientific method of hypothesis testing to advance researcher understanding of the complex relationship amongst constructs. The goal of using the SEM analysis is to determine the extent to which the theoretical model is supported by the sample data. It followed 5 building blocks they are:

1. Model Specification
2. Model Identification
3. Model Estimation
4. Model Testing
5. Model Modification

Model Specification: The tentative model is given with identified indicators (refer diagram 1 through 4). The diagram contains variables: both endogenous (dependent) and exogenous variables (independent), directly observed indicators are called variables which are shown in square or rectangles boxes, unobserved variables are called latent variables which are shown in circles , double headed arrow is used for indicating covariance (in the unstandardized solution) or correlation (in the standardized solution) between or among latent variables, single headed arrow is used to indicate hypothesized directional effects one variable on the another or direct effects. All Models contains factor loadings, unique variances and factor variances. Factor loadings (λ_V) are the regression slopes for predicting the indicators from the latent factor. Unique variance (δ) is simply called error variance which is not accounted by the latent factors. Factor variance (ϕ) expressed the sample variability or dispersion of the factor in terms of unstandardized solution,

correlation in terms of standardized one. Latent variables or Factors are exogenous variables (ξ). Before testing or estimating the model, the model should be identified.

Model Identified: After specifying the model, the next thing is, model identification, it is checked whether the sample data contained in the sample variance-covariance matrix (symbolized as *S)*, and the theoretical model implied by the population variance-covariance matrix (symbolized ∑), can be matched or similar. In other words, estimation should minimize the differences between these two matrix summaries (S and ∑). In model some parameters are fixed and others are free. Assessing the ***Order Condition*** is the first step to determine identification, the formula to calculate Order condition is equal to P (P+1)/2, P is the number of variables in the sample variance-covariance matrix. To proceed to the next step of model estimation, the model should be just or over identified. Outcome has been shown in the table 5, since all the d.o.f values are > 0 all the three models are over identified. All the models are eligible to test.

Model Estimation Results: In this process of estimation, with help of modification index, some of the variables are removed from their respective dimensions due to lack of statistical support. Totally, four models are tested, measurement model1 for Hospital service Quality (HSQ) , measurement model2 for Customer loyalty, Structural model1 for HSQ on customer loyalty and last model, structural model 4 on equivalent model which is different relation of structural model 1. All the results are discussed below. Details of the results are given in the table 4 through table 6 for first 3 models, table 7 through table 10 comparing model3 with model 4.

Measurement Model1: HSQ - 5 factors model : Overall goodness of fit: Overall goodness of fit indices showed that the 5 factors measurement model 1 of HSQ, it does fit these data well: $X^2(110) = 130.99$, p=.084, SRMR= 0.037, RMSEA = .026, TLI=.982, CFI=.986, GFI=.951 [Hu and Bentler, 1999; Browne and Cuddeck, 1993]. Since p value is >.05, in MLE methods, ***accept-support*** context, where the null hypothesis is accepted, where the model is consistent with the data matrix (Kline, 2011). Hence null hypothesis is accepted in H1. So it is statistically provided that, Hospital Service Quality, as a construct, consists of distinguishable dimensions (Reliability, Responsiveness, Assurance, Empathy and Tangibility) that define its domain. However all the original variables could not maintain due to poor fit for some variables, Out of 22 variables, 17 variables are part of the construct and 5 factors are maintained. Each factor has minimum 3 items.

Measurement Model 2: Customer Loyalty - 1 factor model : Overall goodness of fit: Overall goodness of fit indices showed that the 1 factor measurement model 1 of customer loyalty (only 4 items), it does fit these data well: $X^2(2) = 5.726$, p=.084, SRMR= 023, RMSEA =. 080, TLI=.978, CFI=.993, GFI=.990

Structural Model 1 and Model 2: HSQ on Customer Loyalty : Structural model 1 showed the result as $X^2(139) = 194.441$, p=.001, SRMR= 0.045, RMSEA =.037, TLI=.964, CFI=.971, GFI=.937. To assess the robust and to avoid confirmation bias, (Kline, 2005) equivalent model is created, it is, and data may fit for a different configuration of hypothesized relations among the same observed variables for a given model. In structural model1 and structural model2 (refer diagram 4 and 5), the equivalent model, the only difference is the item C4.Price justification, relationship. In former

model, HSQ is directly related with customer loyalty, in latter, though HSQ is directly related with customer loyalty but also directly connected to item C4.Price justification, which is part of customer loyalty. The purpose is to check whether HSQ and C4.Price justification is negatively correlated even though the HSQ is positively related with customer loyalty. The comparisons of both models are given in table7 to 10. In most of the aspects structural model 2 is better than structural model1. However on selected Indices, both the models looks better. In table 8, standardized regression weight for both models are same except in model2, the relation between HSQ on price justification is showed, -0.324, which is quite accepted by the previous literature also.

Table 10 comparison of Structural model1 vs. Structural Model 2 on Squared correlation, showed that, dimensions reliability and responsiveness are having high score in both the models.

The squared correlation is ranging from .18 to .89. It explains the very moderate relationship between dimension and constructs.

Discussions

The outcome of the study showed, there is an empirical support for the given theoretical model. Compared to the previous literature, most of the things are aligning with this study for instance: The relationship between dimensions and construct is positive. The relation between HSQ and price justification item is negative. The R square or squared correlation ensured the statistical fit of the model, however some of the original items could not retain due to lack of statistical support, rather than theoretical basis, this may be considered as one of the limitation of the study. The further studies by the researcher can address all these limitations.

Table 1 - Sample composition,

Hospital	Count	Percentage	Kind of treatment	Count	Percentage
Single speciality	156	53%	Out patient	55	19%
Multi speciality	136	47%	In-patient	84	29%
Total	292	100%	Surgical Treatment	147	50%
Age - Patients	**Count**	**Percentage**	Postoperative(Follow-Up)	6	1%
Less than 40	119	41%	Total	292	100%
41-50	89	30%	**Income - Patients**	**Count**	**Percentage**
51-60	61	21%	Less than 1 lac	133	46%
Above 60	23	8%	1 to 3 lac	69	24%
Total	292	100%	3 to 5 lac	48	16%
Occupation - Patients	**Count**	**Percentage**	Above 5 lac	42	14%
Business	42	14%	Total	292	100%
Professional	42	14%	**Education - Patients**	**Count**	**Percentage**
Academician	16	5%	Under graduate	104	36%
Govt.Employee	30	10%	Graduate	111	38%
Others (Retired, House wives, Students etc)	162	55%	Post graduate	29	10%
Total	292	100%	Others	48	16%

Table 2 – Descriptive statistics of Service Quality and Customer loyalty

Descriptive Statistics and Reliability test						
	Mean	Std. Deviation	Skewness	Kurtosis	No of item in construct	cronbach alpha
Reliability	5.83	0.49	-0.07	0.23	5	0.773
Responsiveness	5.76	0.43	-0.20	0.35	4	0.687
Assurance	5.93	0.46	-0.33	1.37	4	0.727
Empathy	5.71	0.47	-0.51	1.01	5	0.777
Tangibles	5.71	0.59	-0.48	2.06	4	0.722
Customer Loyalty	5.25	0.70	0.21	-0.28	4	0.802

Diagram 1 - Theoretical Model

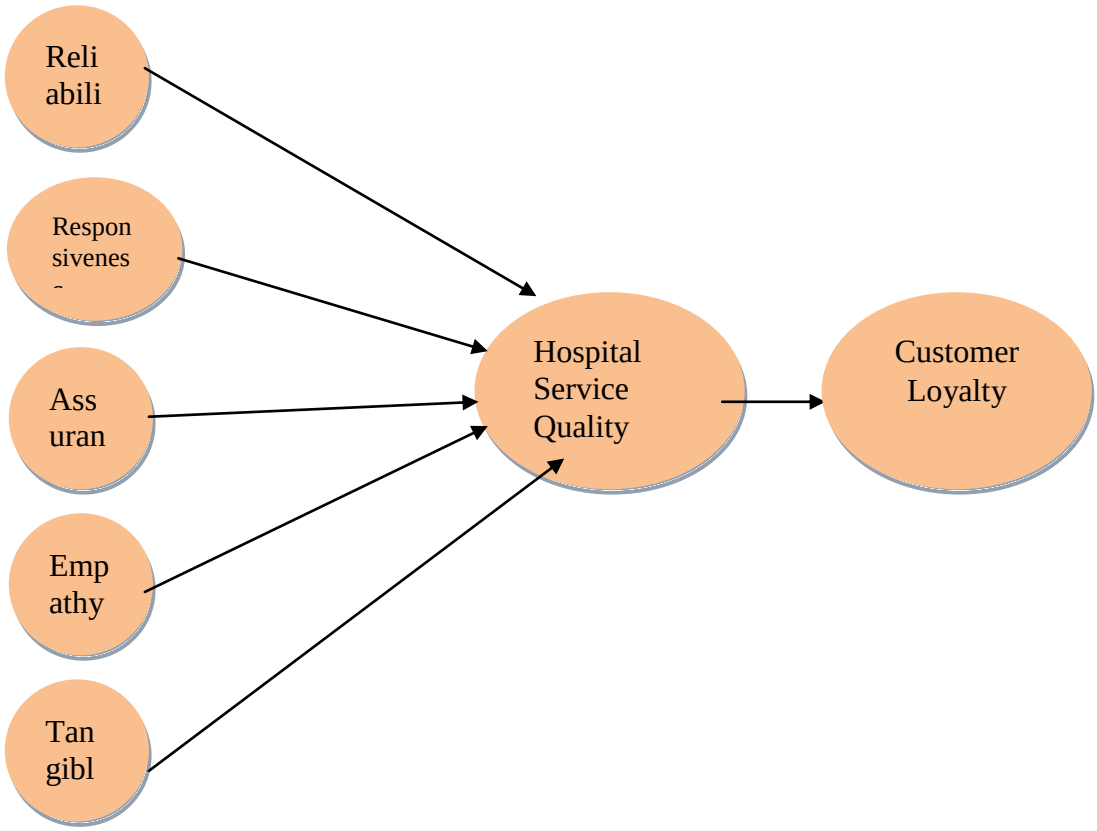


Diagram 2 - Measurement model1 for Service quality constructs

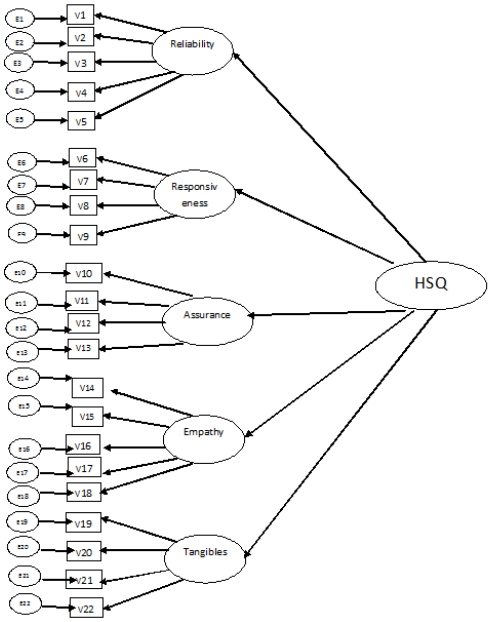


Diagram 3 - Measurement model2 for Customer Loyalty constructs

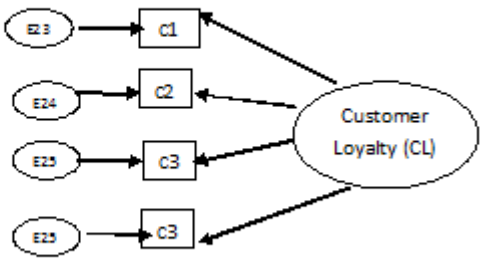


Table 4 – Variables in all the model

Measurement Model 1 - Hospital Service Quality (HSQ)		Measurement Model 2 - Customer Loyalty (CL)		Structural Model 1 - Hospital Service Quality (HSQ) --> Customer loyalty (CL)	
Variables in the Model		Variables in the Model		Variables in the Model	
Observed, endogenous variables	Unobserved, endogenous variables	Observed, endogenous variables	Unobserved, exogenous variables	Observed, endogenous variables	Unobserved, endogenous variables
p1	F1	C1	L	p1 to P3	F1 to F5
p2	F2	C2	23		
p3	F3	C3	24	p6 to P9	CL
p6	F4	C4	25		
p7	F5		26	p12 & P13	
p8	Unobserved, exogenous variables				Unobserved, exogenous variables
p9	e1 to e3			p14	e1 to e3
p10	e6 to e9			p15	e6 to e9
p12	e10 to e13			p16	e12 & e13
p13	e14 to e17			p17	e14 to e17
p14	e20 to e22			p20	e20 to e22
p15	ef1,ef2,ef3,ef4, ef5			p21	e 23 to e26, Res
p16	HSQ			p22	ef1,ef2,ef3,ef4,ef5
p17				C1	HSQ
p20				C2	
p21				C3	
p22				C4	

Table 4a – Number of Variables in all the model

Measurement Model 1 – Hospital Service Quality (HSQ)	Measurement Model 2 - Customer Loyalty (CL)	Structural Model 1 – Hospital Service Quality (HSQ) --> Customer loyalty (CL)

Number of Variables in the Model		Number of Variables in the Model		Number of Variables in the Model	
variables in model	45	variables in model	9	variables in model	51
observed variables	17	observed variables	4	observed variables	19
unobserved variables	28	unobserved variables	5	unobserved variables	32
exogenous variables	23	exogenous variables	5	exogenous variables	26
endogenous variables	22	endogenous variables	4	endogenous variables	25

Table 5 – Computation of Degrees of freedom

	Computation of degrees of freedom		
	Measurement model 1	**Measurement model 2**	**Structural model 1**
Number of distinct sample moments	153	10	190
Number of distinct parameters to be estimated	43	8	51
Degrees of freedom	**110**	**2**	**139**

Table 6 : Selected Indices of all 3 models

Selected Indices	**Measurement model 1**	**Measurement model 2**	**Structural model 1**	**Threshold value**
NPAR	43	8	51	na
CMIN	130.996	5.726	194.441	na
DF	110	2	139	na
P	0.084	0.057	0.001	>.05
CMIN/DF	1.191	2.863	1.399	< 2.0
GFI	0.951	0.990	0.937	>=.96
TLI	0.982	0.978	0.964	>=.96

CFI	0.986	0.993	0.971	>=.97
SRMR	0.037	0.023	0.045	<.09
RMSEA	0.026	0.080	0.037	<.06
Standardized Residual Covariance	< 1.96	< 1.96	< 1.96	< 1.96

Table 7 Comparison of Structural model1 vs. Structural Model 2 on selected Indices

Statistics	structural model 1	structural model 2
NPAR	51	52
CMIN	194.441	183.244
DF (190-NPAR)	139	138
P	0.001	0.006
CMIN/DF	1.399	1.328
GFI	0.937	0.939
TLI	0.964	0.97
CFI	0.971	0.976
SRMR	0.045	0.0397
RMSEA	0.037	0.034
Standardized Residual Covariance	<1.96	<1.96

Table 8 comparison of Structural model1 vs. Structural Model 2 on correlation

Standardized regression weight		
	Structural model1	**Structural model 2**
F1<---HSQ - Reliability – Hospital Service Quality	0.939	0.947
F2<---HSQ - Responsiveness – Hospital Service Quality	0.947	0.939
F5<---HSQ - Tangibility – Hospital Service Quality	0.894	0.898
F4<---HSQ - Empathy – Hospital Service Quality	0.878	0.876
F3<---HSQ - Assurance – Hospital Service Quality	0.802	0.791
CL<---HSQ - Customer Loyalty – Hospital Service Quality	**0.695**	**0.703**
p1<---F1 - item 1 – Reliability	0.747	0.754
p2<---F1 - item 2 – Reliability	0.629	0.624
p3<---F1 - item 3 – Reliability	0.638	0.636
p6<---F2 - item 6 – Responsiveness	0.592	0.593
p7<---F2 - item 7 – Responsiveness	0.432	0.435
p8<---F2 - item 8 – Responsiveness	0.54	0.54
p9<---F2 - item 9 – Responsiveness	0.56	0.556
p12<---F3 - item 12 – Assurance	0.725	0.737
p13<---F3 - item 13 – Assurance	0.524	0.515
p14<---F4 - item 14 – Empathy	0.622	0.621
p15<---F4 - item 15 – Empathy	0.658	0.657
p16<---F4 - item 16 – Empathy	0.661	0.662
p17<---F4 - item 17 – Empathy	0.613	0.612
p20<---F5 - item 20 – Tangibility	0.636	0.632
p21<---F5 - item 21 – Tangibility	0.569	0.572
C1<---CL – Recommend – Customer Loyalty	0.874	0.874
C2<---CL - Stay in hospital l – Customer Loyalty	0.81	0.808
C3<---CL- consideration of future – Customer Loyalty	0.866	0.864
C4<---CL – Price justified - Customer Loyalty	0.311	0.557
C4<---HSQ - Price justified – Hospital Service Quality	**NA**	**-0.324**

Table 9 comparison of Structural model1 vs. Structural Model 2 on Factor loadings

Factor loadings						
Standardized Regression Weights:						
	Structural model1			**Structural model 2**		
Indicators	**Estimate**	**C.R**	**P Label**	**Estimate**	**C.R (unstandardized)**	**P Label**
F1<---HSQ - Reliability – Hospital Service Quality				1		
F2<---HSQ - Responsiveness – Hospital Service Quality	0.647	8.12	***	0.626	8.1	***
F5<---HSQ - Tangibility – Hospital Service Quality	0.732	7.819	***	0.727	7.977	***
F4<---HSQ - Empathy – Hospital Service Quality	0.701	8.44	***	0.685	8.507	***
F3<---HSQ - Assurance – Hospital Service Quality	0.486	6.52	***	0.462	6.37	***
CL<---HSQ - Customer Loyalty – Hospital Service Quality	1.04	9.539	***	1.034	9.762	***
p1<---F1 - item 1 – Reliability						
p2<---F1 - item 2 – Reliability	0.764	9.803	***	0.751	9.837	***
p3<---F1 - item 3 – Reliability	0.797	9.934	***	0.788	10.031	***
p6<---F2 - item 6 – Responsiveness	1.115	7.355	***	1.124	7.286	***
p7<---F2 - item 7 – Responsiveness	0.695	5.457	***	0.704	5.44	***
p8<---F2 - item 8 – Responsiveness	0.974	7.987	***	0.98	7.927	***
p9<---F2 - item 9 – Responsiveness	1			1		
p12<---F3 - item 12 – Assurance	1.414	6.661	***	1.464	6.521	***

Factor loadings						
Standardized Regression Weights:						
	Structural model1			**Structural model 2**		
Indicators	**Estimate**	**C.R**	**P Label**	**Estimate**	**C.R (unstandardized)**	**P Label**
p13<---F3 - item 13 – Assurance	1			1		
p14<---F4 - item 14 – Empathy	1.012	8.281	***	1.015	8.257	***
p15<---F4 - item 15 – Empathy	1.09	8.425	***	1.093	8.398	***
p16<---F4 - item 16 – Empathy	1.118	8.455	***	1.126	8.454	***
p17<---F4 - item 17 – Empathy	1			1		
p20<---F5 - item 20 – Tangibility	1.213	7.422	***	1.2	7.477	***
p21<---F5 - item 21 – Tangibility	1			1		
C1<---CL – Recommend – Customer Loyalty	1					
C2<---CL - Stay in hospital l – Customer Loyalty	1.05	16.73	***	1.047	16.743	***
C3<---CL- consideration of future – Customer Loyalty	0.98	18.25	***	0.978	18.372	***
C4<---CL – Price justified - Customer Loyalty	0.332	5.189	***	0.594	5.793	***
C4<---HSQ - Price justified – Hospital Service Quality	na	na		-0.509	-3.289	0.001

*** <.0001

Table 10 comparison of Structural model1 vs. Structural Model 2 on Squared correlation

Squared Multiple correlation				
	Structural model1		**Structural model 2**	
Indicators	**Squared multiple correlation**	**Error variance**	**Squared multiple correlation**	**Error variance**
CL. Customer Loyalty	0.483	0.517	0.494	0.506
F5.Tangibility	0.8	0.2	0.807	0.193
F4.Empathy	0.77	0.23	0.767	0.233
F3.Assurance	0.643	0.357	0.626	0.374

F2.Responsiveness	0.897	0.103	0.881	0.119
F1.Reliability	0.882	0.118	0.897	0.103
C4.Price justification	0.097	0.903	0.162	0.838
C3.consideration of future	0.75	0.25	0.747	0.253
C2.Stay in hospital	0.657	0.343	0.653	0.347
C1.Recommend	0.764	0.236	0.765	0.235
p1.When the hospital commits to do something by a certain time, it does so	0.559	0.441	0.568	0.432
p2. When a patient have a problem. The Hospital will show sincere interest in treating it.	0.396	0.604	0.389	0.611
p3. The Hospital should perform the service right the first time.	0.407	0.593	0.405	0.595
p6. The Hospital keeps the patient informed about when the services will be performed.	0.35	0.65	0.351	0.649
p7. Employees in the Hospital should give prompt service(General treatment Pre-operative, postoperative	0.187	0.813	0.189	0.811
p8. Service Employee in the Hospital ,Will be always willing to help you	0.292	0.708	0.292	0.708
p9. Service Employee in the Hospital Will never be too busy to respond to your request.	0.313	0.687	0.309	0.691
p12. The employees in the Hospital should be courteous with you.	0.525	0.475	0.543	0.457
p13. The employees in the Hospital should have the knowledge to answer your Question.	0.275	0.725	0.265	0.735
p14. The Hospital gives you individual attention.	0.387	0.613	0.386	0.614
p15. The Hospital has employees who give you personal attention.	0.433	0.567	0.431	0.569
p16. The Hospital has best interest of the patient.	0.437	0.563	0.439	0.561
p17. Employees of the Hospital should understand the specific needs of the patient.	0.376	0.624	0.374	0.626
p20 .The Hospital's physical facilities (canteen, Lab facilities, Equipments, etc) should be visually clean & neat.	0.404	0.596	0.4	0.6
p21. The Hospital's employees (Doctors, Nurses, paramedical) should appear neat.	0.324	0.676	0.328	0.672

Diagram 4 – Structural model1 - Relation between Service quality constructs & Customer Loyalty

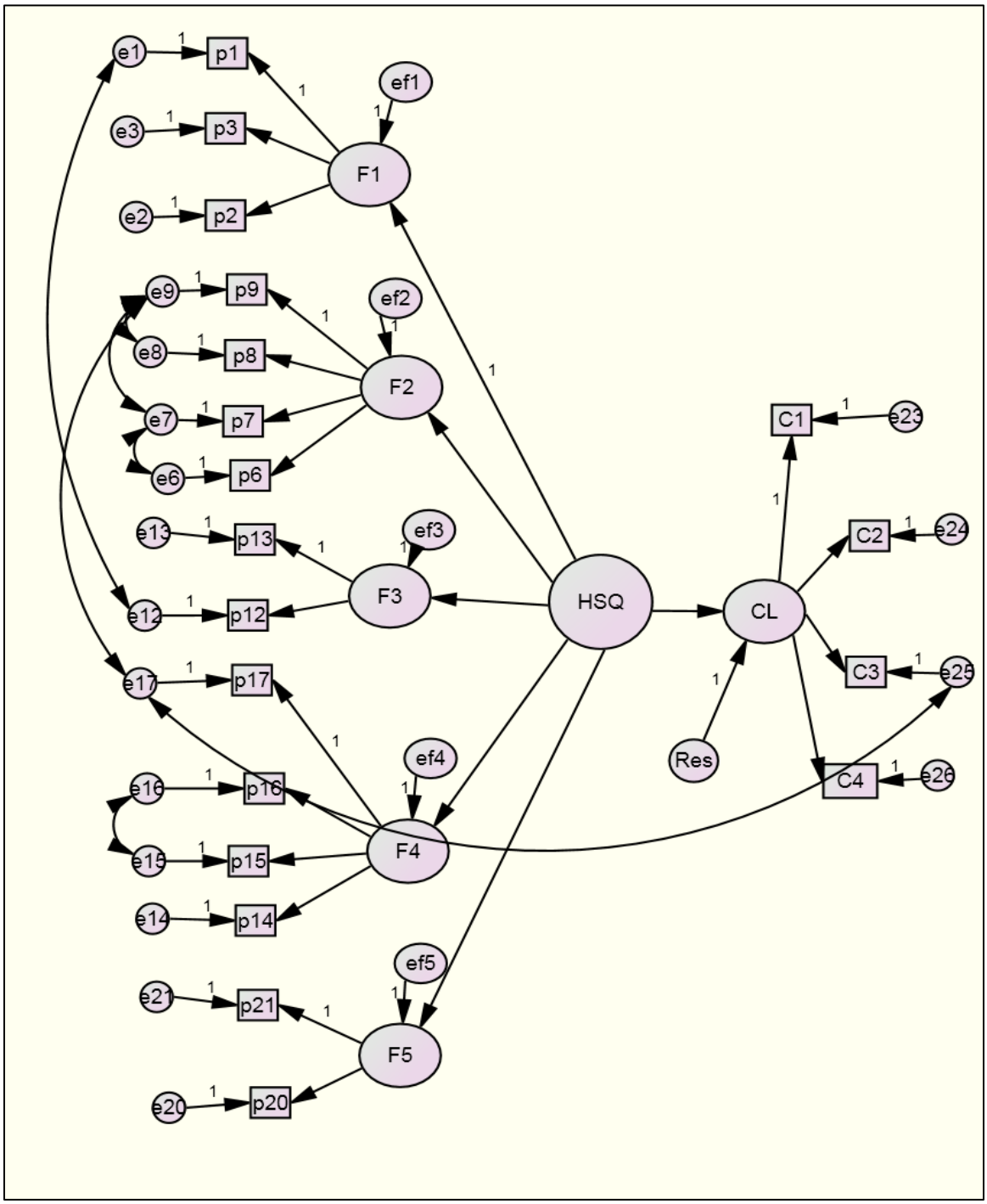
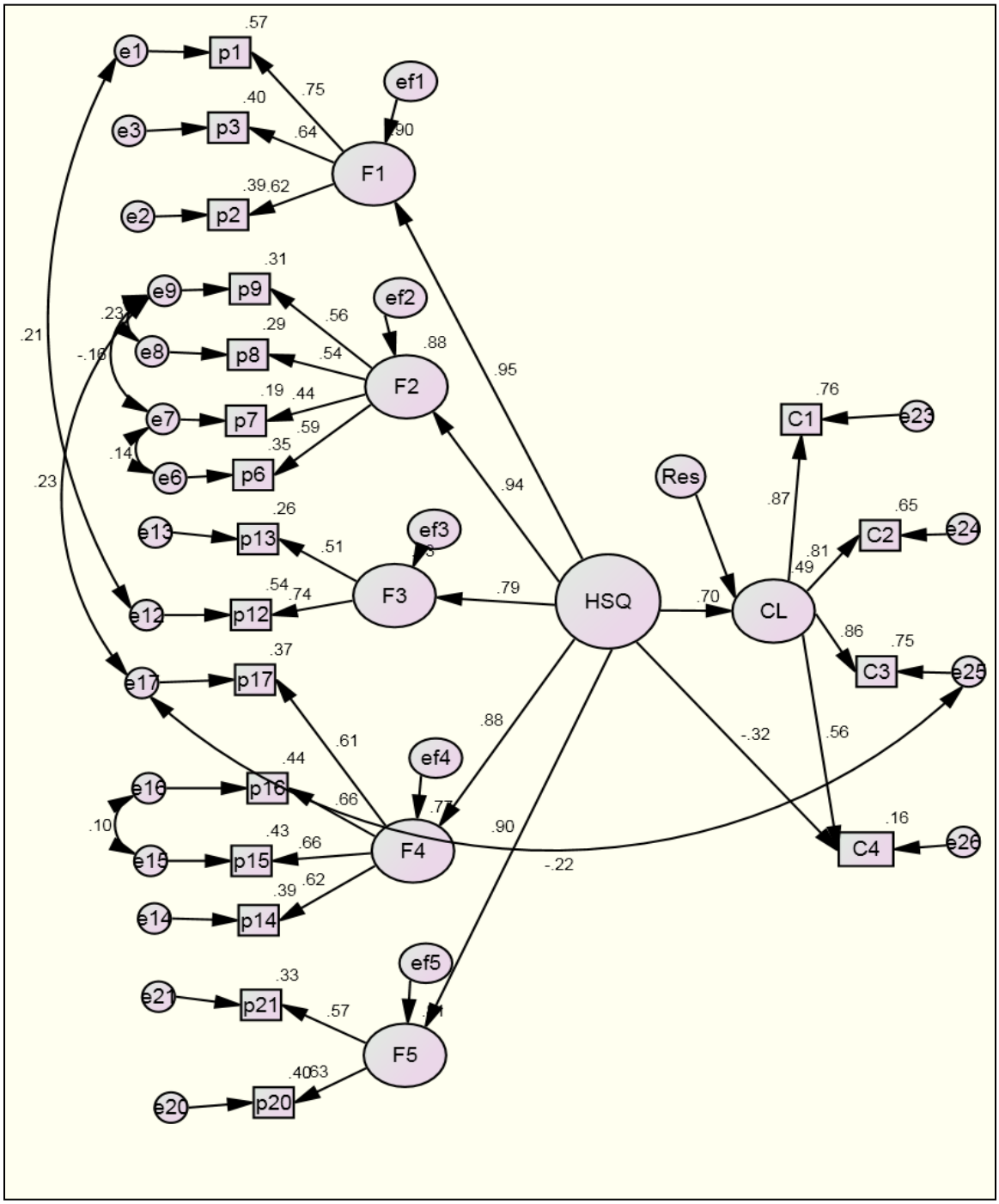


Diagram 5 – Structural model2 - (Equivalent Model) Relation between HSQ on Customer Loyalty



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Promotional Strategies Of Apparels In Selected Retail Stores: A Study On Private Labels

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INTRODUCTION

Private labels have stormed the Apparel market in the recent years. Giant Retail brands such as Future Group, Reliance, Shopper's Stop and West Side, Spencers, Life Style etc., have revolutionized and monopolized the functioning of stores today. The Indian scenario has drastically changed for the better. Higher educational levels (especially among women), double incomes(as more women are working), rise in nuclear families, increased disposable incomes and consumption pattern, changes in consumer needs, attitudes and behavior, and easy availability of credit(through Credit Cards) are the key growth drivers for the emerging apparel retailing in India.
In the process of evolving a product and service mix, there is a dire need for the retailers to focus their efforts on the promotional strategies effectively, so that the product is not a failure. Effective promotional and innovative strategies are the key to success in any organisation and will enable the private labels to lure the customers effectively. This necessitates the application of promotional tools more diligently so that retailers would enhance their market share and profitability in the long run.

REVIEW OF LITERATURE

A private label can be defined as a brand name owned by a retailer or wholesaler for a line or a variety of items under controlled or exclusive distribution (Euromonitor, 1998). A private label is characterized by being a product produced, improved, processed, packed or distributed exclusively by the organization that has the brand control (A C Nielson, 2002). It can carry the company's name or use other brands not associated to the company's name. Still, due to these characteristics and their appeals, the market for private label has grown in the last few years (AC Nielsen, 2004). Retailers private labels, are often also referred to as own labels, store brands, or distributor-owned brands (Nirmalya Kumar & Jan-Benedict E.M.Steenkamp, 2007).

Lee and Kim (2008) conducted study on Mexican students to conclude the purchase affecting intention of Mexican students while choosing apparels towards a US apparel brand and concluded that interpersonal influence, brand awareness, apparent quality, and arousing value affect purchasing intentions. Using structural equation modeling (SEM), the study finds that Mexican college students' interpersonal influence optimistically affected brand awareness. Brand awareness is optimistically related to emotional value, but perceived quality of a US brand. Emotional value optimistically influences purchase intention toward a US brand, while perceived quality negatively influences purchase intention.

AlkisThrassou (2009) in his study on consumer behavior towards internet tried to focal point on the motivators basic internet shopping behavior are also related and include speed, convenience, and information. Important factors affect internet purchase are found to consist of mainly product variety, quality, and price.

Kotta Thomas (1992) in his study examined the collision of extrinsic factors like price, reputation and advertising using multi-item assess. The result indicate that these affect consumer price, quality perception and purchase intention.

Doyle (2002) focused on role of product assortment, product quality, product performance and capability of product to carry out its function as significant factors in product buying.

Lang & Crown (1993)opined that many aspects, such as price, aesthetics and quality are key considerations when buying decisions for clothing items are made. Criteria that have been found to persuade the evaluation and buying decision of apparel include price, care requirements, brand, product style, color, store image, and advertising image. These authors have classified intrinsic or extrinsic. Intrinsic cues are product attributes that cannot be changed or manipulated. Product attributes that are not component parts of the physical product but that are applied by the manufacturer or retailer are extrinsic cues.

According to Eckman et al (1990), found price and brand are the attributes most recurrently used by consumers in assessing apparel. When all the studies cited are measured as a whole, intrinsic characteristics appear to be more important to consumers than extrinsic characteristics.

Beaudoin et al (2000) identified 12 attributes that associated with attitudes when purchasing apparel, namely: good fit, durability, ease of care, favorable price, comfort, quality, color, attractiveness, fashionableness, brand name, appropriateness for occasion, and choice of styles.

Dickerson (in Beaudoin et al,2000) investigated the relative substance that consumers put together to five garment attributes while making purchasing decisions, namely: price, care, country of origin, quality, and style.

UshaChowdhary (1989) conducted survey on older consumers(above 65 yrs, and above) apparel shopping behavior and their satisfaction level on shopping malls. Analysis showed that most of the older people consider price, quality, brand, window advertising, shopping ease, product assortment while they purchase apparels.

Surendra Rajiv, Shanthanu Dutta, Sanjay. K. Dhar (2002) suggests that promotional advertising is determined by "offensive" (traffic-building) as well as "defensive" (consumer-retention) considerations by the service positioning of the stores. exclusively, relative to the low-service store, promotional advertising by the high-service store is determined more by offensive reflection than

defensive consideration. a store's service positioning impacts its regularity of promotional advertising and the discount that it offers during "sale." Specifically, relative to the low-service store, the high-service store offers advertised sales supplementary discounts. Specifically, the consumer-mix of the high-service store comprises a higher valuation of the consumers who are less responsive to promotional advertising suitable to their higher store switching.

J. Van De Velde, W, Pelton, S. Turnbull Caton, M. Byrne (2003) focused on an outcome of the values issue, namely store selection criteria and clothing evaluative criteria used by university students in Winnipeg, Canada and Newcastle upon Tyne, U.K.

Du Preez, R. Visser, E. M. (2003) researched on female apparel consumer market segments on the basis of differentiating lifestyles, shopping orientation, cultural consciousness, store patronage and demographics.

Kaur, Tripat, Gupta, S.L.(2006) examined the best practices followed by various retailers in India in an active segment of apparel; in apparel retailing it has been pragmatic that chain stores are becoming a powerful force, withdrawing the role of wholesalers. Researcher has included complete outfits in formals, ethnic, semi-formals and denim with respect to male, female and children.

Rothschild and Gaidas (1981) concluded in their study that customer satisfaction with a promoted brand leads to repeat purchasing even after the promotion has been withdrawn. Their merchandising policies and marketing programs are intended specifically with the target consumer in mind.

Lewison (1997), explained that customary difference between the three store types is the target consumer and product positioning for that targeted consumer. Department stores usually appeal to middle and upper income consumers and offer brand name and designer label merchandise at multiple price points. Equivalent to the department store, specialty stores appeal to those in the middle to upper income groups. Specialty retailers furnish to a more narrowly segmented consumer and bring just clothing and accessories specifically geared for this well defined target consumer. Specialty store assortments have price points in the better and bridge points, which are in the upper-middle to highest price ranges. In distinction, discount stores target the economic-minded consumer and use mass merchandising techniques to offer national or manufacturers' brand and private label merchandise at prices below traditional department store prices (Lewison). Merchandise is positioned at budget and moderate price points. Furthermore,different store types have traditionally had different place strategies.

Martineau (1969) showed in his article that one of the decisions facing the consumer is where to shop. Most advertisers declare price cuts and huge savings to the shopper as if these were the only considerations in a buying decision. Martineau studied the influence of the social class in the choice of retail outlet; and he opines that every one of us in his consumption patterns and style of

life shows an consciousness that there is some kind of a superiority-inferiority system in use which we must observe the figurative patterns of our own class. Environmental psychologists discuss patronage in terms of approach-avoidance behaviors. According to Mehrabian and Russell , approach behavior is described as a willingness or desire to stay, explore, work, or affiliate. In contrast, avoidance behaviors are represented by opposite behaviors, a desire not to stay, explore, work, and affiliate. Donovan and Rossiter used the approach-avoidance concept by Mehrabian and Russell to study graduate students in retail settings. The study found that approach behaviors (i.e., shopping enjoyment, returning, attraction and sociability toward others, spending money, time spent browsing, exploration of the store) influenced perceptions or responses to the environment.

Kumar and Leone (1988) and Walters (1991) find a major impact of promotions on store switching/traffic. However, it is improbable that consumers would keep track of weekly promotions on a huge number of categories in all the stores in their neighborhood.

Bucklin and Lattin (1992) explained that retail promotions in any one category do not directly influence a consumer's store choice decision, but they indirectly influence where the category is purchased. Consumers normally shop in more than one store. They may purchase a promoted product in the store they come to pass to be visiting whereas they would otherwise have purchased it in another store. These also repeat the important moderating effect of in-store atmosphere. The impact of promotions will be higher in a pleasant atmosphere because the longer consumers stay in a store, the more likely they are to notice promotions and buy more than planned during the shopping trip. Consumers are more likely to develop a positive price image when retailers offer recurrent discounts on a large number of products than when they offer less common, but steeper discounts. Further, products that have high unit price and are purchased more frequently are more salient in determining the retailer's price image. One pricing plan does not dominate another, but large silo shoppers prefer EDLP stores while small basket shoppers prefer HILO, and it is best for HILO stores to charge an average price that is higher than the EDLP in conclusion, price promotions are associated with store switching but the effect is indirect, shifting consumers' category purchase decisions while they are in the store rather than shifting their choice of which store to visit.

Inman, Shankar, and Ferraro (2004) analysed that assured types of product categories have "signature" relations with specific channels, e.g., supermarkets with food, drug channel with medications and health products, and mass merchandisers with household items.

(Farquhar and Herr 1993) research has revealed that a brand that is seen as exemplary of a product category can be hard to extend outside the category Therefore, if a retailer has strong signature relations with positive categories, consumers may find it complicated to think of the retailer in association with other, very different categories.

Ahluwalia and Gurhan-Canli (2000) ,Gurhan-Canli and Maheswaran (1998) , Keller and Aaker (1992) found that if the retailer attempts to sell a new line of products or offer a new service that fails to bond with consumers, there may be little long-term impairment as long as the new line is not too strongly associated to the retailer's signature categories or its own brand name. Research on brand equity intensity has found that parent brands usually are not particularly susceptible to failed brand extensions: An ineffective brand extension potentially damages a parent brand only when there is a high degree of comparison or "fit" involved.

Tamara F.Manglaburs ,Patricia M.Doney,Terry Bristol (2004) examines the observable fact of teenagers' shopping with friends, and ,in particular, whether shopping with friends might enhance teens' attitudes towards retailing and their propensity to spend more when shopping with friends.

ElsGijsbrechts et al (2003) concentrates on a number of store flyers and location uniqueness that may affect a flyer's efficacy in enhancing store performance. In analyzing the impact of retailer's store flyer composition, he takes three strategic marketing options of the store i.e., its basic price strategy, assortment and service level. Within the boundaries of these options, he analyses whether and how changes in the store flyer's work affect its tendency to draw customers to the store. he finds depend on the store flyer's aptitude to attract the customers' awareness and, once noticed, the amount to which it provides an incentive to visit the store and /or alter in-store buying behavior.

David M. Hardesty, William O.Bearden (2003), emphasized the effects of promotion type and price presentation from corner to corner promotional levels. The proposition of these results for retailers and manufacturers were that percentage price presentation s should be used when large discounts were being offered. It also stated that bonus packs are a feasible substitute to price discounts when promotion levels are small or reasonable since they have less of a harmful effect on brand.

Ananth Raman, Nicole DehoratiusZeynepton (2001),found that in contrast to the economic shopper, the recreational woman shopper spends more time shopping even after making purchases, and tended to buy something she likes over and above urgency or need, and spends less time deliberating before purchases. also, the recreational shopper engages in more information seeking than the economic shopper does. When choosing a store, she considers the quality of merchandise, variety of merchandise, and décor of malls rather than shopping centers and downtown areas.

RESEARCH OBJECTIVES:

The primary objective of this study is to examine the factors driving the customers towards private labels. In addition to this the study also examines the awarenss and preference of customers towards private labels.

RESEARCH METHODOLOGY:

The research design for the study is descriptive in nature. The methodology is based on primary and secondary data a structured questionnaire was used for the study, of which pre testing of the questionnaire was administered on 30 people. 300 questionnaires were administered out of which 200 usable questionnaires were considered for the study. The questionnaire comprised of a series of closed ended questions and a few open ended questions, a likert scale (1-5) was also used to elicit information from the customer.

The paper mainly discusses the promotional strategies adopted by the apparel retail outlets to promote private labels. The first part of the paper discusses the factors contributing to the purchase behavior of customers in adopting private labels. The next part of the paper highlights the promotional strategies used by the apparel retail outlets in promoting the private labels. To extract the factors contributing to the promotion of private labels, Exploratory Factor Analysis (EFA) technique is used with the help of spss 19 version. Factors are extracted based on KMO and Bartlett's Test, Total Variance Explained, Scree Plot, Factor Loadings, 2D graphs, Bivariate Correleation etc., are used in the study.

RESULTS AND DISCUSSION

From table 1, it can be inferred that Kaiser-Myeyer-Olkin (KMO) measure of sampling adequacy is 0.670, which means the common variance, attributed to the underlying factors is medicore (>0.6). And the Bartlett's test of sphericity tests the hypothesis whether the population correlation matrix is an identity matrix. The existence of the identity matrix puts the correctness of the factor analysis under suspicion. From table 1, it can inferred that chi square statistic is 610.886 with 153 degrees of freedom. This value is significant at 0.01 level. Both the results, that is the KMO statistic and Bartlett's test of sphericity, indicate an appropriate factor analysis model.

Based on the eigenvalue approach, only six factors have eigenvalues more than 1 (Table-2) . The cumulative percentage of variance for the six factors is 57 % (approx. 60%), which is well justified within the limits of factor analysis of the consumers' purchase behavior on clothes. The scree plot for the clothes purchase of customers is also indicating more than two factors on the steep slope should be retained. However a number of factors to be retained in the factor analysis is a highly subjective matter.

Scree method is a randomization method proposed by Montanelli and Humphreys (1976) for determining the appropriate number of factors. This method involves an exploratory factor analysis performed on random uncorreleated data, with the same number of respondents and the same number of items as the real data. There can be no common variation in random data, so the scree plot for this analysis is indicative of zero factors. By comparing the scree plot for the real data with the scree plot for the random data, the number of significant eigenvalues in the real data can be determined. The number of eigenvalues that exceed the corresponding random eigen values suggest the number of factors required. (Graph-1)

Today's Indian Apparel market is highly scattered with various private labels i.e. brands of their own company. Normally while in the process of apparel shopping (clothes) customers purchase behavior encompassed with various factors in gauging the performance of private labels. Thirteen such type of statements is included in the study to measure the customers purchase behavior. Purchase of private labels is always associated with perceived risk and this is especially true with apparels. So the customers are preparing themselves to take calculated risk on this type of purchase decisions. All these statements are measured in 5 point Likert scale. By applying varimax rotation, factor matrix and factor loading are extracted and presented in the table 3 & table 4.

Variables are grouped into factors by selecting variables with a factor coefficient>0.5 and such type of factors are presented in the table 4 and finally it is observed that four factors are evolved. The four factors are named as F1 – Advertisement in Print Media, F2 – New Fashions, F3-In Store Promotional Strategies, F4-Window Shopping etc., (presented in table-4)

During the process of extraction of factors spss will produce a 3D graph and for the purpose of better presentation of results 3D graph converted into a 2D graph by excluding z-axis. From the 2D graph it can be clear that all the variables are presented in the extreme right hand side of the graph. (2D Graph-2)

BIVARIATE CORRELEATION BETWEEN THE FACTORS

Based on the factor analysis it is observed four factors have significant impact on the purchase behavior of customers on private lables viz., Advertisement in Print Media, New Fashions, Instore Promotional Strategies and Window Shopping factors in the appareal market had a major impact on private lables promotion. Further to identify the intra correleation between the factors bivariate correleation is executed and results are presented in the following table 5. The correleation between the factors must be <0.3, for accepting their relationship. From table 5, it is observed that a strong intra correleation was presented between the factors at 1% and 5% significantlevels. From table 5 it can be observed that intra correleation between the factors is less than 0.3 (in all the factors). Based on the bivariatecorreleation matrix it can be inferred that these four factors are vital in promoting private lables for the apparel stores.

Based on the study it can be concluded that apparel stores are assigning more weightage towards promotion of private lables at the cost of quality.

PROMOTIONAL STRATEGIES OF APPERAL STORES

Apparal stores in India are primarily using print media, electronic media and internet, transit advertisements, television ads, hordings as the main channels for promoting their private labels. From table 6 it is evident that big bazar had a highest percentage of share in using all modes of promotional channels for prmoting private labels and the next position is occupied by spencers, shoppers stop, except in the case of internet where life style and westside are highly dependent on

this media of promotion, it may be due to the price tag of private labels which are premium prices than compared to Big Bazar and Spencers, Shoppers Stop. In case of Hoardings almost all the stores have equal concentration on this media of promotion due to economical viable option for promoting private labels for more number of days. Big Bazar is heavly dependent on print media than compared to its competitors, due to its mass presence.

In addition to this, all the selected apparel stores are commonly using in store promotional channels like window shopping as the main strategy for promoting private labels, but for the question brand ambassador influence on the purchase behavior of customers, majority of them opined that it may not influence their purchase behavior, in case of private labels only price, variety, colours will influence not the brand ambassadors.

CONCULSION

According to the Indian Council for Research on International Economic Reforms (ICIER), India is the seventh largest market in the world and is expected to grow between 15 to 20% at the end of 2012 and the apparel and textile segment accounts for 38.1% of the organized retail segment. The apparels segment contribution to India GDP is $ 1370 Billion. The Indian apparel industry consists of groups in men's wear, women's wear & children's wear in the formal, casual, ethnic and sports segments. Private labels are store own brands establish by retailers like Shoppers stop, Westside, Big Bazaar, Life Style, Spencer's. They offer low prices, provide a wide range of product assortments all under one roof. A poignant feature of these stores are attractive displays, spread over sprawling spaces at vantage locations across metros and cities.

In the apparel market, private labels are emerging as a new branch of choice to customers by giving cut throat competition to branded companies in terms of variety and price, but over a period of time it is a proven fact that at the cost of quality the selected apparel stores in the market are extending variety and price to the customers. Suppose the private labels promoted by these stores emerges as highly successful brand in the market, the apparel stores put those brands in the main line of business like Big Bazar promoting their private label 'FBB' (Fashion at Big Bazar) by opening separate stores, then these brands may not have an added advantage as private labels. It is the main risk involved in the promotion of private labels for the apparel stores. The life span of private labels usually are very small as a result it involves continuous promotion throughout the year. Once the brand enters into the main line of business, maintainence of variety, colour, price, quality are key parameters for success. Keeping these issues into consideration apparel stores should design their private labels, otherwise trading with private labels is always a risky venture to these apparel stores.

The study reveals that majority of the apparel stores are using all types of promotional strategies to promote their private labels in the market. The study concludes that Big Bazar is one store heavily dependent on print media as the basis for promotion of private labels,where as the rest of the players are concentrating more on television advertisements, hoardiangs, transit ads, internet etc.,

With reference to the usage of hoardings as a promotional strategy all the apparel stores are using it as a main line of promotional strategy, to attract large number of customers.

Finally, it can be concluded that the success of private labels always depends on the variety, price, colour and appropriate mix of promotional startegies will decides the fate of private labels in the market.

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Tables and Graphs in the Artcile

Table-1
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.670
Bartlett's Test of Sphericity	Approx. Chi-Square	610.886
	Df	153
	Sig.	.000

Table-2

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.875	15.971	15.971	2.875	15.971	15.971	1.922	10.678	10.678
2	2.251	12.505	28.476	2.251	12.505	28.476	1.827	10.151	20.829
3	1.472	8.176	36.652	1.472	8.176	36.652	1.817	10.094	30.923
4	1.401	7.784	44.436	1.401	7.784	44.436	1.635	9.083	40.006

5	1.267	7.036	51.472	1.267	7.036	51.472	1.631	9.063	49.069
6	1.070	5.942	57.414	1.070	5.942	57.414	1.502	8.346	57.414
7	.915	5.081	62.496						
8	.870	4.832	67.328						
9	.784	4.356	71.684						
10	.722	4.010	75.694						
11	.710	3.946	79.639						
12	.674	3.747	83.386						
13	.594	3.299	86.685						
14	.571	3.171	89.856						
15	.531	2.948	92.804						
16	.490	2.723	95.527						
17	.430	2.391	97.919						
18	.375	2.081	100.000						
Extraction Method: Principal Component Analysis.									

Graph-1

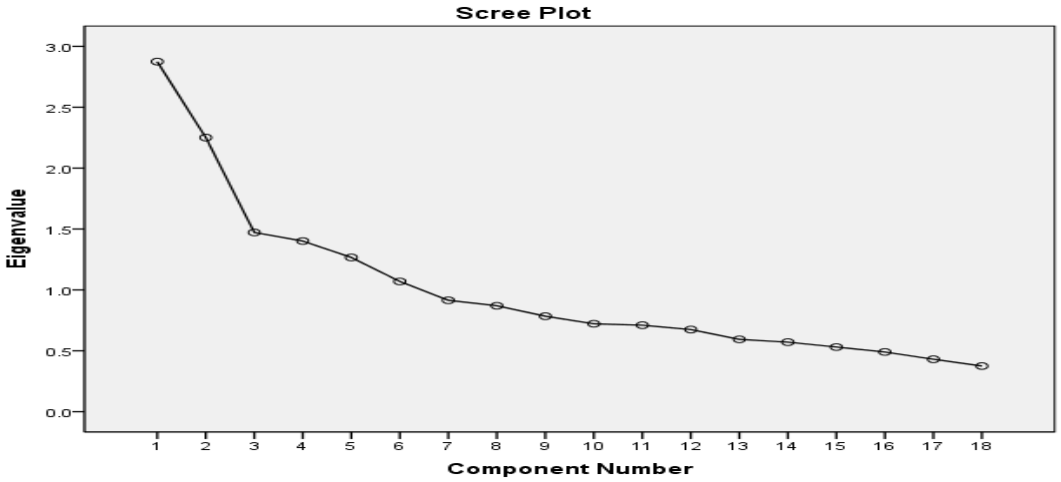

Table-3

Loading of selected variables on Key Factors

(Loading Criteria >0.5)

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
p1						
p2						
p3						
p4	.592					
p5						
p6			.765			
p7			.746			
p8						
p9						.806
p10		.812				
p11					.499	
p12					.768	
p13				.707		
V26				.616		
V27						
V28						
V29						
V30	.717					

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 18 iterations.

Table-4

Grouping of Factor Loading for Identifying Key Factors

Attributes	F1 (Advertisements in Print Media)	F2 (New Fashions)	F3 (In store Promotional Strategies)	F4 (Window Shopping)
P4	0.592			
V30	0.717			
P6		0.765		
P7		0.746		
P13			0.707	
V26			0.616	
P11				0.499
P12				0.768
Loading Range	0.592-0.717	0.765-0.746	0.616-0.707	0.499-0.768
No of Items	2	2	2	2
Cronbachs Alpha	0.421	0.577	0.247	0.422

2D Graph-2

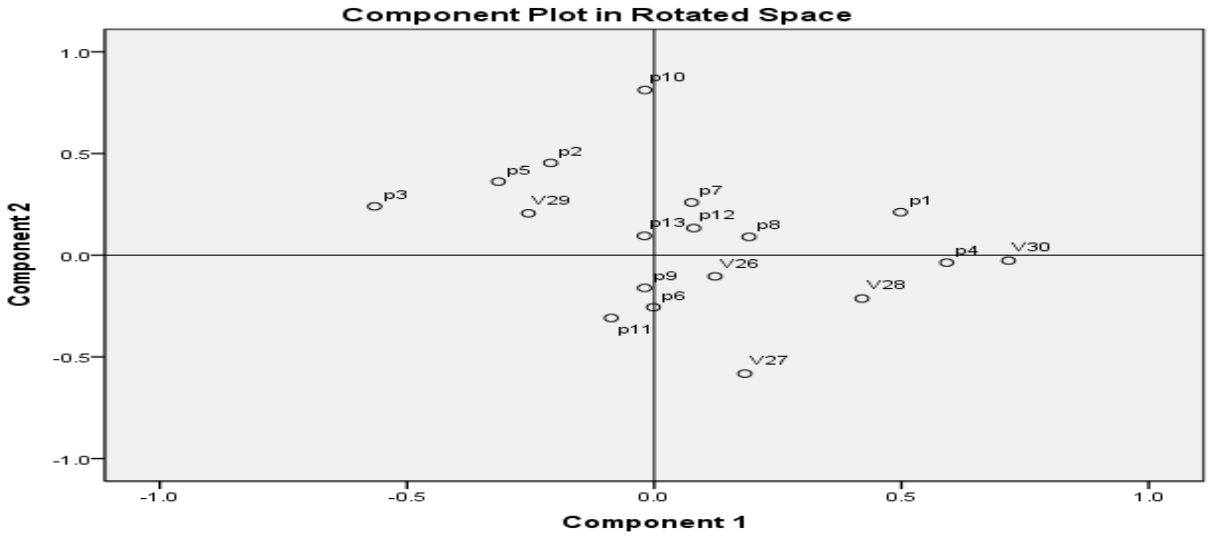

Table-5

Bivariate Correlations between F1 TO F4

		F1	F2	F3	F4
F1	Pearson Correlation	1	.080	.094	.195**
	Sig. (2-tailed)		.240	.167	.004
	Sum of Squares and Cross-products	973.382	66.527	77.382	150.127
	Covariance	4.445	.304	.353	.686
	N	220	220	220	220
F2	Pearson Correlation	.080	1	.145*	.247**
	Sig. (2-tailed)	.240		.032	.000
	Sum of Squares and Cross-products	66.527	719.359	103.027	163.259
	Covariance	.304	3.285	.470	.745
	N	220	220	220	220
F3	Pearson Correlation	.094	.145*	1	.155*
	Sig. (2-tailed)	.167	.032		.021
	Sum of Squares and Cross-products	77.382	103.027	702.382	101.627
	Covariance	.353	.470	3.207	.464
	N	220	220	220	220
F4	Pearson Correlation	.195**	.247**	.155*	1
	Sig. (2-tailed)	.004	.000	.021	
	Sum of Squares and Cross-products	150.127	163.259	101.627	608.959
	Covariance	.686	.745	.464	2.781
	N	220	220	220	220

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

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

Relaibility Scale Statistics

Factor -1

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.421	.428	2

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.11	4.445	2.108	2

ANOVA with Cochran's Test

		Sum of Squares	df	Mean Square	Cochran's Q	Sig
Between People		486.691	219	2.222		
Within People	Between Items	18.409	1	18.409	13.500	.000
	Residual	281.591	219	1.286		
	Total	300.000	220	1.364		
Total		786.691	439	1.792		

Grand Mean = 3.05

Factor-2

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.577	.578	2

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.19	3.285	1.812	2

ANOVA with Cochran's Test

		Sum of Squares	df	Mean Square	Cochran's Q	Sig
Between People		359.680	219	1.642		
Within People	Between Items	3.457	1	3.457	4.891	.027
	Residual	152.043	219	.694		
	Total	155.500	220	.707		
Total		515.180	439	1.174		

Grand Mean = 3.09

Factor-3

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.247	.251	2

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
4.61	3.207	1.791	2

ANOVA with Cochran's Test

	Sum of Squares	df	Mean Square	Cochran's Q	Sig

Between People		351.191	219	1.604		
Within People	Between Items	5.682	1	5.682	4.630	.031
	Residual	264.318	219	1.207		
	Total	270.000	220	1.227		
Total		621.191	439	1.415		

Grand Mean = 2.30

Factor-4

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.422	.423	2

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
5.29	2.781	1.668	2

ANOVA with Cochran's Test

		Sum of Squares	df	Mean Square	Cochran's Q	Sig
Between People		304.480	219	1.390		
Within People	Between Items	.511	1	.511	.637	.425
	Residual	175.989	219	.804		
	Total	176.500	220	.802		
Total		480.980	439	1.096		

Grand Mean = 2.64

Table-6

Promotional Channels Used by the Apperal Stores (in percentages)

	BB	S	SS	LS	W
TELEVISI	38.4	20.8	15.6	14.4	10.8
PRINT	36.61202	20.76503	12.56831	10.92896	19.12568
TRANSIT	26.08696	21.01449	13.04348	21.01449	18.84058
HOARDIN	21.69312	18.51852	19.57672	20.10582	20.10582
INTERNET	14.67391	15.76087	20.1087	25	24.45652

Driving Customer Experience Management through Business Analytics

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INTRODUCTION

Customer Experience Management (CEM) involves designing, delivering and continuously improving the manner and ease with which customers interact with various aspects of business across multiple channels in order to achieve their desired outcomes and critically establish a customer connect with business / brand / product / service. However to many, CEM is the next generation of the same practice of buying technology and creating process around Customer Relationship Management (CRM). But they could not be more mistaken. CRM, for starters, is internally focused e.g. How do we as a company collect and leverage customer information to our benefit? CRM provides great insight into customer behavior, marketing effectiveness, buyer demographics and so on, allowing the company to better tailor its products, services and go-to-market strategies. By contrast, CEM is externally focused. With CEM technology and processes the company takes the customers' perspective of its products, services, people, partners and so on. CEM in the online world is focused on how customers choose to interact with the company and were they successfully served.

Previously referred to in whispers in C-level corner offices back in mid 2000-s, Customer Experience Management (CEM) is now a crucial topic of conversation amongst C-suite executives. Especially given the global economic climate of the recent past, companies are enduring increased competition for business and increasingly looking for ways to drive customer satisfaction and loyalty. The fact is, it is tough out there and customer experience management can make all the difference as it:

- Allows differentiation on Emotive Attributes
- Engineers consistent Customer Experience across touch points
- Transforms Loyalists to Advocates
- Promotes Internal Collaboration enabling Customer Collaboration
- Manages Customer Expectations from Brand
- Leverages multiple channels to enhance and standardize the customer experience (Social, Web, Mail, Phone, Face to Face etc.)

The core of a CEM strategy is the delivery of a positive, predictable and profitable experience across the entire customer lifecycle. A winning CEM strategy is realized when the most valuable customers remain loyal. This is further facilitated by use of analytics on customer data to anticipate

shifting customer priorities, to improve cross-selling opportunities by laying a foundation for highly-targeted marketing efforts and to improve decision making abilities. A successful CEM strategy coupled with customer-focused analytics drives value across the organization by enhancing customer satisfaction across a variety of business functions:

Sales – Improve sales force effectiveness by leveraging insight into the unique needs of their target customers.
For Example: Toyota has a 'Build your car' feature on its website which recommends the best fit features based on customer needs

Service - Improve operational effectiveness by delivering services that maximize the value perceived by your most valuable customers.
For example: The consumer experience team has worked with dedicated dealers to develop a plan to make Ford and Lincoln dealerships the premier place to purchase and service vehicles.

Marketing – Improve customer/brand loyalty by promoting the services that matter most. Customer Plus designed a CEM program "Moments of Truth" to raise
For Example: Ford Retail's standards of customer service and create a consistently excellent customer experience.

Product Design - Improve customer satisfaction by incorporating customer feedback into designing the right products that best meet the needs of the customer.
For example: Mazda Teams with Facebook to Find Designer of the "2018 Mazda3"

A recent study, by Forrester Research, based on a survey of 141 executives from large North American firms indicates that:

- 90% of executives say customer experience is very important or critical to their firm's strategy in 2010
- 80% of executives want to use customer experience as a form of differentiation
- 49% of executives have a senior executive in charge of customer experience efforts

Based on this study, it is clear that a majority of top business leaders recognize the value of and pressing need for an enterprise-wide, cross channel CEM program. Yet many continue to feel hamstrung by the inability to get an effective, integrated program up and running.

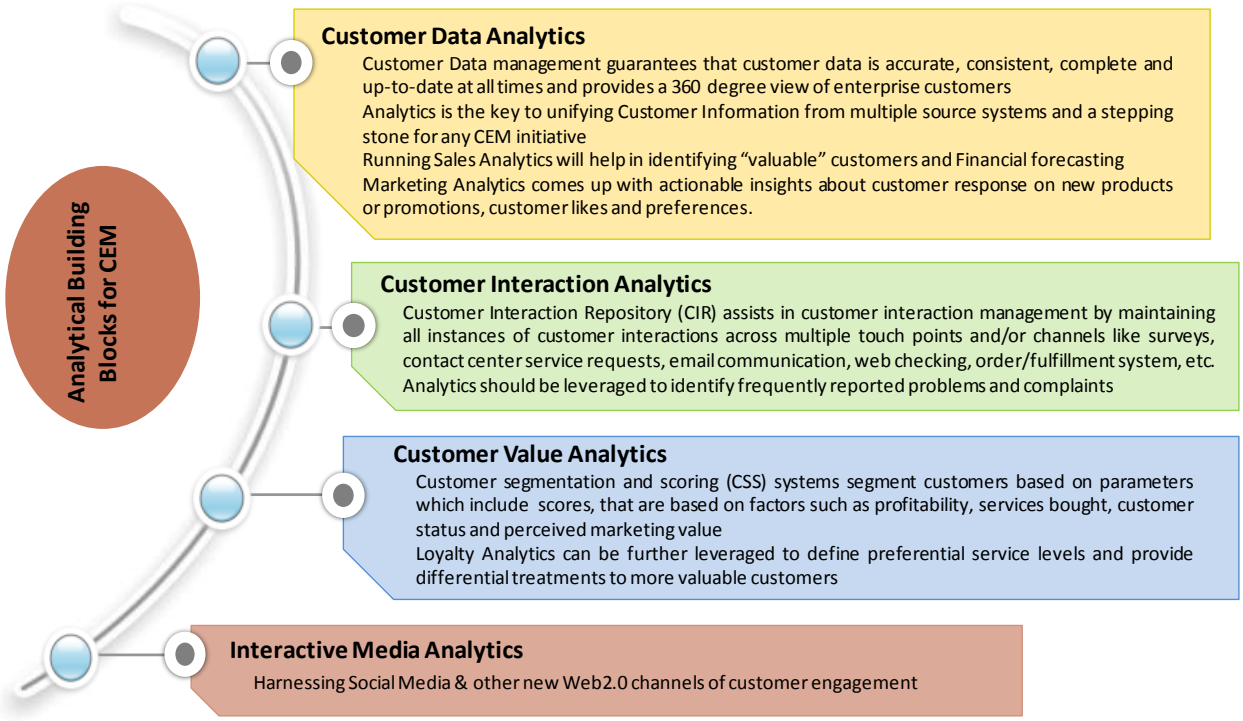
1. Building Blocks of Analytical CEM

Modeling a Customer Experience strategy should start with addressing some key questions:

- What are people saying about your brand and products?
- Who and where are they interacting? Twitter, Facebook, auto forums, blogs, YouTube, other? Are you listening and engaging?
- Is your messaging consistent across the channels?

- How can you improve the customer experience at each stage in the lifecycle through the various channels?
- More importantly, how do your customers want to be engaged to enhance their experience via various channels?
- How can product feedback data be better used to improve customer experience?

Delivering on the promise of customer experience requires organizations to connect customer segments through channels to products & services, delivered over customer lifecycle phases. A holistic Analytics driven Customer Experience Management framework is incomplete without all of the components outlined in the illustration below:



CUSTOMER DATA ANALYTICS:

Customer information originating from different source systems is generally fragmented or differing in nature depending on the nature of the touch-point viz. whether the information was captured at a brick & mortar service center/dealership or was it recorded by a customer service representative at a call centre or through the product/service self-help portal. In unifying the customer information from multiple source systems organizations benefit by:

- Better profiling of customer that leads to higher up-sell and cross-sell conversion rates
- Personalizing interactions with the customer across touch points based on complete and accurate data of his/her profile, buying patterns, wishlist etc

- Reducing cost of service as the company reps can instantly call up customer information and corresponding quicker turn-around-time for customer calls

Unifying customer information from multiple source systems is the stepping stone for developing more meaningful multi-channel marketing strategy and is characterised by decision support systems that rely on business logic gleaned from extensive data mining and marrying the same with business intelligence systems.

CUSTOMER INTERACTION ANALYTICS:

After having implemented a unified-view of customer, an organization needs to centralize all instances of customer interaction across touch points as the next logical step. Companies today are tackling questions about how to take advantage of the unprecedented volumes of information that's being generated by customers. And the responsibility to answer these questions are increasingly falling on the shoulders of the marketing function in the organization whose profession is undergoing significant transformations riding on the proliferation of new mobile devices, ever-widening reach of social media and "big data". Marketers, armed with insights from "big data", can now bring more rigor to the RoI of their marketing investments by effectively strategizing how their products and services interact with consumers. Connecting the universe of transactional, social and search data can help build new levels of customer profiling and understanding allowing marketers to develop novel methods of customer engagement and rather than shaping customer's desires actually predicting them. Evolving customer needs also become evident as organizations track customer interaction history thus giving valuable insights for up-sell and cross-sell opportunities. Most importantly, consistent and prompt responses to customer initiated conversations enhance brand image and create customer loyalty.

CUSTOMER VALUE ANALYTICS:

So the question now is, how do organizations cope with the ever-expanding customer touch points and the associated data? Given that every organization is restrained by limited resources, Customer Segmentation and Scoring based on the insights from customer analytics enables them to tailor products and services precisely to meet those needs and shift resources away from lower-value customers towards higher-value customers, to drive loyalty and retention. Focus on higher value customers can drive positive Word-of-Mouth and lead to increased willingness to make repurchase decisions, garnering greater share of customer wallet. Loyalty Analytics can then be leveraged to define preferential service levels and provide differential treatments to the newly-identified-but-more-valuable-customers.

INTERACTIVE MEDIA ANALYTICS:

Quite a few of the most powerful inventions in the annals of human history, from language to computer, were those that enabled society to better generate, consume and share information. The proliferation of the social networks has contributed to the exponential rate of growth at which information is generated and consumed globally today. For instance now, every minute of the day

100,000 tweets are sent, 684,478 pieces of content are shared on Facebook, 2 million search queries are made on Google, 48 hours of video are uploaded to YouTube, 47,000 apps are downloaded from the App Store, 3,600 photos are shared on Instagram, 571 websites are created and $272,000 is spent by consumers online. (Source: AllTwitter)

What all these statistics point to is there is no denying the fact that companies are finding more and more of their customer interactions to be happening online. Whether B2C or B2B, there is a great opportunity to attract, serve and interact with customers in a brand-consistent and cost-effective way when done electronically. The biggest challenge companies face in these online interactions is insuring satisfaction and so they are constantly trying to define a manageable set of personas that represent the majority of their site visitors so they can fine-tune content creation, marketing campaigns, product or service offerings and so on. A Harris Interactive poll found nine out of 10 web users have experienced problems. Of these, 41 per cent immediately abandon the site in which they face the problem. Of those remaining, only 47 per cent contact the company to report their problem and close to half of these do not get resolution. So from a baseline of 100 per cent, we are down into the low 20s or high teens with respect to user count. CEM contributes to the online customer experience by providing on one hand the means to undertake **break-fix analysis** by replaying web visitor interactions so that customers can rapidly resolve online issues and help companies improve their online interaction touchpoints. On the other hand, organizations can leverage their CEM to chalk out how to get someone to consider buying their products– something that can be called as **behavioral analysis** by proactively analyzing what brought visitors to your site; what they wanted to do; what they did; and how companies can make their site better at serving visitor needs.

Web analytic solutions of today collect a huge amount of data defining what campaign, keyword or affiliate directed a visitor to the company's site. Further this data can show the click-path and conversion funnel analysis allowing web marketers to understand past behavior. Historically web analytics was an IT tool for reporting on baseline site statistics – numbers of visitors, numbers of pages viewed, data usage volumes and so on. Today marketing tends to be the primary consumer of web analytic data and they are more interested in campaign reporting, keyword and affiliate leads, content consumption and click-path analysis, and conversion funnel reporting. But web analytics can not be a stand-alone solution to a company's CEM quest. As discussed earlier, the theme of analytics and logic-driven decision systems cuts across the building blocks of CEM – be it for Customer Master data or Customer Segmentation & Scoring. But by monitoring conversation about products/services on social media across the globe right down to real time tweets, organizations can certainly aim to win over a sometimes-hostile world and engage stakeholders in conversations, identify evangelists, gather communities around interests/topics and co-create products and services.

In conjunction with analytics companies are using multivariate testing solutions to serve, test and evaluate the effectiveness of various content on driving desired behavior. As well, many companies

are using voice-of-thecustomer systems to garner direct feedback from their online visitors. All these solutions feed into a CEM model for those organizations that want to improve the experience their customers have with them as a company. This in turn, leads to great brand loyalty and even affinity whereby their customers lead others to these companies for service.

2. Business Transformation Roadmap: Placing Your Bet on Analytics-driven CEM

So how do you do it? In the increasingly networked world, Customer Experience Management (CEM) is vital to the success of any organization. Yet, traits that distinguish successful organizations from the rest are that they invest both resources and executive backing to ensure that a Customer Experience strategy and design is conducted both at outset as well as on an ongoing basis. In other words, monitoring, understanding and acting on the voice-of-customer must become part of organizational DNA. A step-by-step operational approach to drive CEM-led business transformation is detailed below:

Assess: Begin by creating a baseline understanding of current initiatives, determining cross channel collaboration and identifying possible issues.

- Understand the CEM Vision & Strategy
- Segment your customer and provide expected experiences by segment
- Survey end-customers to capture experiences across various touch-points
- Understand Moments of Truth
- Define processes to support these experience requirements
- Define governance of experience & guiding principles for engaging the consumer
- Improving target marketing

Prioritize: Prioritize the improvement initiatives based on customer experience impact and on potential ROI (Relationship Equity).

- Build Customer Advocacy Index & Customer Experience map
- Formulate CEM Roadmap
- Establish the governance committee structure & operating principles
- Recognize consumers & their preferences across touch points & organizational processes
- Begin building/changing and integrating processes across your organization
- Plan large scale OCM

CEM Design & Execution: Consolidate information into a scalable framework using a common vocabulary and context to identify and address customer experience issues in three stages:

Improve:

- Enhance existing service centres to a NexGen Contact Centre built around Big Data Analytics
- Build a Customer Data Hub
- Identify customer segments & apply consumer preferences based on value
- Make Customer Analytics ready to validate consumer assumptions
- Cross-sell/up-sell targeted products/services

Enhance:

- Build a Customer Scoring System
- Adapt Processes and interactions to support individual consumers based on value
- Pervasive usage of Self Service
- Use Predictive Analytics

Attain Excellence:

- Consumer satisfaction Surveys
- Social Media integration
- Change Consumers to become advocates
- Streamline CEM peripheral functions
- Operational efficiencies and ROI calculation

CONCLUSION

It is crucial to keep in mind that organization wide CEM programs face a lot of hurdles in form of silos, inertia and local/departmental priorities. To get desired results from an Analytics driven CEM program organizations need to:

Create Consistent Interactions: Interacting through various touch points gives the organization an opportunity to reinforce their brand image and get valuable feedback but in a consistent manner:

- Every company should thrive to respond to customers swiftly and consistently across channels in order to avoid any sour experience.
- Technology has enabled companies today to effectively listen to the voice of customers. All that is required from the company is the will to tap this valuable source of information.
- A common message and theme across all touch points can ensure that the customer perceives the brand as the company would like them to.
- While many CEM programs are successful at a business unit or functional level, implementing CEM consistently across a global organization requires a different level of effort and commitment.

Handle Changes Properly and Swiftly: CEM is about change and as such cannot succeed without appropriate and timely actions from the executive team.

- CEM initiatives cannot succeed if there is no executive will driving it. Identify the "change agents" in the organization and involve them in the initiatives.
- Customer experience data is perishable, and must be collected and addressed within the "corporate moment."
- Tactical responses should be an important aspect of the program as they are often more valuable than strategic responses.

Manage Data Effectively: Data and analysis drawn from it are the backbone of most corporate initiatives thus its importance should not be undermined.

- Respondents to surveys and market research need to be carefully chosen as data is only as valuable as the people who provide it.
- Costumers should be given proper incentive to encourage them to respond.
- Segments and levels of the customers should be identified efficiently so that data from same type of customers is not collected.
- Qualitative data needs to be integrated with quantitative data to ensure that managers make the right decisions and consider all factors.

Motivate Employees: Employees are the most important creators of customer experience. Organizations need to ensure that they are customer focused at all times.

- Keep organization goals and metrics aligned with customer experience policies to ensure credibility of the initiative
- Always link the incentives with the desired business outcome to so that compensation doesn't seem capricious and unfair.
- The ultimate goal should be to influence and change the behavior of all the employees in the company and not to create a powerful central group.

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Social Media Analytics: A study of select Indian banks

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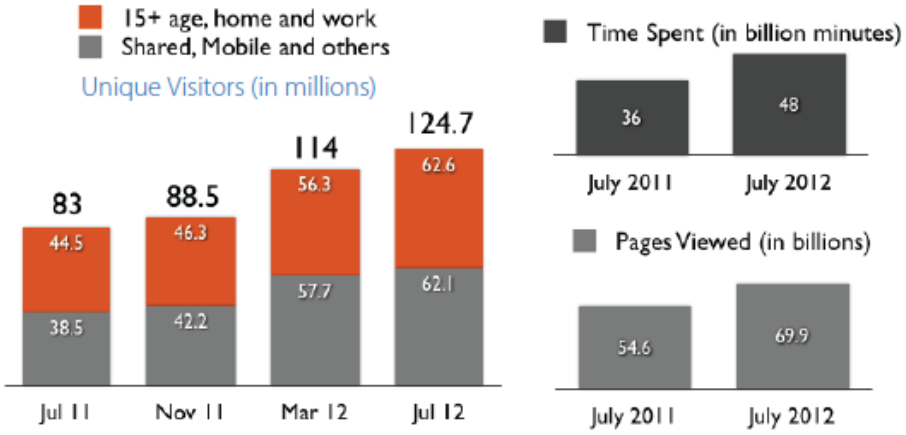
INTRODUCTION

As businesses are growing more customer-centric, the need to be where the customer is cannot be overemphasized. Social media has emerged as a new avenue for both existing and prospective customers to engage in conversations regarding various products and services. The social web includes social networking, micro-blogging, blogging, content sharing, reviews/opinion sharing etc. While Facebook, Twitter, LinkedIn, YouTube and Blogs comprise the top 5 social media channels (Awareness Inc. Social Marketing Software, 2012a), there are many others in which people and there by companies are showing interest in. These include Google+ (social networking), Pinterest (content-sharing), FourSquare (location-based social networking), Instagram (photo-sharing), Flickr (photo-sharing), Tagged (social discovery) and more.

India's online population grew by 50% from Jul 2011 to Jul 2012, as reported by comScore.



Source: (comScore, 2012)

Figure 1: Indian Internet Statistics

It also reported that social networking constitutes the top online activity in India with Facebook in the lead (comScore, 2012). In fact India ranks third in the Facebook statistics by country (Social Bakers, 2012).

Table 1: Social Media Penetration

Social Media Channel	Worldwide (in Million)	India (in Million)
Facebook	901	70
YouTube	800	65
Twitter	600	36
Google+	250	34
Linked In	161	19
Pinterest	20	1

As on July 24th 2012
Source: (Mind Shift, 2012)

A study conducted in America finds that 93% of social media users expect companies they have interest in or association with to have a social media presence (Leary, 2008). They like to connect to brands to build relationships, and have fun in the process. A recent survey by Nielsen found out what users in India want from a brand page (Glenn, 2012):

- Sales/discounts (53%)
- To know Industry trends (50%)
- Tips and tricks for maintaining and using products and services (48%)
- Contests (42%)
- Troubleshooting (41%)
- Applications and games (35%)
- More conversations (31%)
- Updates on products and services (17%)

Social media provides users a platform to discuss products and services, share their experiences, and seek advice from their peer group. Consequently, it provides an opportunity for companies to exploit that wealth of information to their benefit by being a part of it.

Today, having a social media presence is not a choice. People talk about one's products and services regardless of whether one is monitoring their discussions. It is particularly damaging to the brand's image if the company remains silent at or ignorant of any negative talk going on about its products as it gives out a negative message – "I don't care", which can lead to devastating effects.

ROLE OF SOCIAL MEDIA IN THE BUSINESS SCENARIO

Social media has the potential to touch every point in the customer journey right from the considering phase to the after-sales interaction and subsequent advocacy to his peers. Companies have created buzz around new product launches, learned from the customers, and provided location-specific and other personalized deals through social media (Divol, Edelman, & Sarrazin, 2012). In fact, businesses can leverage social media for various purposes like

- Creating brand awareness
- Improving exposure

- Running social campaigns
- Targeted marketing
- Improving sales
- Generating leads
- Increasing active customers
- Developing loyal fan base
- Increasing traffic to the website
- Improving search rankings
- Getting customer feedback
- Performing customer service
- Growing business partnerships
- Finding new ideas
- Crowd sourcing
- Market research
- Scanning the external environment for market insights
- Recruitment
- Gauging performance
- Identifying areas of improvement
- Fostering innovation

Networking within the organization too has tremendous benefits like increasing speed of accessing knowledge, reducing communication costs, increasing speed to access internal experts, managing projects, allocating resources, matching employees to tasks, assessing employee performance and determining compensation. A fully networked company, one which is both internally networked with its employees and externally networked with its customers, suppliers, and partners, realizes significant competitive gains (Bughin, Byres, & Chui, 2011).

In order to realize the above benefits, there are two ways in which companies can approach social media: passive and active. Passively they can monitor the social activity, listen to the customer voice and pulse, and measure the sentiment, thereby gleaning valuable insights about the market and the customers. And then the companies can actively engage the customers by providing right and useful content to drive awareness about new products/services, inform customers about new offers, and offer useful advice and guidance to the customers and prospects.

Hippo Chips put Twitter to an innovative use to address the retail inventory tracking problem (Vats, 2010). Other creative ideas include creating video content like drama series and TV soaps, with sublimed sale intention and broadcast them via social media, which would ensure rapid reach in to the customer segment with significantly less cost than traditional advertising campaigns (Chiu, Ip, & Silverman, 2012).

WHAT IS THE RIGHT APPROACH TO SOCIAL MEDIA?

With all the buzz around social media and its indisputable role in the organization's interactions with its customers and other stakeholders, one shouldn't jump on the bandwagon blindly without a proper strategy in place. Divol et.al (2012) argue that in order to achieve success in its social media investments, it is important for a company to understand the core functions of social media, which include monitoring the brand constantly, responding to the customers at a personal level, amplifying the marketing activities to include an inherent social motivator, and proactively leading the consumers toward long-term behavioral changes.

Some other aspects to consider while embarking on social media journey are:

Goal clarity: The organization should begin with a clear goal – what the company wants to achieve through its social media presence. It can be directed at internal or external stakeholders or both. The top business objectives of social media as found by a study include (Awareness Inc. Social Marketing Software, 2012a):

- Better customer engagement
- Revenue generation
- Better customer experience
- Increased thought leadership
- Operational efficiency

Others may include increasing brand awareness, protecting brand reputation etc.

Choosing right channels: Next, one has to figure out where the company's customer base is located on the social space and choose the specific social media channels it want to enter with care. Deciding on the type of "voice" or "tone" one wants to take - whether formal and reserved or hip and bold etc - on the social sphere is essential as it reflects the brand perception by the users.

Building a content strategy, what and when to post, is the next crucial step. On the social media, content is the king. It drives the interest of and participation by the customers and keeps the channel active. Customers like to have a rapid response to their queries and comments on social networks. Besides being acknowledged, they expect to have their issues resolved as soon as possible. Hence devising procedures and protocols for escalating the issues is important. Companies can even proactively anticipate the customer problems and mitigate the issues before they lead to a major service disruption. For example, by monitoring tweets about long-queues at the counters at certain branches, the bank can proactively make necessary changes at the branches.

Culture of communication: Often times, social media involvement requires considerable changes in the organizational structure, complicates lines of reporting and even demands a cultural shift. But it is advised that an organization that has not yet developed a "culture of communication" will be handicapped it if rushes into the social arena (Fields, 2012). One other caveat here is that the

organization has to make sure to maintain and sustain its social presence once it has entered the space. Having profiles on the channels but being inactive sends out a very negative message.

Integration with CRM: Developing social profiles of the customers and building a social layer on top of the traditional Customer Relationship Management application leads the organization to realize the true benefits of the social media engagement. The need to integrate the social and traditional aspects has given rise to the new concept called Social CRM. It differs from the traditional counterpart in significant ways in that SCRM is content-driven, conversation-centric, and people/community focused where as traditional CRM is data-driven, process-centric, and operationally focused (Leary, 2008).

Measurement: Last but not least, measuring one's activities is imperative to guide one's path to success.

SOCIAL MEDIA ANALYTICS – ROI AND METRICS

Measure the ROI of social media engagement is the top most concern of the executives (Stelzner, 2012) and is perceived to be a hard exercise. But that isn't stopping companies to try and measure a variety of metrics to prove the worthiness of the social media initiatives. Despite the apprehensions, it is possible to measure tangible benefits of social media activities, provided proper strategy is in place. The goals and objectives should be clear so that the metrics can reflect them. There is not yet a standard set of metrics that works for everyone and hence each company is experimenting with a range of useful metrics – from simple ones like #of likes, #retweets to complex ones like lead generation effectiveness etc.

Marketers measure aspects such as (Awareness Inc. Social Marketing Software, 2012a, 2012b; Hoffman & Fodor, 2010)

- Reach – Total # of followers across all social platforms, Facebook's People talking about this, Tweet audience, YouTube video views
- Growth – month-over-month, quarter-over-quarter
- Engagement - #likes, #shares, #retweets, #comments, #posts by the company, #posts by the customers, Top people by #comments
    - Engagement by campaign, by platform etc.
    - Comment keyword analysis
- Sentiment
- Traffic to website
- Social mentions
- Share of Voice
- Social influence
- Lead generation
- Customer satisfaction

- Issue resolution

Other interesting metrics include (Nilsson, 2012):

- Content relevance rate = Engagement/Published activities
- Conversation relevance= interactions/activity
- Average potential reach per activity = Potential reach/activity
- Subscriber interaction = Interaction/Subscribers
- Lead generation effectiveness = # of new leads from social channels/# of total leads

Awareness Inc., a social marketing software company, proposes a framework which suggests approaching measurement of social media ROI from two perspectives (Awareness Inc. Social Marketing Software, 2012b):

- Return on marketing objectives, which is goal-oriented and measures results from specific marketing campaigns and initiatives
- Return on marketing investment, which involves the measurement of overall social marketing contributions to the business over time.

Several vendors are coming up with innovative and unique metrics to enable marketers to track social media ROI. Klout is one such, which measure measures the overall social media influence of a brand or a company by taking into account more than 400 variables on multiple social networks (Klout, 2012). While there are a wide variety of free online tools for monitoring and measuring ROI like Social Mention, Tweet Feel etc., paid tools offer more comprehensive solutions. Most companies are found to use a mix of free and paid tools (Awareness Inc. Social Marketing Software, 2012a).

However, measuring social media ROI involves certain difficulties in the areas of tying social media results to actual business results, analyzing the unstructured data, integrating disparate social media data sources, integrating with the existing CRM application etc. (Awareness Inc. Social Marketing Software, 2012a).

BANKS ON SOCIAL MEDIA

Being a customer driven sector, retail banks need to be in constant touch with its customers. With ever increasing number of people going online and spending an increasing amount of time on social media channels, banks need to consider social media as a major means of reaching out to its customers in a comparatively quick and inexpensive way.

With the rising competition and customer expectations, retail banks are required to be aggressive in their customer-related activities to improve or reinforce their brand position. Social media engagement involves letting the customers take the reins and control the way the conversations are carried. They determine the pulse and the banks just need to listen, acknowledge, participate, and interact with the customers.

Customers like to associate with banks on social media for a variety of reasons like (Fiserv, 2010)

- Receive information about financial services (66%)
- Receive information about offers and promotions (32%)
- Review other customers' opinions or advice, or post reviews, complaints or questions (31%)
- Conduct customer service related activities (30%)

The greatest potential lies in engaging with customers through meaningful conversations and letting them know that you are listening and that their opinions matter.

Bank of the Philippines Islands is addressing customer queries and offering online financial help through its social media team formed by hand-picking a few Facebook-savvy employees from various departments (Dumlao, 2012). Visa, Lloyds Banking Group (LBG), Citi, and Commonwealth Bank have all been using social media channels to promote their brands alongside the London 2012 Olympic Games (Data Monitor, 2012). Social media can also be assisted in crisis management as demonstrated by HSBC, which used its Twitter account to keep the customers updated during a cash machine outage (Fisher, 2012). Community banks in US are using social media in a big way to boost their business and bond with their customers. Indian banks have reportedly been using social media to track loan defaulters (Ramalingam, 2012).

The top 10 Indian banks by market capitalization are selected for the present study, which consist of 5 public sector and 5 private sector banks (KPMG, 2012). They are:

1. State Bank of India
2. Punjab National Bank
3. Canara Bank
4. Bank of India
5. Bank of Baroda
6. ICICI Bank
7. HDFC Bank
8. Axis Bank
9. Kotak Mahindra Bank
10. IndusInd Bank

Their presence on the top 5 social media channels is represented as below:

Table 2: Social Media Presence of the Top 10 Indian Banks

Bank	Facebook	Twitter	LinkedIn	YouTube	Blogs
State Bank of India	✗	✓	✓	✓	✗
Punjab National Bank	✓	✓	✓	✗	✗
Canara Bank	✗	✓	✓	✗	✗
Bank of India	✗	✓	✓	✗	✗

Bank of Baroda	✓	✓	✓	✗	✗
ICICI Bank	✓	✓	✓	✓	✗
HDFC Bank	✓	✓	✓	✓	✗
Axis Bank	✓	✓	✓	✓	✗
Kotak Mahindra Bank	✓	✓	✓	✓	✗
IndusInd Bank	✗	✗	✓	✓	✗

As of Nov 6, 2012

It is evident that none of the banks have active blogs maintained by them. Though ICICI and HDFC have their presence on the blogosphere, they have been inactive for more than a few years. Also, since there is no proper integration, it is not easy to know the existence or not of their social presence.

In order for the social media activity to result in actions by the prospective customers and for the current customers to connect to the bank on the social space, there is a need to integrate the various platforms. A seamless platform for communication and collaboration puts the customer at ease and also make the bank to manage and track the activities without losing the sight of the goals and objectives. Therefore, integration across the social media channels and with the website is crucial.

The table below indicates the social media integration of the top 10 banks:

Table 3: Social Media Integration

Bank	Website Home	Facebook	Twitter	LinkedIn	YouTube
State Bank of India	✗	-			
Punjab National Bank	✗				-
Canara Bank	✗	-			-
Bank of India	✗	-			-
Bank of Baroda	✗				-
ICICI Bank					
HDFC Bank					
Axis Bank					

Kotak Mahindra Bank	✗				
IndusInd Bank	✗	-	-		

As of Nov 6, 2012

It can be observed from the above table that majority of the banks (7 out of 10) do not have any kind of social media integration on their homepages. While all of the public sector banks do not practice any such integration, the homepages of only 3 of the private sector banks reflect their social media presence.

While link to the bank website homepage is provided on all channels in all cases, only a limited integration can be seen among the channels. As can be observed, YouTube is the channel which is highly integrated with other social media channels.

Existence of multiple profiles can be observed in certain cases, mostly in Facebook where there are multiple unofficial and inactive pages leading customers to confusion. It is true even in the case of Twitter and YouTube. However, there is a practice of maintaining multiple profiles by the companies to cater to different needs, purposes or offerings. For example, HDFC bank has two official Twitter profiles - @HDFC_Bank, which is used for customer service purpose and @HDFCBank_Offers, which is used to promote the banks offers. Usually, customers expect to have a single outlet to interact with the brand and the existence of multiple profiles will only cause inconvenience to them (Carroll, 2012).

Below are the major observations of the present study for each channel:

Facebook:

Only 6 of the 10 banks have an active official Facebook page. Though SBI has a couple of pages existing on Facebook, they are not official pages maintained by the bank. There are official pages for Bank of India and Bank of Baroda but they are not active with little content whatsoever. There is some confusion on part of the banks as they create pages under inappropriate category. As in the case of Bank of Baroda which has a page in Product/Service category, which is of course left inactive since March 2011, in addition to Bank/Financial Institution.

Table 4: Facebook Metrics

Bank	No. of Likes	Last Activity	Date Joined
Punjab National Bank	3,428	Sep 4, 2012	Feb 8, 2012
Bank of Baroda	188	Oct 24, 2012	Oct 1, 2011
ICICI Bank	963,504	Nov 6, 2012	Jan 5, 2012
HDFC Bank	439,921	Nov 6, 2012	Aug 26, 2010
Axis Bank	663,574	Nov 6, 2012	Jun 7, 2011
Kotak Mahindra Bank	45,684	Nov 6, 2012	Jun 27, 2011

As on Nov 6th 2012.

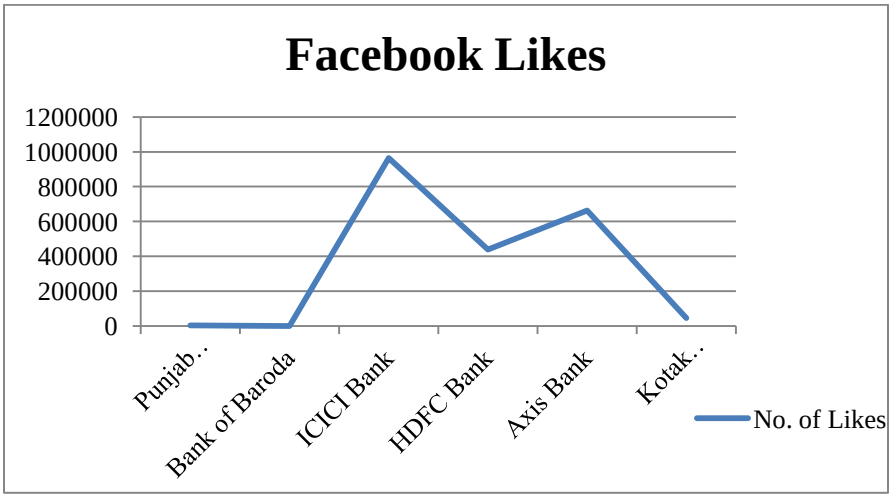


Figure 2: No. of Likes on the Facebook Page

As can be seen from the above table, private sector banks have strong and active presence on Facebook except IndusInd bank. While ICICI Bank has the highest number of likes, HDFC Bank and Axis Bank have longer presence on the network with steady activity. Only two of the five public sector banks have official pages on Facebook and they have nominal participation at the best and not very active compared to the private sector banks. Canara bank has a page but it is devoid of any content by the bank.

Even in the case of proper responses by the bank to the customers' comments, private sector banks are far ahead of the public sector banks with ICICI Bank and HDFC Bank leading the pack.

Twitter:

All the banks under study have twitter accounts except IndusInd bank. ICICI Bank and HDFC Bank have the highest number of followers and have tweeted more than the others.

Table 5: Twitter Metrics

Bank	No. of Tweets	No. of Followers	No. Following	Last Tweet
State Bank of India	2,053	3,287	6	Jul 24, 2012
Punjab National Bank	8	318	4	Sep 13, 2012
Canara Bank	40	920	0	Nov 2, 2012
Bank of India	5	14	6	Aug 17, 2012
Bank of Baroda	37	315	0	Apr 14, 2012
ICICI Bank	10,521	6,414	4,276	Nov 6, 2012
HDFC Bank	13,053	5,064	76	Nov 6, 2012
Axis Bank	151	817	0	Nov 6, 2012
Kotak Mahindra Bank	2,973	663	218	Nov 6, 2012

As of Nov 6, 2012.

It is evident from the above table that the public sector banks are not that active and tweet rarely. The exception is the State Bank of India, which has a decent number of followers and tweets. But there has been no activity since July 2012.

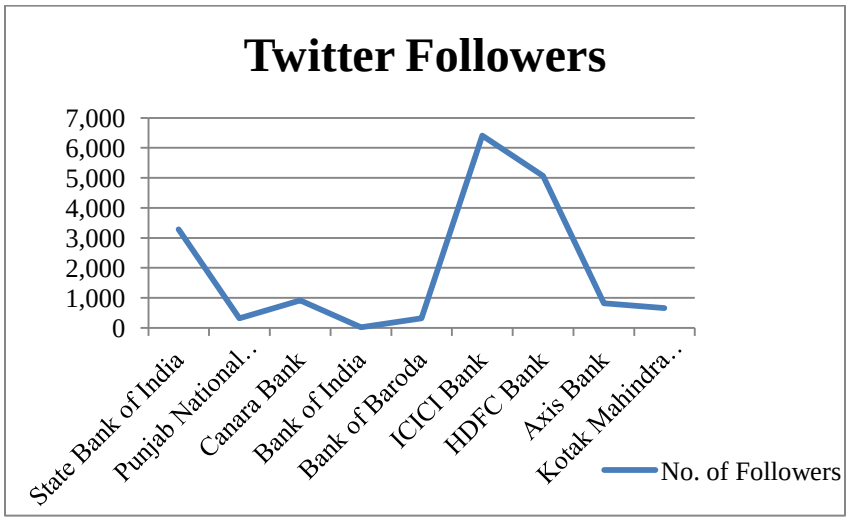


Figure 3: No. of Followers on Twitter

Linked In:

All of the banks under study have LinkedIn profiles. The number of followers for each bank is depicted in the following chart.

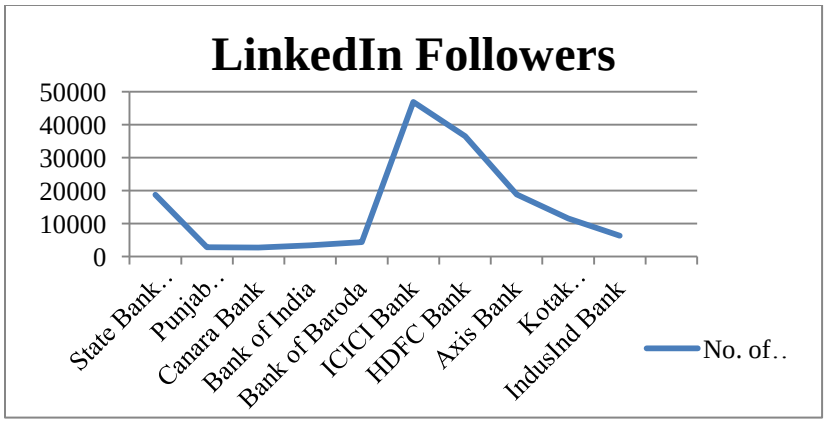


Figure 4: No. of Followers on LinkedIn

This channel too reinforces the earlier observation that ICICI and HDFC are in the lead with the maximum number of followers. A useful feature of LinkedIn is Products/Services tab where the company can list its products and services, which can be recommended by the users. This feature is leveraged only by the private sector banks with the exception of IndusInd. Axis bank has the most impressive profile page with attractive images and updated content. Another observation is that none of the banks is using the "Status Update" feature to update and engage followers.

You Tube:

Only SBI of the public sector banks has a presence on You Tube with 13 videos. May be the very low number of subscribers is due to the fact that SBI joined the channel only about a month ago. ICICI Bank has uploaded the highest number of videos. Even though Axis Bank gathers highest video views with only 41 views, ICICI bank is not far behind. It can be observed that the banks have comparatively longer presence on You Tube than on other channels.

Table 6: You Tube Metrics

Bank	No. of videos	No. of Subscribers	No of video views	Last Activity	Date Joined
State Bank of India	13	2	63	Oct 31, 2012	Sep 26, 2012
ICICI Bank	84	366	268,249	Oct 13, 2012	Dec 9, 2006
HDFC Bank	41	365	135,706	Oct 16, 2012	
Axis Bank	41	77	297,800	Sep 12, 2012	Dec 12, 2007
Kotak Mahindra Bank	8	5	1,331	Sep 27, 2012	Aug 8, 2011
IndusInd Bank	9	34	33,523	Feb 1, 2012	Dec 9, 2010

As of Nov 6, 2012.

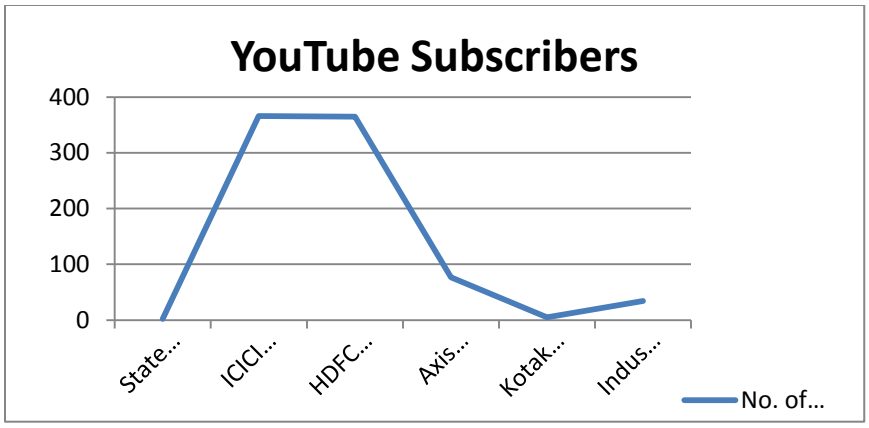


Figure 5: No. of Subscribers on You Tube

However, comments by the users are sparse at best for all the banks.

The metrics of strength, sentiment, passion, and for the banks as measured by the social media search and analysis platform Social Mention are as follows:

Table 7: Social Mention Metrics

Bank	Strength[1]	Sentiment[2]	Passion[3]	Reach[4]
State Bank of India	11%	3:1	30%	51%
Punjab National Bank	7%	7:1	25%	30%
Canara Bank	8%	15:0	23%	32%
Bank of India	31%	4:1	27%	64%
Bank of Baroda	6%	4:1	51%	29%
ICICI Bank	17%	10:1	36%	45%
HDFC Bank	26%	4:1	49%	32%
Axis Bank	14%	7:1	38%	45%
Kotak Mahindra Bank	2%	5:1	34%	22%
IndusInd Bank	1%	13:1	44%	19%

As of Nov 22, 2012

1. Strength: Phrase mentions within the last 24 hours divided by total possible mentions
2. Sentiment: Ratio of positive mentions to negative mentions
3. Passion: Likelihood that individuals talk about the brand repeatedly
4. Reach: Number of unique authors referencing the brand divided by the total number of mentions

From the above set of metrics it can be seen that Bank of India had the maximum number of mentions in the past day with 31% strength, followed by HDFC Bank at 26%. It can be observed that the sentiment is largely positive for all the banks. People are more passionate about Bank of Baroda and HDFC bank by repeatedly talking about them. While Bank of India has the most unique authors with 64% reach, SBI records 51% reach. Such monitoring of social activity is important so that the banks can take appropriate actions. These metrics give a superficial view and digging deeper into the details provides more useful insights.

ISSUES AND CHALLENGES

The path to social media success is however full of challenges. The top 10 questions that marketers want answered, as found by an industry report (Stelzner, 2012), besides indicating that marketers are unclear about various critical things emphasize the need for the emergence of best practices. The questions constitute:

1. How do I measure the effect of social media marketing on my business?
2. How do I find my target audience with social media?
3. What are the best ways to engage my audience?
4. How do I sell with social media?
5. How should I best use my time to maximize my social media results?
6. How do I create a social media strategy?
7. What social media tactics are the most effective?
8. What are the best social media management tools?
9. How do I use the different social media platforms?
10. How do I select the right social platform for my business?

Developing the right processes and governance structure, identifying clear roles and bolstering the talent base, improving performance standards, establishing seamless communication across the organization, aligning business objectives with measurement methodologies, integrating social marketing efforts with the rest of the marketing pose significant challenge for the companies getting into the social media space.

Often times, lack of enough budgets and resources acts as a hindrance. Others challenges include measuring ROI, managing and growing social presence, monitoring social media, integrating social information into the existing IT applications, achieving a single view of the customer to be able to cater to the customer queries and issues more readily.

Providing customer service on the social networks is akin to placing the problem resolution desk in the middle of the town square. Considering the sensitivity of information involved, banks may not be able to address the issue over the web and may have to redirect the customer to some other reliable channel like e-mail, telephone etc. And this is what most banks are doing right now. This may not only frustrate the customer as he is required to approach the bank multiple times, but also result in increased overall support costs (The Financial Brand, 2012). In such a scenario rises the question of whether or not the bank should attempt to offer customer service over social networks. Nevertheless, banks cannot risk of being not responding to the customer complaints in the social space. With leaders like CitiBank, which resolves 36% of twitter requests (Kapner, 2012), paving the way, the novices will follow the trodden path.

Financial institutions need to comply with certain regulations in their interactions with their customers and there is a need for more clear and stringent rules guiding the behavior of the banks on the social space. Losing control of the conversations, achieving transparency in its interactions, and fostering community feeling are inherent challenges for any bank embarking on the social journey.

DISCUSSION AND CONCLUSIONS

Social media no doubt has serious implications for the banks. It provides, besides many other benefits, cheaper and effective way to know what the customer feels about them and their products than traditional methods, though it has the disadvantage of being hauled stones at in full view of the public. Like any other initiative, social media investment will not see immediate returns. With proper strategy in place and treading the path with perseverance and caution, one is bound to succeed and reap the benefits.

From the present study of social media presence of the top 10 Indian banks, the following conclusions can be drawn:

- Private sector banks fare a lot better compared to public sector banks
- ICICI, HDFC, and Axis banks leverage the social media to a significant extent
- The activity is limited on the channels and there is a lot of scope for greater customer engagement
- Banks should have a set of goals and fool-proof plan of action for their social media initiatives.
- Banks should be guided by a sound content strategy
- Banks should be more responsive to customers
- Banks should take their social media forages more seriously and maintain a consistent behavior online.
- Various platforms need to be integrated in order to be able to track the return on social media investments.

The significant gap observed between social media involvement of public and private sector banks can be explained in some sense by their very natures. Public sector banks have traditionally been conservative and usually tread the path of technology cautiously. Also, owing to the wide customer base of public sector banks with deep penetration into both urban and rural areas, the Internet-savvy, young people who are most likely to be socially active online, represent only a minor piece of the pie. Consequently, the resources and efforts in terms of time, people and money that social media engagement demands may not always be fully justified in the case of public sector banks. In contrast, private sector banks largely target the urban, employed segment and are generally technology-savvy, which is a reason them to embrace social media more readily.

With Indian banks getting about 30,000 to 40,000 mentions per day (Langlois, 2012), there is a great opportunity and need for the banks to monitor and participate in the social activity. Even as

many of the banks are focusing only on the social networks, micro-blogging, and content sharing channels, it is found that much of the content related to banking can be found on forums and blogs (Falls, 2012). Banks need to overcome the concerns over lack of control on content, lack of safety regulations and standards, and a mismatch between the entertaining character of social media and the serious nature of financial business and adopt "the social media way" of thinking to get more accustomed to the social technologies (Mitic & Kapoulas, 2012). Finding alternative routes to overcome these concerns and utilizing modern technology which ensures insulation regarding content and security concerns is imperative for banks desirous of realizing the full potential of social media. Indian banks should take cue from their more socially advanced counterparts in US and Europe and exploit social media to the fullest.

Social media will bring tremendous change to the way banks operate. It will take targeted marketing to a whole new level altogether. It will result in lower complaints as banks proactively manage issues. It will cause many of the transactions to take place through social apps resulting in complete transformation of the branches. Banks are likely to lose the opportunity to charge for financial advice as people share insights and experiences with peers for free (Piron, 2012).

In conclusion, banking companies can rely on high end technology to ensure safety, confidentiality and other related concerns. At the same time, consistent social media performance on part of banks can ensure lasting customer engagement. Indian public sector banks could see the shortfall in their social media presence as an area of improvement and leverage modern internet technology to bridge the gap. Private sector banks on the other hand have presence ranging from medium to highly active. With continued up gradation, social media can provide a stronger means of impacting consumer mind space.

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A Fuzzy Logic Based Model for Analysis of a Research Design for its Suitability to Avoid Non-Sampling Errors in Market Research

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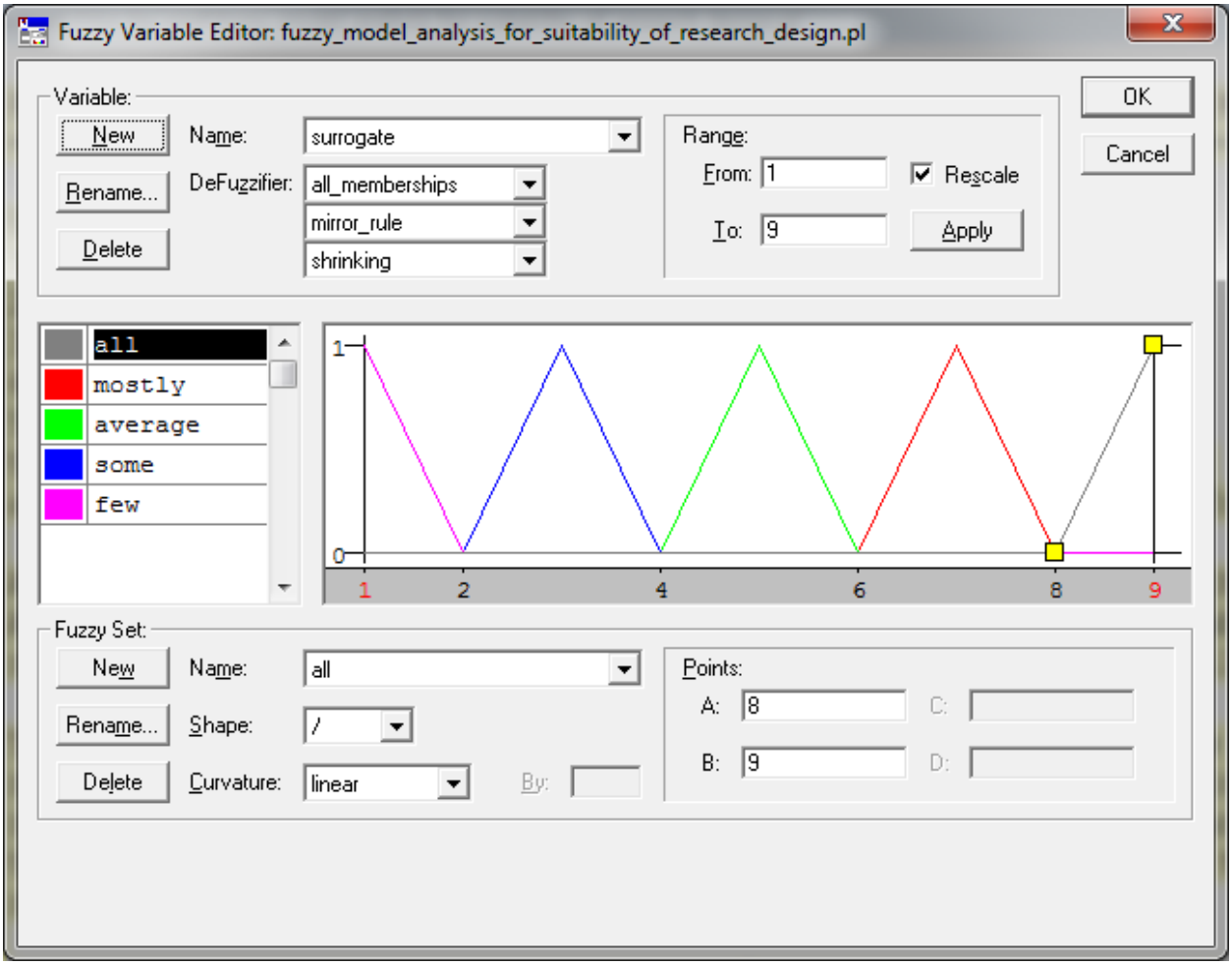
ABSTRACT

This research presents and demonstrates an implementation of a fuzzy logic based model for analysis of a research design for its suitability to avoid non-sampling errors in market research. The suitability analysis is performed based on the scores of five attributes for any research design. The five attributes taken into consideration are: 1. Use of surrogate variables, 2. Accuracy of measurements, 3. Extend of use of multiple frames, 4. Extend to which the selected samples are comparable with known population, 5. Handling the cases of the non-responses. The research design is analyzed to provide overall rating of how suitable the research design is to avoid possible non-sampling errors. A fuzzy variable is defined for each of the qualities of the research design. A matrix of fuzzy rules is then given for each fuzzy variable, which relates the fuzzy sets of the fuzzy variables to a suitability value. The use fuzzy logic based system can handle uncertainty in the information as long as an appropriate number of fuzzy-variables are taken.

PURPOSE OF THE RESEARCH: Estimating or measuring errors is better than ignoring them. Ignoring a non-sampling error equal in amount to sampling error reduces the confidence .95 level to .83 (Tull & Albaum, 1973). The purpose of the research is to implement and study a fuzzy logic based model to analyze suitability of a research design to avoid non-sampling errors before the research is actually executed.

METHODOLOGY: The model is implemented using LPA Win-Prolog and the associated fuzzy logic toolkit (Flint). The prototype developed is executed for few sample records indicating the values of attributes of few hypothetical research designs because the instead of the actual research design its attribute values (may be with some uncertainty) are needed as input for the computer program.

Given below is a screen-shot for specifications of a fuzzy-variable named ‘surrogate’ indicating the extend of use of surrogate variables. Similarly all the specified fuzzy variables are specified.



MAJOR RESULTS:

Some sample results for some research designs are as follows:

S. No.	Research Design (Project Name)	Suitability (100%)
1.	Transport	86.67
2.	Health	80.00
3.	Roads	80.00
4.	e-mitra	70.00
5.	Fuel	65.71
6	Agro	60.00
7	Water	60.00

Depending on the parameter values provided for the research designs and/or addition of new research design parameters the output will change. The major advantage is handing of uncertainty in information pertaining to the parameters and provides an analysis for suitability.

IMPLICATIONS:

The present implementation can be extended to include more parameters to use the model for real-life projects.

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Advertising On Mobile Phones In India: Spread And Areas Of Control

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Advertising, a quintessential part of Marketing activity, has come a long way and has dominated all media – from the print, electronic, and the online media to the contemporary mobile media or the media represented and ubiquitously created with the ever rising number of cell phone and mobile phone operators. This communication medium is probably the latest, yet it is the most phenomenal arena of advertising and has witnessed huge growth across the world. Advertising on Mobile Phones in India has witnessed phenomenal growth from a virtually non-existent state. The mobile advertising market in India is worth a whopping $56 million with around 900 million consumers.[1] With the sheer size of the market, it is not just the specialist bulk SMS service providers, but also mobile phone operators themselves who have forayed in the market. [2]

The different forms of mobile advertising are as follows:

- Short Message Service (SMS).
- Multimedia Message Service (MMS).
- Mobile Alerts.

The two types of approaches in the mobile advertising avenues are as follows:

1. **Push Advertising**

   ➢ **Solicited**: This is a solicited advertising with prior permission taken from the users.

   e.g. news alerts, job alerts, cricket scores.

   ➢ **Unsolicited advertising**: In this advertising, no prior permission is taken from users.

   E.g. promotional SMSes, prerecorded mobile calls .

2. **Pull Advertising**

   This is the form of advertising when users request the services to themselves from the service provider.

[1] http://www.ndtv.com/video/player/all-about-ads/mobile-advertising-in-india-why-are-clients-wary-of-investing/234322 retrieved on August 25, 2012.

[2] http://timesofindia.indiatimes.com/business/india-business/Bharti-Airtel-enters-mobile-advertising-segment/articleshow/13568677.cms retrieved on August 25, 2012.

E.g. subscriptions to quote of the day, quotes from religious texts, daily horoscopes, etc.

MOST RECENT THEMES AND USE OF THE MOBILE ADVERTISING IN INDIA

1. FAIR AND LOVELY SCHOLARSHIP PROGRAMME 2007

As the most innovative and unprecedented initiative in India's Mobile Advertising history, the Reliance Communications mobile ad campaign - Fair & Lovely Scholarship programme 2007 which was adjudged winner by the Mobile Marketing Association (MMA) Annual Global Awards jury at a glittering ceremony held in Los Angeles in November 2007. It was the creativity shown by Hindustan Unilever Limited when the company launched an ad campaign of 'Fair and Lovely scholarships for women,' using short code (51234) and instant voice from mid-August to mid-September 2007. This Fair & Lovely Scholarship programme 2007 mobile advertisement was powered by an easily accessible and clickable banner ad in various languages on the internet. These banners were linked to a micro-site where interested scholarship aspirants were required to provide their choice of course of study, annual family income and other related details for processing the application. In addition to the online advertising mode, Hindustan Unilever Limited tied up with Reliance Communication in creating a special Fair & Lovely Scholarship Zone on 'R World' to promote the campaign. This registered a huge and unparalleled success by generating around 50,000 leads of which 60 percent leads came from tier II and tier III cities and 40 percent from urban cities. Another noticeable aspect of the Fair & Lovely Scholarship programme 2007 campaign was that it received enormous response from the semi urban and rural India, which also broke the long-term myth that the mobile advertising can only be targeted to the urban and metropolitan areas.[3]

2. MOBILE MESSAGES TO PROMOTE THE CAUSE OF THE DESTITUTE

Advertising is sometimes viewed skeptically as a means of promoting products and services and not the public welfare and socially relevant causes. This wrong notion has also been dispelled by the Mobile Media and we find instances when Mobile Advertising has actually addressed the grievance of the poor, the destitute and underprivileged rather than just serving as a means of promoting business. A good example in this context is Amrita TV's public service initiative 'Send an SMS. Save a Child' to help the underprivileged children. Under this initiative, revenue was collected from the SMS vote responses of the viewers of Amrita TV reality shows. The entire SMS revenue collected by Amrita TV was donated for the education, shelter and healthcare of the underprivileged children.[4] This highlights not just the reachability of the mobile phones but also the philanthropic arm that can be an inherent and supportive as well as an ethical part of it.

[3] http://adverteaze.com/description/32/7/42/Fair Lovely.php retrieved on August 25, 2012.
[4] http://www.indiantelevision.com/headlines/y2k7/nov/nov8.php retrieved on August 25, 2012.

3. PROMOTING IDEAS, IDEOLOGY AND POLITICS

Wide access of mobile phones has inevitably also induced itself as a tool of political campaigns. During the 2009 general elections, India's main opposition party Bharatiya Janata Party aimed at approaching to about 70 per cent of the total mobile users' population in India by sending them messages - sending at least three SMSes to every individual before the commencement of electioneering.Thus, it was seen that fairly large sections of the Indian population can be planned and reached through mobile advertising campaigns.

4. DEALING WITH THE GLOBAL MENACE OF HIV

The spread of HIV across the globe has been a cause of concern for individuals across the world. In this context, a good step has been undertaken by the state-run Goa State AIDS Control Society (GSACS) with a working arrangement with various mobile service providers in the coastal state to launch a unique facility of sending SMS alerts reminding HIV patients about the monthly drug regimen dosage. This service replaces the cumbersome telecalling reminders which were also invasive on the privacy of the HIV patients. Thus, a state with about 14486 HIV and 1546 AIDS patients has finally found Mobile Advertising as an economical, less-manpower intensive, highly personalized and privacy-respecting mode of communication.

5. ADDRESSING ENVIRONMENTAL CONCERNS THROUGH MOBILE ADVERTISING

B.S. Bhadrakumar, a 41-year-old forest officer in Palakkad, campaigning for ecological responsibility as part of his duty in protecting the forest cover undertook the initiative of establishing an SMS network that now serves as an effective tool for spreading awareness on the campaign to conserve forests. The messages range from environment-related programmes conducted by Government agencies or NGOs, quotes by great men and requests to public to plant trees. The mode of operation was not to impose any financial implication on the message recipients or to send unsolicited messages. Instead, the interested persons were required to type MAPRITHVI from their mobile phones to a specific number. The SMS is sent with the help of GupShup, a mobile social messaging platform. Thus this voluntary SMS receiving option has around 900 willing and registered recipients who receive environment-friendly messages every day.

6. USE OF MOBILE AD CAMPAIGNS THROUGH MMS

One cannot presume that mobile ad campaigns in India are restricted to SMSes alone. A pertinent example in this context is that of the Indian Association of Adoption and Child Welfare MMS campaign which was titled "The hottest MMS ever – If you don't like it, pass it on." In the 25-second video, Indian Association of Adoption and Child Welfare tried to generate awareness about abandoned infants and convince people for their adoption. Judging by the responses, this

campaign was a tremendous and unprecedented success. The promoters were connected in three days from all nooks and corners of the nation with the same message. The discussion forums also generated a very good response. In fact, the very first week witnessed 1,210 downloads. Thus, mobile advertising can even be successful in India even when the mode chosen is that of MMS, although at present there exists the limitation of media content accessibility in several mobile phones of India.

NEED FOR CONTROLLING MOBILE ADVERTISING / DESIGNING OF MOBILE AD MESSAGES

While several suggestions have been made with regard to the control and regulation of mobile messages, some of the more prominent suggestions online are noted below:

i. Notification of Privacy, Security and Usability Implications

When integrating with Ad Providers, App Publishers are responsible for ensuring that their users are properly notified of privacy, security and usability implications.

ii. Addressing Crucial Aspects of Transparency and Clarity

Service Providers have to ensure Transparency and Clarity to users about data collected, and present such information in a way that is readily accessible, easily understandable, and usable by average users. The agreement to mandate specific privacy policy documentation for mobile apps is a start, but to be truly useful these privacy policies must be adapted for a mobile experience. In cases where Personal Information is collected (which can include name, phone number, email address, fine-grained location information, or more), simply providing detailed privacy policies may not be sufficient and requires gathering informed consent from users through the use of conspicuous, clear notification techniques prior to enabling data collection. This guideline has clear implications for App Publishers, but is especially important for Ad Providers, with whom mobile users rarely directly interact knowingly. When integrating with Ad Providers, App Publishers are responsible for ensuring that their users are properly notified of the privacy, security and usability implications that embedded third-party Ad Providers pose.

iii. Option to withdraw consent

Mobile users should have the facility to withdraw consent from Ad Provider data collection.

iv. Enable Individual Control

Mobile users must be able to exercise control over what identifying data is collected by Ad Providers, and how it is used. This is tied closely to Transparency & Clarity, in that App Publishers

must make it easy for users to understand what tools are available to them by communicating this from within the mobile app itself. In addition, mobile users should have the facility to withdraw consent from Ad Provider data collection and usage through accessible controls.

v. Context and Control When Experimenting With New Ad Delivery Behavior

It is imperative to provide context and control when experimenting with new Ad Delivery Behavior. Mobile Ad Providers have recently started to explore new methods of ad delivery, including delivering ads in the system notification bar (also known as "push" notification ads), placing new icons or shortcuts on the mobile desktop, and modifying browser settings such as bookmarks or the default homepage. When an ad is delivered outside the context of an individual application, mobile users have a right to know where the ad came from and how they can take action to control such behavior. More specifically:

a. Ad Providers experimenting with push notification ads must provide clear attribution to the source host application responsible.

b. Ad Providers that modify browser settings or add an icon to the mobile desktop must provide clear, conspicuous notice to users and gain explicit consent prior to doing so.

vi. Focused Data Collection

a. Ad Providers should respect reasonable limits on the collection and retention of data collected from end user devices. The collection, usage, and storage of data that can be used to uniquely identify a user or their device must be performed in ways that are consistent with the context in which users provide that data, and accompanied by methods of user notice that reflect the relative privacy implications of such data. More specifically:

b. Ad Providers should move away from using unchangeable device identifiers and should move towards using independent and/or temporal device identifiers that provide the same level of functionality with respect to targeted advertising.

c. Ad Providers must not collect subscriber-specific identifiers such as MSI or MSISDN, unless the collection of such identifiers enables a demonstrable feature or service for the user (such as carrier-billing).

vii. Transport Security

a. Device or user identifying data must be secured and handled responsibly at all times by both App Publishers and Ad Providers. Common security best practices such as transport layer encryption and forward hashing should be a minimum standard. Mobile users have a right to expect accountability from all members of the mobile ecosystem, including Ad Providers and application developers. More specifically:

b. When collecting unique device identifiers that are permanent and unchangeable by a user, Ad Providers MUST hash such identifiers using a generally accepted secure hashing algorithm.

c. When collecting Personal Information such as email address or phone number, Ad Providers MUST transmit it securely using transport layer security (TLS / SSL).

In addition to the above technical and corporate communication etiquette related aspects, there are also the problem of anonymous SMSes such as:

a) Hoax messages from anonymous senders informing the recipients of winning huge amount of lotteries which defies logic as the recipient never participated in any lottery or the specific lottery in the message– mobile version of similar spam email messages.

b) Mischievous propagation with the whole and sole intention of creating panic among the recipients such as the SMSes circulated over the internet that a worker from a beverage and food products company had added his blood contaminated with HIV into the products. This message, which generated a lot of interest, anxiety and fear among the receiving mobile users was completely maliciously designed. Apart from the concocted nature of this communication, according to the United States Center for Disease Control and Prevention, the HIV virus does not live long outside the human body. According to the Center, even if small amounts of HIV-infected blood were consumed, the virus would be destroyed from exposure to air, heat and stomach acid. Thus, the idea behind this message and other similar SMS messages was to create a public panic rather than alerting any real danger or perceived public health hazard to the intended recipients.

c) In a geographically, culturally and linguistically diverse country like India, there is every possibility that there might be hostile quarters outside the country which may grossly misuse the mass communication tools such as the bulk SMSes to create panic in some sections of the society. This was witnessed in our country in August 2012 when many people hailing from the Northeast left Bengaluru out of the fears arising from the SMSes received anonymously. It was later confirmed that these SMSes were sent from outside the country with the ignoble aim of destabilizing the nation.

To conclude, there is a need not only to regulate the technical and corporate communication etiquette related aspects of organizations, but also to check and control anonymously sent SMSes. Of these, the second category of SMSes often promote hoax messages, ill-motivated propagation and also maliciously designed messages leading to havoc among the straightforward and unsuspecting masses of the country. These are the areas which do not just require continuous check and monitoring from the government and other regulating agencies but also call for a stringent mechanism so that the boon of personalized and individualized communication does not become the bane in the face of mounting vested interests and rising numbers of scamsters.

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An Operational Approach To Crop Forecasting: The Case Of Jisl

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Piyush Shah

INTRODUCTION

My statistician friend and colleague working for Jain Irrigation Systems Ltd (JISL), approached me and told me that Mr Bhanvarlal Jain, the Chairman of the group would like to meet me in Jalgaon, Maharashta, where their plant and head office is located to discuss certain issue concerning their operations. I met Bhanvarlalji and he said:

"Professor you are a management consultant with Economics cum Statistics background. I want your help in solving our problem. We have just entered the food processing business with export in mind. Our key concern is the judicious purchase of our raw materials, which are subject to high price fluctuations, not only year-to-year but also and more so within a year. Can you help us develop an operational method of crop forecasting so that we can project the likely price pattern in the future? We are interested to begin with in two crops: white onions and mangoes."

JAIN IRRIGATION SYSTEM LTD (JISL)

JISL is a agribusiness firm located in Jalgaon and has interest only in certain restricted areas where it purchases white onions and mangoes for processing them for export market. We developed an operational method of crop forecasting which has helped JISL to predict both quantity and price at which it can source mangoes and white onions and strengthen the contract farming practices with Farmers of these two crops in Maharashtra.

(a) White Onion

Objectives

A survey is conducted by the Business Statistics Group of JISL every year. The objectives of the survey are (i) to estimate the crop size as compared to previous year (Area, Yield per Acre and Total Production), (ii) to study likely arrival pattern in the onion mandies (markets), total and month-wise and (iii) to gauge price expectations by the farmers. My role was restricted to giving them the route sampling methodology, which I had used extensively in HLL.

AREAS CHOSEN FOR THE SURVEY

White onions are purchased by JISL in areas close to its processing plant in Jalgaon, Maharashtra State, to minimise the transport cost of raw material. Normally white onions are purchased by JISL

in three areas close to the plant: Dhule, Manmad and Yeola mandies in North Maharashtra; Nagpur and Malkapur mandies in Vidarbha; and Bhavnagar, Mahua and Rajkot mandies in Gujarat.

HARVESTING PERIOD

North Maharashtra has two peak harvesting months, November (Kharif crop) and April (Rabi crop). Vidarbha has one peak harvesting month, April (Rabi crop). Gujarat has peak harvesting months,January – March (late Kharif crop). A major market arrivals follow soon after the harvest and peak purchases by JISL are also the same time. Onion surveys are therefore planned during harvest months given above.

PRICE PATTERN

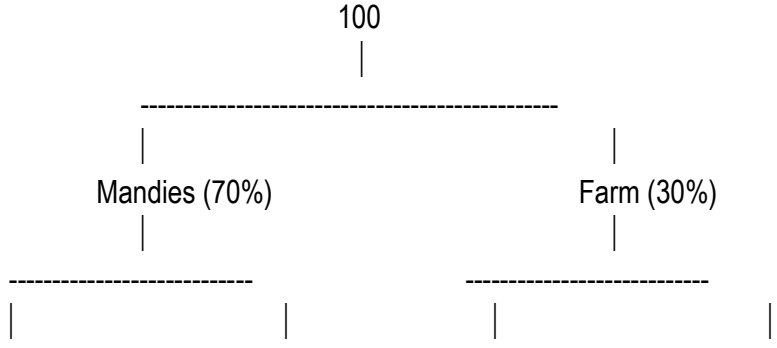
Analysis of white onion prices and their arrival patterns have been examined and it was found that the prices slump sharply, if arrivals peak up and vice versa, prices rise sharply when arrivals dry up.

PLACE OF SALES

In North Maharashtra and Gujarat, about 70 % sales take place in mandies, whereas in Vidarbha only 55 % of the produce is sold in the mandies. The rest of the produce is picked up by the commission agents or directly by the onion processing plants, on the farm itself.

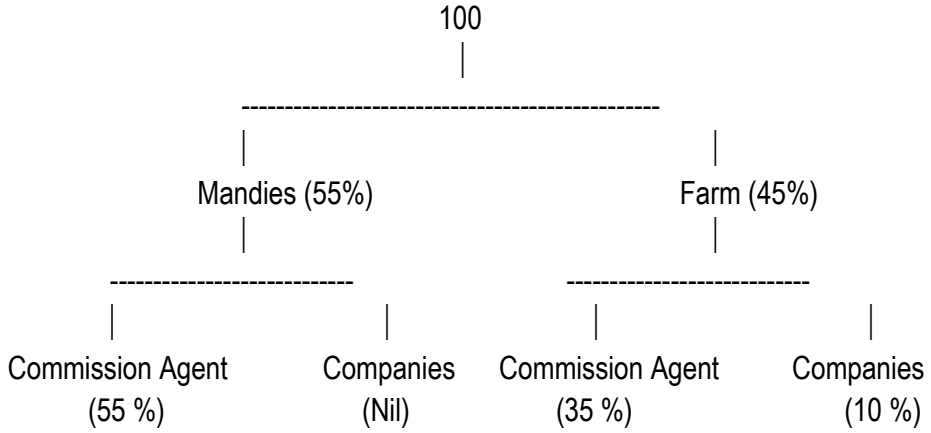
TO WHOM THE SALES TAKE PLACE?

North Maharashtra and Gujarat have similar pattern, namely, 75 % is bought by the Commission Agents and 25 % directly by the food processing companies. The companies prefer to buy most of their requirements on the farm itself. The Commission Agents buy 70 % requirement in Mandies, while only 5 % is bought on the Farm.



Commission Agent	Companies	Commission Agent	Companies
(70 %)	(Nil)	(5 %)	(25 %)

In Vidarbha, a different pattern emerges. Only 55 % of the produce is sold in Mandies and the balance 45 % is sold on the farm itself. In Vidarbha there are very few processing industries and their total share of purchase is only 10 %. The rest 90 % is purchased by the commission agents. But unlike Maharashtra and Gujarat, the Commission Agents prefer to buy a significant percentage (35 %) on the farm itself.



WHO ARE INTERVIEWED IN THE CROP FORECAST SURVEYS?

For the JISL survey, in the year 2000, a total of 107 white onion growing farmers in 51 villages were interviewed. In addition Commission Agents and Mandi Officials, in various mandies were also contacted for their opinions on crop prospects, arrivals and prices.

A SAMPLE OF THE AREA AND PRODUCTION FORECASTS (FOR 2000 SEASON)

(Base 1999 season = 100)

	North Maharashtra	Gujarat	Vidarbha
Area	71	52	99
Yield Per Acre	106	127	105
Production	75	65	106

In North Maharashtra and Gujrat regions area under white onions was less than last year, due to low prices for onions prevailing last year and also because of late rains. In Vidarbha, sowing were almost same as last year.

However, subsequently the weather conditions were favourable, resulting in higher yield per acre in all the regions, particularly Gujarat. Therefore the total production recovered somewhat. After discounting for pessimistic outlook by the farmers in a bad year, the survey team's observation was that in the area covered, area will be 80 % of the last year and production 85%.

PRICE EXPECTATION

Farmers expect price to be around Rs 400 per quintal in North Maharashtra and Gujarat, where crop is less than normal and Rs 350 per quintal in Vidarbha, where crop is marginally better than last year. However there is a tendency on part of the farmers to exaggerate their price expectations.

FARM PURCHASE AND CONTRACT FARMING

The survey team's recommendation was that JISL should examine the commercial and techno-economic feasibility of these two methods of buying. These methods will improve yield per acre, save the transportation costs and reduce ultimately the per kg purchase price for white onions.

PRICE PREDICTION AND ACTUAL AVERAGE PURCHASE PRICE BY JISL

Predicted (First Survey in December 2000)	Rs 360 (per quintal)
Predicted (Second Survey in April 2001)	Rs 255
Actual Average Purchase Price by JISL (whole Season)	Rs 273

(b) Mango

JISL has a Mango Processing Plant at its factory in Jalgaon, where mango nectar and pulp are produced for export market.

VARIETIES AND GROWING AREAS

JISL's main interest is in processing two varieties of mango, namely,

(i) Alphanso which is grown in Konkan Region of Maharashtra (Ratnagiri and Sindhudurg Districts); North Karnataka (Dharwad and Belgaum Districts) and South Gujarat (Valsad District) if necessary only.

(ii) Totapuri which is grown in Andhra Pradesh (Khammam and Krishna Districts), Tamilnadu (Chittor and Dharmapurai Districts) and Karnataka (Bangalore and Kollar Districts)

These districts were chosen not only because JISL was interested in the varieties grown in those areas but also for the relative proximity of these areas to their plant at Jalgaon, so as ensure minimum transport cost.

SURVEY OBJECTIVES

(i) To estimate the mango production (crop size) in the current year, on the basis of flowering and fruit bearing percentages reported by the mango growers;
(ii) To study the plucking pattern and relate it to the estimated of arrival pattern of mangoes on a time frame and area-wise.
(iii) To estimate growers perception of likely price they expect to get during the season.

RESPONDENTS

The survey is conducted among mango growers and also among traders in mandies. Also Mango Research Centres in the various regions were visited to cross check on weather conditions and its impact on crop size and quality as reported by the growers.

Sample Size

For Alphanso: 57 growers
For Totapuri: 42 growers

Plucking Season

For Alphanso, the flowering season is generally in the months of February/March and the plucking starts in April/May. The needy growers may start plucking earlier, say by end-March only. The season is over before the break of the monsoon in early June.

For Totapuri variety, plucking starts in the month of May only and continues in June or even July, depending on weather conditions.

PRODUCTION FORECAST (FOR YEAR 2002)

	Alphanso Variety		
(Base: previous season = 100)	Ratnagiri	Sindhudurg	North Karnataka
% Trees Flowering	96	98	86
% Trees Bearing Fruits	61	33	47
% Production Expected	81	42	105

There was a bumper crop last year; hence it is not surprising that the crop is not so good. Further weather conditions were adverse in Sindhudurg with cloud cover and partial rains at critical stage of growth.

Totapuri Variety (Base: previous season = 100)	Andhra Pradesh	Tamilnadu/Karnatak	Total
% Trees Flowering	72	32	52
% Trees Bearing Fruits	58	62	60
% Production Expected	35	28	31

There was a bumper crop last year; hence it is not surprising that the crop is not so good this year as compared to the last year. Further weather conditions were adverse in Tamilnadu/Karnataka region with cloud cover and partial rains at critical stage of growth.

Where the Sales Take Place?

In Konkan and South Gujarat, system of farm purchase by the trade prevails; whereas in North Karnatak, growers prefer contract sales immediately after flowering when crop prospects become clear and get some advance payment in return.

Alphanso Mango for household consumption is marketed in April and May, through commission agents, wholesale traders, and retail fruit dealers/vendors. Mumbai City alone takes a major share of the produce and acts both as a consuming center and also as a forwarding center to other markets. Industrial sales of mangoes for canning, however, take place later in the month of May. In North Karnataka, most of the produce is sold locally (for household consumption and canning) as there is no surplus left.

For Totapuri variety, 55 % growers sell their crop in mandies to the traders, 43 % sell directly to commission agents at the farm itself and only balance 2 % is sold directly to the food processing companies, in Andhra Pradesh. However in Tamilnadu and Karnataka regions, sales to canning factory are substantial.

Price Expectations

For Alphanso mangoes, the growers were expecting last year (2001 season) an average price of Rs 12 per kg, while in reality they got about Rs 11.50 per kg price, due to a bumper crop. This year (in 2002) the growers are expecting a higher price, say Rs 14 – 15 per kg due to poor crop. The survey team feels that the price may hover around a little less than this, say Rs 13.50 –13.75. Growers generally overestimate a good crop and under-estimate a bad crop.

For Totpuri mango, the price range for previous season (May 2001) was between Rs 1.74 to Rs 2.76 per kg. This season (May 2002) due to poor crop, the price range expectations by the growers

is between Rs 5.60 to Rs 8.90 per kg. The growers, however, are more bullish on price front during shortages in production. The trade also shares the bullish market sentiments The survey team feels that though the prices will not touch the levels expected by the growers, they will be quite high as compared to last season's prices, which were abnormally low.

FARM PURCHASE AND CONTRACT FARMING

Over 75 % of the growers in Ratnagiri area are ready to enter into a contract with JISL, before beginning of the season. In north Karnataka almost all the growers have sold their mango trees to commission agents even before flowering.

Totapuri growers are not in favour of contract farming; they prefer ready sale of the produce on cash basis or advance payment terms.

Factors affecting choice of Global vs. Local Apparel Brands: An Empirical study in Indian Context

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INTRODUCTION

Brands are important for both consumers and companies. They serve as indicators of quality and authenticity (Aaker, 1994). In a competitive marketplace brand names can provide equity and a point of differentiation (Murphy, 1990) from competitors, and are often the primary capital of many businesses (Motameni and Shahrokhi, 1998). Understanding brands and consumer relationships is vital for any business seeking to improve its competitive advantage in the marketplace (Berry, 2000). Globalization has pragmatically increased consumers around the world to develop preferences (Yip, 1995). It has also led to the availability of alternative choices of local and global brands.

The Indian textile and apparel industry is the second largest global exchange earner for the country. Indian apparel market is estimated to grow at a compounded annual growth rate of around 13 percent from Rs 885 billion in 2007 to Rs 1,637 billion in 2012 (Crisil Report, 2008). With increased globalization and the opening of bilateral trade agreements with other countries, India's market presents opportunities for both domestic and global retailers (Fernandes et. al., 2000, Bharadwaj et. al., 2005). Hence, it is important to understand the purchasing intention as well as the perceptions that Indian consumers hold with respect to global and local brands.

In the case of apparels, it is seen that brands demonstrate important symbolic meaning that go far beyond the basic functionality (Auty and Elliot, 1998) and consumers use apparel brands as a primary means of symbolically constructing and communicating their personal and social identity (Polhemus, 1994, Mullarkey, 2001). Accordingly global brands are expected to become more popular in India with jeans, T-shirts and skirts becoming the norm for college students and working woman. While several international apparel companies have successfully launched their brands like Lee, Wrangler and Nautica in India (Mozumdar, 2006), their presence is relatively small in the overall market.

Anholt (2000) argued that since consumers in developing countries are becoming wealthier and better informed with foreign brands (e.g. Polo, Gap, and Guess), they are more sensitive to what the brand offers, how it speaks to them. This appeal is stronger in developing countries like India where higher income disparities and status mobility exist (Kottak, 1990). Besides, consumers in developing countries, wishing to lead a life similar to western cultures, seek to emulate Western practices by purchasing foreign brands (Batra et al., 2000; Kinra, 2006). In increased competitive

environment, retailers must understand how and why consumers make choices between foreign and local brands. Studies on consumer attitudes towards local and global brands are limited to consumers from U.S and U.K and more recently China (Beaudoin et. al., 2000; Wang et. al., 2004). There exists considerable gap in the existing literature on consumer preferences for global brands over the local brands as to date few studies have focused on this aspect. This study aims at bridging this gap and increasing understanding of Indian consumers' brand choice behaviour with respect to a global and local apparel brands.

The research objectives for this study are:

1. To determine important factors affecting purchase of apparel brands.
2. To understand the factors influencing purchase of global vs local apparel brands.

2. Factors affecting purchase of apparel brands

Extrinsic factors affecting purchase of apparel brands

2.1 Perceived quality

Aaker (1991) defined perceived quality as customer's perception of the overall quality or superiority with respect to its intentioned purpose relative to alternatives. Objective quality refers to the actual technical excellence of the product that can be verified and measured (Monroe & Krishman, 1985). In contrast, perceived quality is the consumer's judgment about a product's overall excellence or superiority of product (Zeithaml, 1988) that includes both tangible and intangible characteristics. It may also include performance, features, reliability, conformance, durability, serviceability and aesthetics. Individuals interested in clothing tend to pay more attention to physical properties and features of the clothing that include quality of the garment (Kaiser, 1998). Seen from the apparel marketing angle, Yoon and Kijewski (1997) point out that the quality of apparel products is associated with the degree to which it fills the needs of the consumer.

Study by Zain and Yasin (1997) identified perceived quality as an important evaluation criteria for several categories of products such as cars, dresses/shirts, pants, shoes, cameras, televisions, refrigerators and radios. When consumers perceive a brand to be of high quality, they are more likely to purchase the brand over competing brands, pay a premium price and choose the brand (Netemeyer et. al., 2004). Brown and Rice (1998) add that the quality of apparel has two dimensions, namely the physical dimension that embraces what the item of clothing is, and a performance dimension indicating what the item of clothing can do. Since the physical properties influence the performance characteristics, consumers select apparel products because of the physical properties that they believe will then bring about the desired performance.

Increasing disposable incomes, urbanization and greater exposure to the different parts of the world has started enhancing Indian consumers' need for good quality apparels. In our study, quality was been cited by many respondents as a guiding factor in purchase of apparel brands. Taking

reference to a statement by one of the respondents during focus group discussion, "Obviously if you are going to buy something in branded apparel you will look for quality as you invest an amount which is comparatively more," it is evident that consumers give importance to perceived quality for branded products. As also highlighted in earlier research (Netemeyer et. al., 2004), Indian consumers are starting to place a greater emphasis on both objective and perceived quality when purchasing apparel brands. This leads to the following proposition:

H1: Perceived quality is an important factor affecting purchase of apparel brands.

2.2 INTERPERSONAL INFLUENCE

The interpersonal influence on consumer behavior is strong when the product category is conspicuous and its ownership or consumption are more publicly visible (Bearden and Etzel, 1982). Consumers often rely on interpersonal relationships for information search or exchange. Clothing brands that serve to communicate social distinctions (e.g. status) reflect consumers' social life, aspirations, and their affiliation (Levy, 1959; Solomon, 1986). O' Cass and Frost (2002) demonstrated significant positive effect between status consumption (clothing brands such as Clavin Klein and Oakley) and susceptibility to interpersonal influence indicating that certain status products may be used for image portrayal to provide entry into certain groups or to fit into different situations.

The involvement of consumers in fashion products such as clothing depends not only on their own perceptions but also on peers' response to their personality and change proneness (Pinheiro, 2008). The relation between clothes and identity is perceived by the consumers from the values generated in various social interactions. Consumers exhibit fashion and lifestyle as an aesthetic way of presenting their personality. People use dresses to express their information to others, to engage in social gatherings and activities and can make a significant place in their social system (Omair, 2009). Hence, clothing is often considered as an opportunity for communicating a new order of identity of a person. In this process there are both cognitive and affective incentives that translate into potential welfare gains (or indifference) for the consumer in a given social and work related environment (Bianchi, 2002).

In their well-known work, Lee et al. (2006) found that consumers often conform to group norms when they purchase apparel brands. This is further reinforced in Lim and Ting's (2010) research on consumption of apparel product that is shown to be affected by opinion of others. Consumer perception of products such as apparel is equally more important in developing countries where interpersonal relationships are of prime importance (Ger et. al., 1993). In their study Sun et. al (2004) found that consumers from collectivist or Asian countries were invariably more family oriented than consumers from individualistic or American countries. The former attached high importance to children, family benefit and family opinion. Understanding the role of interpersonal influence in the Indian context is, therefore, even more important in determining what the consumers' will be purchasing. Accordingly, we propose the following:

H2: Interpersonal influence is an important factor affecting purchase of apparel brands.

2.3 PERCEIVED PRESTIGE

Prestige is a subjective evaluative judgment by status conscious consumers who expect to receive not only tangible benefits like functional value from prestigious brands, but also intangible benefits like social status. A prestigious brand is typically more aggressive on pricing than non prestigious brands (Wiedmann, Hennigs and Siebels, 2009) and wealthier persons are more likely to purchase prestigious brands (Vigneron and Johnson, 1999), which symbolize social status, wealth, or power (Alden et. al., 1999). In general, prestige brands are infrequently purchased, require a higher level of interest and strongly relate to an individual's self-concept. According to Beaudoin et. al. (1998) attitudes toward buying apparel are associated with satisfaction of various needs such as self-image and self-identity.

The prestige value of brands is an abstract concept and brands high on prestige accommodate a wider range of products as compared to brands based on functional value like durability and reliability (Park et. al., 1991). Consumers develop prestige meanings for brands based upon interactions with people (e.g., aspired and/or peer reference group), object properties (e.g., best features), and hedonic values (e.g., sensory beauty) (Vigneron and Johnson, 1999). An apparel brand's image may be a primary means of symbolically constructing and communicating their personal and social identity (Noesjirwan & Crawford, 1982, Polhemus, 1994, Mullarkey, 2001).

Indian urban middle class consumers often acquire new and famous brands for their prestige value. A discussion with students highlighted the importance of prestige along with quality and trust when one of the students' stated "Brand prestige is significant for me as it adds value to my personal and social life." Clearly the reasoning emerging from the literature review applies well to the Indian context. Hence, we propose the following:

H3: Perceived prestige is an important factor affecting purchase of apparel brands.

2.4 COUNTRY OF ORIGIN

Country of origin is defined as the country of manufacturing or where "made in label" was made (Schooler, 1965). The growth of multinational companies and the appearance of hybrid products have blurred the validity of the "made in" connotation, necessitating the need for a universally accepted definition. One such definition is "overall perception that customers form for a particular country and its products based on prior experience with products originating from that country (Roth and Romeo, 1992).

Ahmed and d'Astous (2004) found that Chinese consumers had more positive attitudes towards products from highly industrialised countries such as the USA than from products made in newly industrialised countries such as South Korea. Research done by Patterson and Tai, 1991 for

country of origin effect for apparel products show that consumers from Australia had preference for apparel brands from New Zealand and United Kingdom due to higher quality. In another study Dzidrov, 2010 showed that Bulgarian consumers perceive Macedonia apparel as having overall satisfactory quality implying country of origin effects. Wang and Heitmeyer, 2005 study reveals that country-of-origin preference had a significant impact on Taiwanese consumers' attitudes toward apparel brands. Research by Peterson (2009) shows that country of origin of brands does play a large role when consumers' are making inferences about the quality of an apparel item.

It may be noted that sometimes country of origin perception can encompass an entire country's products. Thus, in one study, Chinese consumers in Hong Kong perceived American products as prestigious, Japanese products as innovative, and Chinese products as cheap (Siu and Chan, 1997). Bilkey and Nes (1982) reviewed the effects of country of origin on product evaluation and summarised that country of origin affects consumer attitudes towards all products from a particular country as well as specific products or brands from that country. In general, country of origin is a critical cue used in the process of acceptance/rejection of products in different world markets. A research conducted by Batra et.al. (2000) in India found that Indian consumers prefer brands having non local country of origin for their high quality and attached social status. The country of origin effect has not been adequately investigated in India for most categories of products. This leads us to the following proposition:

H4: Country of origin is an important factor affecting purchase of apparel brands.

2.5 CONVENIENCE AND AVAILABILITY

It is well recognized that consumer preference for a product depends significantly upon convenience and availability. A number of studies have pointed out that, consumers are influenced by the travel costs of shopping (Craig, Ghosh and Mclaffarty, 1984).

The modern Indian consumer is seeking more value in terms of improved availability and quality, pleasant shopping environment, financing option, return and exchange policies and competitive prices. This has created a rapid growing opportunity for organized, modern retail outlets to emerge in recent years (Kotler, 2006). Brands that are available in nearby or central supermarket tend to retain its buyers. Consequently a manufacturer faces the danger of losing its consumer in favour of another brand which is readily available. It is important to note some contradictory findings in this context. Research done by Rehman et. al. (2011) on the factors affecting consumer's decision making while purchasing shirts has shown that availability does not have significant effect on purchase decision.

During focus group discussion, one of the respondents pointed towards problems faced in shopping at traditional stores "Many traditional stores do not disclose discount schemes offered by companies thinking we are unaware of these offers. By visiting malls we are able to better plan and save money by comparing product brands and offers available." Another respondent stated

"convenient store location and guaranteed availability of brand saves my travelling time and search for the brand." The need to enhance convenience and availability from several studies Goyal and Aggarwal (2009) and Ali and Kapoor (2010) that highlight increasing income levels and dual career families with high disposable incomes. Shukla (2007) and Goyal et. al. (2009) have found that food, grocery, health, beauty, apparel, jewellery and consumer durables are the fastest growing categories of organized retail sector in India.

It is evident that more research has to be done to understand convenience and availability as factors influencing purchase decision of necessity brands. It is proposed here that:

H5: Convenience and availability are important factors affecting purchase of apparel brands.

2.6 EMOTIONAL VALUE

Emotional value is defined as the benefit derived from the feelings or affective states (i.e. enjoyment or pleasure) that a product generates (Sweeney and Soutar, 2001). It is the benefit which one gets by experiencing something new or different (Lee et. al., 2006). Products and brands can provide non-utilitarian benefits such as fun and enjoyable experiences that generate distinct emotional value for consumers (Holbrook, 1986). Batra and Homer (2004) argue that the emotional benefits desired by the consumers from a brand have a greater impact on intentions and actual behaviour (e.g. brand choice) than on brand attitudes. Clearly emotions play a key role while purchasing products. A glimpse into supermarkets and advertising campaigns reveals that consumers make buying decisions based in part on their feelings and emotions about particular brands (McEwen, 2004). According to McEwen (2004) emotional brand connections are not only reserved for atypical brands such as sports car and perfumes, but for any company that plans and hopes to compete in the market.

Research by Shaheen (2004) showed that perceived quality of apparel brands and emotional value that they generate had significant impact on purchase intention. In the apparel market, the functional benefit of the product can be measured through some variables structured into factors like comfort, safety, duration, service, technology, performance, guarantee (Demir, 2008).

Apparel products thus not only have formal qualities, but also expressive qualities that concern the expression of the feelings. These could be related to inherent human emotional experiences of a specific consumer (as when a specific color provides a feeling of warmth or causes elation) or it could be an acquired association (that green reflects restfulness of nature). At the stage of trying clothes or during wearing, clothing attributes can have a positive or a negative impact on the moods of consumers because there are multi-sensory aspects of clothing (Moody et. al., 2010). Through fashion and clothing, people express their identity. Fashion and dress preferences tell about the type and personality of a person (Rathnayake, 2011). Emotional factors mentioned in the literature review are clearly of great importance in the Indian context leading us to the following proposition:

H6: Emotional value is an important factor affecting purchase of of apparel brands.

2.7 BRAND LOYALTY

One of the most crucial goals for any marketer is to create "customer brand loyalty" through which brands can obtain competitive advantage (Kotler, 1984). Brand loyalty is defined as the attachment that a customer has to a brand (Aaker, 1991). Wilkie (1994) defines brand loyalty as "a favourable attitude toward, and consistent purchase of, a particular brand." Such a characteristic has both a behavioural and an attitudinal perspective. From a behavioral perspective, it is defined as the degree to which a buying unit, such as a household, concentrates its purchases over time on a particular brand within a product category (Schoell and Guiltinan, 1990). From an attitudinal perspective, brand loyalty is defined as "the tendency to be loyal to a focal brand as demonstrated by the intention to buy it as a primary choice" (Oliver, 1997). This definition suggests that purchase intention is related to and reinforces brand loyalty. Oh and Fiorito (2002) identified brand loyal customers in clothing through their buying behavior, self image and demographics and concluded that perceived status, attractiveness, fashionability and brand awareness were important criteria for brand loyal customers. Hence, the following proposition:

H7: Brand loyalty is an important factor affecting purchase of apparel brands.

INTRINSIC FACTORS AFFECTING PURCHASE OF APPAREL BRANDS

2.8 FITTING

Fit may be defined as the way a apparel item conforms to the body (Workman & Lentz, 2000) or the relationship between the apparel item and the body (Ashdown & Delong, 1995). A study by Kim and Damhorst (2010) supported the contention that fit and size of the garment are main concerns of the consumers while purchasing apparels. Research by Miller et. al. (2005) also found that fit was perceived as an important apparel attribute by consumers. Wu and Delong (2006) in their study on Chinese perceptions of western-branded denim jeans identified fit and comfort as the main attribute affecting consumer purchase perception.

The above studies on apparels clearly indicate the need for fit well apparels regardless of the brand or price features. It also indicates that consumers have definite preferences in terms of fit of apparel products. Thus we propose:

H8: Fit is an important factor affecting purchase of apparel brands.

2.9 DESIGN

Design is the visual appearance of a product and includes line, shape and details affecting consumer perception towards a brand (Frings, 2005). Generally branded apparel tend to have their own distinct designs and package that attract loyal consumers. In the absence of any rational

consideration designs often set apart branded apparels from non-branded ones and fashion conscious public repeatedly purchase products from stores that have latest brands and designs.

A study (Duff, 2007) in the niche market for women's cosmetics showed that cosmetics buyers were becoming more fashion conscious and were demanding products with more attractive design including designs for different occasions. New and trendy design is a commonly mentioned criteria influencing both male and female consumers. Findings by Miller et. al. (2005), Wu and Delong (2006) and Dickson et. al. (2004) showed that apart from fit, fabric and size, the choice of specific design also influences the choice of garments. Since, fashion conscious consumers are generally aware of new designs, changing fashions, and attractive styling (Sproles and Kendall, 1986); design plays an important role in affecting purchase process and ultimate apparel brand choice. Based on the above observations we can propose that:

H9: Design is an important factor affecting purchase of apparel brands.

2.10 COLOR

The color scheme of a garment is another characteristic that satisfies stated or implied needs of consumers and hence plays a crucial aspect in garment selection (Bevlin, 1997). According to Frings (2005), consumers relate personally to colour, and could select or reject a fashion because of colour. If the colour does not appeal to them or flatter their own colour, they will reject the fashion. Findings from Miller et. al (2005) indicate that color was equally important along with other attributes in evaluating apparel product. Moreover, apparel brand choice depends upon its color durability that increases the life of the product. Hence a distinct color combination and color fastness of apparel brand can greatly enhance purchase likelihood. Therefore we propose:

H10: Color is an important factor affecting purchase of apparel brands.

2.11 FABRIC QUALITY

Fabric is an important intrinsic factor that can influence the aesthetic appearance as well as the physical comfort of a garment. Tselepis and Klerk (2004) highlighted the importance of fabric along with design and size that influenced people's choice of clothes. Dickson et. al. (2004) showed that fabric was the second most influential attribute for the consumers interested in buying apparel brands. This is also supported by the study of Wu and Delong (2006). Accordingly we propose that:
H11: Fabric quality is an important factor affecting purchase of apparel brands.

INTRINSIC FACTORS AFFECTING PURCHASE OF GLOBAL VS LOCAL APPAREL BRANDS

In a comparative study between Chinese and Indian consumer on foreign apparel brand Jin et. al. (2009) shows that fitting and stylish designs are one of the main parameters defining quality and preference for foreign brands. A study by Lee et. al. (2010) showed that Indians perceive US brand to be of higher quality due to high durability and reliability as apparel brands compared to local brands.

A study by Wang and Heitmeyer (2005) showed that Taiwanese consumers gave higher evaluation scores for US-made apparel than Taiwan-made apparel on eight of the thirteen apparel attributes. The mean differences of the eight apparel attributes: care instruction label, colour, quality, apparel fibre content, fashionableness, attractiveness, brand name and comfort were significant, meaning that Taiwan consumer had a more positive attitude toward US-made apparel than domestic made apparel for these apparel attributes. The above extant literature review leads us to the following hypotheses:

H12: Global apparel brands are perceived higher on fitting by consumers than local apparel brands.
H13: Global apparel brands are perceived higher on design by consumers than local apparel brands.
H14: Global apparel brands are perceived higher on color fastness by consumers than local apparel brands.
H15: Global apparel brands are perceived higher on apparel fibre content by consumers than local apparel brands.

2.16 PERCEIVED QUALITY

Kinra (2006) has investigated consumer attitudes in India towards local and foreign brands and has found that the quality of foreign brands was perceived to be generally higher and superior to local brands. Most consumers also associated greater accessibility of foreign brands in the Indian market with better quality at lower prices.

The results of the study by Opoku and Akorli (2009) showed that superior quality and consumer taste are the two most important reasons for the Ghanaian consumers' preference for foreign products such as apparel. This also confirms the findings of Kumar et. al. (2009) who investigated Indian consumers' purchase intention toward a United States versus local brand and found that attitudes toward American products positively affect perceived quality and emotional value for a U.S. brand while this effect was negative in the case of a local brand.

H16: Global apparel brands are perceived higher on perceived quality than local apparel brands.

2.17 COUNTRY OF ORIGIN

Country of origin is an important differentiating factor in consumer attitudes to foreign and local brand names. The study by Kinra (2006) held that country of origin credibility of foreign brands was a significant factor influencing consumer attitudes and preferences as it was correlated highly with "quality" and "status and esteem".

The results of the study by Opoku and Akorli (2009) suggest that country of origin is more important than price and other product attributes. The Ghanaian consumer holds the 'Made in

Ghana' label in low regard relative to foreign labels. Superior quality and consumer taste are the two most important reasons for the Ghanaian consumers' preference for foreign apparel products.

Cordell (1992) found that U.S. consumers perceive products originated from industrialized countries such as England and Canada of higher quality than those from less developed countries such as Indonesia and Bolivia. Another study conducted by Schooler (1965) in Guatemala revealed that products made in less developed countries were not evaluated as quality products. Consumers were biased for or against products from a less developed country when they were evaluating products made in different, less developed countries. Based on the above explanation we propose that:

H17: Global apparel brands are perceived higher on country of origin by consumers than local apparel brands.

2.18 EMOTIONAL VALUE

Consumer perception toward a foreign brand versus a local brand not only builds on cognitive components but also on affective components that include the emotional value that consumers obtain from fun and enjoyable experiences (Holbrook, 1986).

The results of Kumar et. al. (2009) suggests that consumers have a positive influence on purchase intention for Levi's brand through attitudes toward American products in general. Research by Iyer and Kalita (1997) show that as customer expects high emotional benefit from foreign brand therefore they will purchase that brand to satisfy their emotional needs from the product. Bhat and Reddy (1998) illustrated that possession of foreign brands in developing countries represents status wealth in the society and provides emotional benefits to consumers. Likewise Indian consumers have a favourable rating for foreign brands due to emotional benefits, such as prestige and status associated with them. Bhat and Reddy linked favourable attitudes towards American products in developing countries to high quality of the products as well as the enhanced emotions, status and prestige. Similarly, Lee et. al. (2008) in their study have shown that Mexican college students perceived US apparel brands higher on emotional value thus having higher purchase intention towards it.

In developing countries, individuals associate foreign brands with having symbolic meanings (e.g., wealth and status), which enhances the emotional reward such as a sense of pleasure and happiness upon using these brands (Batra et. al., 2000; Bhat and Reddy, 1998; Kinra, 2006). More specifically, Shen et al. (2002) found that consumers in developing countries such as China, Singapore, and Hungary prefer products from western countries over locally made products because western brands provide more emotional benefits. Based on extant literature review above it can by postulated that:

H18: Global apparel brands are perceived higher on emotional value by consumers than local apparel brands.

2.19 PERCEIVED PRESTIGE

Foreign brands have higher prestige because of their relative scarcity and higher price compared with local brands (Batra et. al., 2000). Along the same lines, Kapferer (1997) suggests that consumers may prefer foreign brands because of associations of higher prestige. According to Dubois and Czellar (2002), Baek, Kim and Yu (2010) consumers are more interested in prestigious brands because of hedonic and social values that particular brands deliver. In addition, certain consumers prefer to buy foreign brands as it enhances their self-image as being cosmopolitan, sophisticated, and modern (Friedman, 1990). Vigneron and Johnson's (1999) framework clearly denotes, it would be acceptable to consider that consumers look for quality by selecting prestigious brands. Therefore, perceived prestige associated with foreign brands provides intangible value to consumers, and consumers tend to reciprocate this value by enhancing their brand loyalty as well as transferring its good image to others through positive word-of-mouth.

Research by Ergin and Akbay (2010) on consumers purchase intention for foreign products in three specific categories (apparel, chocolate and personal care products) in Istanbul shows that prestige is an important factor influencing consumer buying behaviour. The above literature review suggests the following hypothesis:

H19: Global apparel brands are perceived higher on prestige by consumers than local apparel brands.

3. RESEARCH METHODOLOGY

The methods used for this study included extensive literature review together with a) Qualitative research based focus group discussion among college students in Lucknow and b) Quantitative data collection based on questionnaire survey conducted through both online and hard copy method. The questionnaire had two sections: The first situation was designed to obtain factors affecting purchase of apparel brands. The second section comprised questions relating to comparison between global and local apparel brands. The focus group discussion revealed "Jeans" as one of the most popular casual clothing wear among college students. Jeans have extrinsic as well as intrinsic value, in that they are considered to fulfill a purpose outside of the product itself; that of durability, longevity of wear and utilitarian function.

The sample consisted of 545 college students in a variety of majors at State University and Colleges in New Delhi and Lucknow, India during the period of June-August, 2012. The data was analyzed using SPSS version 16.0 for windows and AMOS-4 for establishing reliability and validity of the items.

3.1 MEASURES

For apparel brands, the measures consisted of fit, fabric, color, design, perceived quality, emotional value, brand loyalty, perceived prestige, interpersonal influence and country of origin. The scales were taken from published sources because they have all demonstrated adequate reliability and validity in previous studies. Scale items for country of origin were adopted from Kinra (2001); interpersonal influence from Bearden, Netemeyer and Teel (1989); emotional value from Sweeney (2001); perceived quality from Dodds et. al., (1991); brand loyalty from Yoo et. al. (2000) and perceived prestige from Ergin and Akbay (2010). The scale items for convenience and availability were developed for this study. The scale items for fitting of apparel brand were adopted from Jin et al., (2010) and Patterson and Tai (1991); design from Jin et al. (2010); fabric and color from Dzidrov (2010) and Patterson and Tai (1991). The original item scales from the above studies were rephrased and further modified according to the Indian context.

The respondents were asked to state which factors they considered most important when buying apparel brands on a 5-point likert scale (1 being not at all important; 5 being highly important). They were also asked to evaluate global and local apparel brands by scoring statements provided to them on the questionnaire on a 5-point likert scale (1 being strongly disagree; 5 being strongly agree).

4. RESULTS

The validation of the items was accomplished through confirmatory factor analysis (CFA) and the result of all items is shown in Table 1. The factor loadings obtained for each item is above desired level of 0.5. The statistical test result for apparel product attributes (χ^2 (610) = 1364.525, p<.001, CFI = 0.903, IFI = 0.904, NFI = 0.839, RMSEA = 0.048) are satisfactory. The root-mean-square error of approximation (RMSEA) is below the cut-off criterion of 0.08 (Bentor, 1990). Further the IFI and CFI values of both the samples were very close to the cutoff criteria of .90). The construct reliability is within requirement, i.e. the composite reliability for each multiple item scale exceeds Cronbach's coefficient alpha of 0.6. The assessment of discriminant validity was conducted for all the correlated constructs. A stringent criterion for testing discriminant validity, suggested by Bagozzi and Phillips (1982) is to fix the correlation between two constructs as 1.0 and then employ a difference test for the constrained and unconstrained models. A significantly lower value for the model in which construct correlations are not constrained to unity would indicate that the constructs are not perfectly correlated and discriminant validity is achieved. Our results indicated that with an additional degree of freedom there was an increase in value ranging from 38.845 to 450.896. So our model demonstrated improved model fits when the constructs were separated and hence discriminant validity was achieved.

After testing reliability and validity of multiple items measuring constructs of this study, the multiple items measuring different factors are averaged to obtain different variables (e.g. fit, fabric, color, design, perceived quality, emotional value, perceived prestige, interpersonal influence, country of origin, convenience, availability and brand loyalty) that are subsequently used for ANOVA for

testing hypotheses. The results indicate statistically significant differences among the means of different factors affecting purchase of apparel brands (Table 2).

As seen from Table 2, the means of extrinsic factors i.e. perceived quality, emotional value, perceived prestige, interpersonal influence are higher than country of origin, convenience and availability and brand loyalty indicating higher importance of these factors in purchase of apparel brands, thus rejecting H4, H5 and H7 while supporting H1, H2, H3 and H6. The analysis also supports H8, H9, H10, H11 according to which intrinsic factors affecting purchase of apparel brand are fit, fabric, color and design.

The validation of the items for global and local apparel brands was accomplished through confirmatory factor analysis (CFA) and the result of all items is shown in Table 3 below. The factor loadings obtained for each item is above desired level of 0.5. The statistical test result for global apparel brand (χ^2 (271) = 728.456, p<.001, CFI = 0.928, IFI = 0.929, NFI = 0.891, RMSEA = 0.056) and local apparel brand (χ^2 (271) = 886.512, p<.001, CFI = 0.942, IFI = 0.943, NFI = 0.919, RMSEA = 0.065) are satisfactory. Further the IFI and CFI values of both the samples were greater than the cutoff criteria of .90. In assessing measurement reliability, the composite reliability of each construct should be more than 0.6 for measurement reliability (Table 3). Our results further indicated that with an additional degree of freedom there was an increase in value ranging from 44.011 to 260.768 our model demonstrated improved model fits when the constructs were separated and hence discriminant validity was achieved for global apparel brand constructs. In the similar vein the correlation between the two local apparel brand constructs was set to unity and the value ranging from 14.822 to 78.285 for 1 degree increase of freedom was significant. Thus discriminant validity for the local apparel brand constructs was achieved.

Comparative assessment of factors affecting purchase of global vs local apparel brands For comparative understanding of factors affecting purchase of global vs local apparel brands, paired sample t-test was done for comparing means of fitting, fabric, color, design, perceived quality, country of origin, perceived prestige and emotional value. In Table 4 mean values are indicated on perception of extrinsic and intrinsic factors affecting purchase of global vs local apparel brand. In support of H12, H13, H14 and H15 the respondents perceived the global jeans brand to be higher on intrinsic factors such as fitting, fabric, color and design. While extrinsic factors affecting purchase of global apparel brands as compared to local apparel brands are country of origin, perceived quality, perceived prestige and emotional value, thus supporting H16, H17, H18 and H19.

5. CONCLUSION

Drawing upon the past work on apparel brands (Wu and Delong, 2006; Miller et. al., 2005; Dickson et. al., 2004) this study supplements the knowledge about factors affecting purchase of apparel brands with the findings that fit, fabric, color, perceived quality, design, emotional value, perceived

prestige, interpersonal influence and country of origin are important factors affecting purchase of apparel brands. The study also shows that convenience, availability and brand loyalty are least important factors.

The strong impact of intrinsic factors signals the fact that Indian consumers determine the performance of jeans through their 'quality', better fabric and 'fitting' aspects, suggesting that Indian consumers will be satisfied with jeans that have superior quality in terms of durability and colorfastness and jeans that have perfect fitting in terms of waist and length. These findings corroborate earlier findings (Wu and Delong, 2006; Miller, 2005; Dickson et al., 2004) of consumers evaluation criteria for purchase of apparel brands.

The significance of emotional attachment suggests that consumers view the brand as being part of themselves and reflecting who they are (Park et al. 2010). The significance of factors interpersonal influence and perceived prestige indicates that teenagers have a natural inclination to spend and embrace products that promote a lifestyle that they can associate with their peers. It reinforces the view that Indian youth is becoming increasingly fashion conscious and imitate by observing one another. Through selection of branded products, they are projecting their images as being trendy, cool or classy. Interestingly, it is also seen that convenience, availability and brand loyalty are the least important factors in purchase of apparel brands. This finding suggests that the young consumers might seek different brands of jeans to experience variety and to go with fashion change. They may have a preference for a particular jeans brand, yet they might not always be loyal toward that brand. The findings further suggests that convenience and availability are not an issue affecting purchase intentions. With the opening up of multinational apparel stores across different parts of the country and ease of finding apparel brands according to taste.

The findings from the comparison of global and local consumers' evaluations of apparel product attributes show that Indian consumers are highly brand conscious. It is also evident from the analysis that perceived quality, country of origin, perceived prestige and emotional value attachment are important extrinsic factors affecting purchase of global apparel brands. The factor of prestige in the purchase of global apparel brands indicates enhanced self esteem and greater confidence through the purchase of prestigious brand names. Possession of global brands is being regarded by youth as a status symbol and a means to identify with a particular social group. The high emotional value attachment indicates happiness and joy in wearing global brands among Indian youth. It highlights the increasing western influence through mass media and foreign exposure and the need among the youth in India to associate themselves with changing fashion and to keep themselves updated with current market trends.

Perceived quality in the form of durability and reliability is yet another important criterion in evaluating the performance of jeans. The long lasting capacity of the apparel item to keep its appearance and structure while being used frequently is one of the primary motive of the Indian youth for buying global jeans brand.

As regards intrinsic factors affecting purchase of global vs local apparel brands, the results show that global brands are perceived higher on fit, fabric, color and design by the consumers. In the consumers' perception, fit of global jeans brands exceeded that of local brands. Here fit reflects jeans with accurate length, waist and hip size that encourage easy movement while sitting or walking. Color durability and scheme also affects purchase of global jeans brands. Indian consumers regard qualities such as non-shrinking and color patterns as important jeans attributes. Also the consumers prefer jeans brand with comfortable fabric, suitable for all types of weather conditions. The study reflects that global jeans brand with unique and trendy designs including pocket design enhances Indian consumers' satisfaction.

As expected, the results show that country of origin plays an important cue for purchase of global apparel brands. Since purchase of clothing forms a part of fashion statement, country of origin of clothing matters for Indian youth. For example, apparel brands originated from Italy are perceived as fashionable and high quality thus giving importance on country of origin of the brand.

6. IMPLICATIONS AND LIMITATIONS

The empirical findings of the study provide valuable strategic implications for firms operating in India. Foreign brand apparel companies seeking business in India can utilize the results of this study to effectively plan marketing strategies for the Indian market and similar developing countries. This study provides important pointers to the quality and variety in Indian garment to satisfy the desire of customer. Intrinsic factors such as fitting, fabric and color are the most important criteria affecting purchase of apparel brands for Indian college students. Therefore apparel companies should give additional effort to provide correct fitting, better fabric quality, design and color scheme garments to the Indian consumers. Companies should specifically utilize peer influence in promotions aimed at encouraging product selection among youths. Furthermore the advertisement should be emotionally appealing and campaign must communicate that their products have standardized quality and one will feel comfortable by using their products. In order to develop strong brand perception and image the companies should also focus on meeting consumers' symbolic needs of like esteem, status and distinctiveness from apparel brands apart from other more tangible benefits.

It is worthwhile to mention here that a major limitation of the study is restriction of the sample to college students only. Future research should test the model involving consumers across all age groups to strengthen and generalize the findings of the study. This study can also be replicated for different product categories in order to understand whether these factors differ across different product categories or not.

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Table 1: Summary of descriptive statistics and confirmatory factor analysis results of extrinsic and intrinsic factors affecting purchase of apparel brands

Factors affecting purchase of apparel brands	Factor Loading	CR[a]
Perceived Quality		.682
This apparel brand is very durable.	0.566	

This apparel brand is very reliable.	0.707	
This apparel brand is of high quality	0.669	
Interpersonal Influence		.813
Observing what your friends are buying to ensure that you are buying the right apparel brand	0.663	
Seeking your friends' advice regarding which apparel brands to buy	0.730	
People around you encouraging you to purchase this apparel brand	0.759	
Achieving a sense of belonging by buying the same apparel brand as your friend	0.644	
Gathering information from family about this apparel brand before you buy	0.619	
Perceived Prestige		.782
Having this apparel brand provide status/prestige in the society	0.595	
Having this apparel brand is a sign of prosperity	0.719	
Having this apparel brand increases your respectability	0.764	
Having this apparel brand influences other people's perception of you	0.604	
Country of origin		.749
Looking for Made in …..label when purchasing this apparel brand.	0.539	
Looking for the place of manufacture of this apparel brand	0.800	
Awareness of the place of manufacture of this apparel brand	0.805	
Emotional Value		.754
This apparel brand tends to be the one that you enjoy	0.595	
This apparel brand tends to be one that you feel comfortable using it	0.710	
This apparel brand make you feel good	0.733	
This apparel brand is the one that you would feel relaxed about using	0.603	
Brand Loyalty		.616
Not buying another apparel brand if this brand is unavailable	0.591	
This apparel brand is your first choice among competing apparel brands	0.717	
Buying the same apparel brand since last few years/months	0.670	
Loyalty towards this apparel brand	0.717	
Convenience and Availability		.733
This apparel is easily available	0.647	
This apparel brand is available in the nearest shop	0.633	
This apparel brand is available locally	0.773	

Fitting		.660
Fitting of this apparel brand is excellent	0.630	
This apparel brand fits you well	0.686	
This apparel brand is available in all size and fitting	0.597	
Design		.694
Designs of this apparel brand are excellent	0.678	
This apparel brand offers unique designs	0.713	
Designs of this apparel brand are trendy	0.581	
Color		.687
This apparel brand has excellent color scheme.	0.590	
Color combination of this apparel brand is excellent	0.723	
Colors of this apparel brand are durable	0.641	
Fabric		.648
Fabric quality of this apparel brand is excellent	0.566	
Fabric of this apparel brand is comfortable to wear	0.710	
Fabric of this apparel brand is quite elastic	0.607	

Note: [a] Composite Reliability

Table 2: ANOVA results for factors affecting purchase of apparel brands

Factors	Mean (μ)	F	Significance
1. Fit	4.49	267.906	0.000*
2. Fabric	4.42		
3. Color	4.42		
4. Perceived Quality	4.34		
5. Design	4.33		
6. Emotional Value	3.75		
7. Perceived Prestige	3.70		
8. Interpersonal Influence	3.42		
9. Country of origin	3.21		
10. Convenience & Avail.	3.10		
11. Brand Loyalty	2.89		

Note: * $p < 0.001$

Table 3: Summary of descriptive statistics and confirmatory factor analysis results of global vs local apparel brands

Factors	**Global Apparel Brand**		**Local Apparel Brand**	
Measurement item	Factor Loading	CR[a]	Factor Loading	CR[a]
Perceived Quality		.687		.830
This apparel brand is very durable.	0.549		0.767	
This apparel brand is very reliable.	0.710		0.810	
This apparel brand is of high quality	0.685		0.785	
Perceived Prestige		.853		.853
Having this apparel brand provide status/prestige in the society	0.788		0.746	
Having this apparel brand is a sign of prosperity	0.813		0.819	
Having this apparel brand increases your respectability	0.765		0.782	
Having this apparel brand influences other people's perception of you	0.713		0.735	
Country of origin		.820		.790
Made in…label when purchasing this apparel brand.	0.843		0.768	
Looking for the place of manufacture of this apparel brand	0.813		0.797	
Awareness of the place of manufacture of this apparel brand	0.683		0.682	
Emotional Value		.770		.888
This apparel brand tends to be the one that you enjoy	0.605		0.779	
This apparel brand tends to be one that you feel comfortable using it	0.673		0.781	
This apparel brand make you feel good	0.718		0.854	
This apparel brand is the one that you would feel relaxed about using	0.731		0.852	
Fitting		.690		.822

Fitting of this apparel brand is excellent	0.619		0.761	
This apparel brand fits you well	0.750		0.825	
This apparel brand is available in all size and fitting	0.617		0.766	
Design		.702		.838
Designs of this apparel brand are excellent	0.724		0.805	
This apparel brand offers unique designs	0.629		0.810	
Designs of this apparel brand are trendy	0.629		0.771	
Color		.685		.834
This apparel brand has excellent color scheme.	0.624		0.771	
Color combination of this apparel brand is excellent	0.624		0.801	
Colors of this apparel brand are durable	0.698		0.804	
Fabric		.694		.835
Fabric quality of this apparel brand is excellent	0.598		0.765	
Fabric of this apparel brand is comfortable to wear	0.717		0.817	
Fabric of this apparel brand is quite elastic	0.661		0.796	

Note: * $p < 0.001$, [a] Composite Reliability

Table 4: Paired sample t-test between Global and Local Apparel Brand Attributes

Items (Global vs Local)	Mean	Significance
Fitting (Global)	4.45	0.000*
Fitting (Local)	3.06	
Fabric (Global)	4.38	0.000*
Fabric (Local)	3.02	

Color (Global)	4.32	0.000*
Color (Local)	3.00	
Design (Global)	4.34	0.000*
Design (Local)	3.04	
Perceived Quality (Global)	4.36	0.000*
Perceived Quality (Local)	2.92	
Country of Origin (Global)	3.59	0.000*
Country of Origin (Local)	2.82	
Perceived Prestige (Global)	3.99	0.000*
Perceived Prestige (Local)	2.79	
Emotional Value (Global)	4.30	0.000*
Emotional Value (Local)	2.94	

Note: * $p < 0.001$

A Study of Factors at Bank Level Affecting the Non-Performing Assets of Bank

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INTRODUCTION

After nationalisation the initial mandate that banks were given to expand their branch network, increase savings rate and provide credit to rural and SSI sector. This mandate was achieved by the banks admirably. Since 1990 the focus was shifted towards asset quality and risk management.

The Narasimham committee recommended that balance sheets should be transparent and comply with international accounting standards. The committee recommended that uniform standards should be adopted for income recognition and bad debt provisioning. Non-performing assets should not be provisioned on accrual basis but on record of recovery. It attributed to the problems faced by the banks in the past.

The classification of an asset as NPA has undergone change over the last few years. Currently, an asset is classified as non-performing if the interest or instalments of principal remain due for more than 90 days.

The NPA is directly linked to the financial performance of the bank and contributes to the credit risk of the banks. An increase in the NPA increases the probability of the credit defaults. The central bank of country requires banks with high NPA to keep a larger base of capital. This erodes the profitability of the banks. Since, NPA's lead to multiple effects, it is mandate to provision for NPAs.

LITERATURE REVIEW:

Thiagarajan (2011) explained the relationship between the lagged NPA (previous year NPA) and current NPA. The lagged NPA had a positive impact on current NPA in both public and private banks. **Dash and Kabra's (2010)** study attempted to ascertain the determinants of NPLs in the Indian banking sector using a panel dataset have explained the relationship of NPA and lagged NPA of One year, which means that today's NPA growth will impact the next year's NPA. The lagged NPA have a positive impact on the current NPA.

Ravi raja and Sarat Chandra dhal (2003) found that the measure of bank size in-terms of assets size have negative impact on NPA while the bank size in terms of capital have positive impact. The measure of an individual bank's size is defined in terms of its total assets relative to the aggregate

assets of the banking industry and/or group, *i.e.,* the ratio of total assets of an individual bank to total assets of banking sector/group.

Abhiman Das and Saibal Ghosh (2007) have found that the expansion of branches in a new geographical area also leads to increase in NPA. The change in number of branches has positively impacted the NPA ratio. They had also explained that the real loan growth rate can impact the NPA as the banks are forced to capture the market share which leads them to compromise on the quality of borrowers. The research had found that the credit growth with lag of 1 year have a positive impact on the NPA. Thus the increase in Credit will impact the NPA one year hence. **Dash and Kabra (2010)** talks about how the lagged growth rate of advances provided by banks affects the NPA but the research didn't find much effect of lagged loan growth rate on the NPA.

Patidar, Dr. Suresh,(2012) have figured out that from 1999 to 2008, the Priority sector lending has significant impact on NPA in Public Sector Banks, whereas in Private Sector Banks, Priority sector lending has no significant impact on NPA. Ranjan and Dhal (2003) with the panel regression model have found have found that exposure to the priority sector lending by banks have impacted the NPA positively. Whereas, **Meenakshi and Mahesh (2010)** have determined that the NPA of priority sector is much higher than the NPA of Non-priority sector after 2005. Among the NPA in Priority sector, the small scale firm forms the major parts of the NPA. The Small scale was always been dominating the NPA in Priority sector. The Agricultural sector is the next contributor of NPA. Gourav Vallabh, Anoop Bhatia, and Saurabh Mishra,(2004) The observation was that NPA decrease with increased priority sector loans to total loans, and public sector loans were affected by macro economic variables at large. But this research didn't take interest rates, inflation rate in consideration.

Dash and Kabra (2010) explained that the loan to asset ratio of banks has high impact on the NPA of banks. The higher the loan to asset ratio the higher will be the NPA (in terms of NPA ratio). **Salas and Saurina (2002)** reveal that real growth in GDP, rapid credit expansion, bank size, capital ratio and market power explain variation in NPLs.

Rajan and Dhal (2003) utilise panel regression analysis to report that favourable Macroeconomic conditions (measured by GDP growth) and financial factors such as maturity, cost and terms of credit, banks size, and credit orientation impact significantly on the NPLs of commercial banks in India. The research found that, in order to reduce the NPA, the credit-deposit ratio (CDR) of bank should have a positive deviation from that of the average of Industry CDR (Banking sector CDR). **Ravi and Sarat** suggests that the bank's CDR ratio should not have a difference of more than 8-13% (Positive) than the industry CDR. The independent variable taken was the difference between CDR of the bank and the CDR of the particular group.

Mayaldri and Sirisha S, (2011) in their research have extracted that the NPA ratio of Nationalised and State bank group banks is higher than the ratio of Private sector banks. Though the Advances

of new private sector banks are higher than old private sector banks, the new private banks are performing well than the old private banks in terms of NPA ratio. It was found that the asset quality of the Indian banks have improved consistently over the years.

DATA COLLECTION & METHODOLOGY:

For the study, 54 banks were selected that included public, private and foreign banks. There are 80 banks in India, since their NPA is not comparable with the NPA of the banks selected. The fifty-four banks selected are:

Table 1:

Bank of Hyderabad	Deutsche Bank AG	Hongkong and Shanghai Bankin
State Bank of India	Standard and Chartered bank	BNP Paribas
State Bank of Mysore	Barclays Bank PLC	Yes Bank Ltd.
State Bank of Patiala	The Dhanalakshmi Bank Ltd.	Tamilnad Mercantile Bank Ltd
State Bank of Travancore	South Indian Bank Ltd.	Ratnakar Bank Ltd.
Allahabad Bank	Nainital Bank Ltd.	Lakshmi Vilas Bank Ltd.
Andhra Bank	Kotak Mahindra Bank Ltd.	Karnataka Bank Ltd.
Bank of Baroda	Karur Vysya Bank Ltd.	Jammu & Kashmir Bank Ltd.
Bank of India	ING Vysya Bank Ltd.	Syndicate Bank
Bank of Maharashtra	ICICI Bank Limited	Indusind Bank Ltd.
Canara Bank	Federal Bank Ltd.	HDFC Bank Ltd.
Central Bank of India	City Union Bank Limited	Development Credit Bank Ltd.
Corporation Bank	Catholic Syrian Bank Ltd.	Axis Bank Limited
Dena Bank	United Bank of India	Vijaya Bank
Indian Bank	Punjab National Bank	Punjab And Sind Bank
Indian Overseas Bank	Oriental Bank of Commerce	

The data of the NPA and variables were collected from RBI database for the year 2011. The study uses cross-sectional data.

Based on the extensive literature review in the field, three variables at bank level are concluded. They are:

- Priority lending by the banks
- Change in advances (2009-10)
- Rural branches of the banks

The NPA of 2011 is the dependent variable. Priority lending by the banks to the priority sector (e.g. agriculture, SME's) has an influence on the NPA level of banks. The RBI made it mandatory for the

banks to lend to the priority sector. The non-repayment of advances or loans of the previous year has a potential to get converted to NPA in the next year. The number of rural branches of a bank affects the NPA level of the bank as there are higher chances of credit default at rural areas.

The paper examines the effect of these variables on NPA using a linear econometrics model. It employs regression modelling to establish a relationship between the dependent variable (NPA) and independent variables (priority lending, test to arrive at a conclusion. Based on the above discussion, the econometrics model equation developed is:

NPA (2011) =ß + ß1(rural_branches) + ß2(advances) + ß3(priority lending)

Y= ß + ß1X1 + ß2X2 + ß3X3

Where X1 stands for rural branches,

X2 stands for advances

And X3 stands for priority lending.

RESULTS AND ANALYSIS:

The dependent and independent variable is subjected to a multiple regression analysis.

Table 2: **Model Summaryb**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.973a	.947	.942	82084.79495	2.306

a. Predictors: (Constant), dummy_foreign, priority_lending, dummy_private, advances, rural_branches

b. Dependent Variable: NPA

A high value of Rsquare signifies a strong relationship between NPA and the three variables. The goodness of fit is explained by Rsquare. The goodness of fit for the model for all the three types of banks is 95% (0.947). The variation in Y by the independent variables is given below:

Table 3: Model		Unstandardized Coefficients	Standardized Coefficients	Sig.
B		Std. Error	Beta	
1	(Constant)	-86154.170	21530.120	.000
rural_branches	104.757	41.000	.239	.014
advances	-.085	.012	-.411	.000
priority_lending	.107	.009	1.089	.000
dummy_privat	63719.277	27753.689	.092	.026

e				
dummy_foreign	69598.197	37761.076	.070	.072

NPAs. When advances increase, NPA decreases by 8.5%. Using the above data the cost efficiency of the banks has been calculated. The banks were put into four categories on the basis of their cost efficiency.

The four categories are:

- Best category
- Second best category
- Mediocre category
- Worst category

Best category: the banks under this category have the highest average cost efficiency. In other words, they have the lowest value for cost efficiency. The average value of rural branches, priority lending and advances is also the lowest.

Table 4: **BEST CATEGORY**

BANK	Y/Y*	rural branches	priority amt	chnge in adv
BNP Paribas	0.005708	0	134705	2773
Nainital Bank Ltd.	0.011437	25	80637	15696
Ratnakar Bank Ltd.	0.011788	25	50943	36933
The Dhanalakshmi Bank Ltd.	0.034921	24	256524	181020
DBS Bank Ltd.	0.039337	3	368140	129235
Yes Bank Ltd.	0.041634	23	903603	979003
City Union Bank Limited	0.054179	34	342077	118821
ING Vysya Bank Ltd.	0.058963	79	804712	175081
Tamilnad Mercantile Bank Ltd	0.064932	49	460359	171592
Lakshmi Vilas Bank Ltd.	0.077381	41	289028	104128
Deutsche Bank AG	0.090251	1	461128	412516

Catholic Syrian Bank Ltd.	0.098293	18	215142	78309
Karur Vysya Bank Ltd.	0.106033	31	562559	303712
South Indian Bank Ltd.	0.106308	63	619783	397501
Indusind Bank Ltd.	0.111081	22	935697	477995
Development Credit Bank Ltd.	0.136035	4	162311	18569
AVERAGE	**0.065518**	**27.625**	**415459.25**	**225180.25**

Second best category: The banks under this category have lower cost efficiency than banks in best category. The average number of rural branches, priority lending and advances has higher value than the banks in best category.

Table 5: **SECOND BEST CATEGORY**				
BANKS	Y/Y*	rural branches	priority amt	advances
Jammu & Kashmir Bank Ltd.	0.176084	241	1027447	212681
Punjab And Sind Bank	0.194742	302	1314102	802376
Indian Bank	0.205232	499	2580435	1074960
Citibank N.A.	0.237216	0	1330594	-326486
Kotak Mahindra Bank Ltd.	0.253603	21	873792	414972
State Bank of Patiala	0.290993	333	1931506	-1405135
Corporation Bank	0.295216	219	2390474	1469040
HDFC Bank Ltd.	0.303178	124	5478123	2694755
Karnataka Bank Ltd.	0.303576	89	623836	262564
Hongkong and Shanghai Bankin	0.309882	1	960427	-411392

State Bank of Mysore	0.310232	214	1174713	-193897
AVERAGE	**0.261814**	**185.7272727**	**1789586.3**	**417676.182**

Mediocre category: the average cost efficiency is low. The banks falling under this category are:

Table 6: **MEDIOCRE CATEGORY**				
BANKS	Y/Y*	rural branches	priority amt	advances
State Bank of Bikaner And Jaipur	0.318251	313	1506097	532568
Andhra Bank	0.324063	410	2357415	1197425
Dena Bank	0.326469	363	1514966	658449
Barclays Bank PLC	0.333926	0	234955	-298532
State Bank of Hyderabad	0.360454	311	2341134	914567
Axis Bank Limited	0.364391	94	4128912	2278418
Allahabad Bank	0.377481	975	3076373	1280311
Standard Chartered Bank	0.398902	0	1297666	406302
Bank of Maharashtra	0.403314	535	1610730	602392
State Bank of Travancore	0.445776	55	1725410	1374580
Federal Bank Ltd.	0.446474	49	1058580	455824
United Bank of India	0.446881	627	1708791	693649
Canara Bank	0.450919	805	6799931	3111523
Central Bank of India	0.457568	1386	4050951	1990029
Oriental Bank of Commerce	0.485514	335	3495856	1498893
Punjab National Bank	0.488128	2034	7863701	3189822
Bank of Baroda	0.503627	1165	5490927	3178388

Vijaya Bank	0.51733	260	1436189	603901
Syndicate Bank	0.556907	785	3217589	887409
Indian Overseas Bank	0.571554	578	3264815	411389
AVERAGE	0.428896	554	2909049.4	1248365.35

Worst category: these banks have the lowest cost efficiency. In other words, their NPA is high. The banks with the highest NPA are:

Table 7: **WORST CATEGORY**				
BANKS	Y/Y*	rural branches	priority amt	advances
Union Bank of India	0.690894	826	4837876	2278107
Bank of India	0.69887	1334	5488306	2558134
ICICI Bank Limited	0.899336	259	5340156	-3710525
UCO Bank	0.911451	801	2408967	1370067
State Bank of India	0.978687	5018	23159787	8941095
IDBI Bank Limited	1	81	4220571	3475738
AVERAGE	**0.863206**	**1386.5**	**7575943.8**	**2485436**

The table 4 to table 7 concludes that lower the number of rural branches, priority lending and advances, higher the cost efficiency. The banks with high NPA have more rural branches, lend more to the priority sector and give more loans. A bank that has no rural branches tends to have less NPA as against a bank with more rural branches. For e.g. State bank of India has 5018 rural branches (table 7) and BNP Paribas has 0 rural branches (table 4). A bank with higher branch size is prone to a higher NPA level. This brings out a question. Public banks and few large private banks (banks in table 7) have branches in rural areas to facilitate easy credit. Is it the reason why these banks have higher NPA as compared to few other private and foreign banks? If so, shouldn't the central bank of the country, RBI do something about the proportion of branches every bank should have in rural areas in order to bring a balance for those banks who are set in rural.

The RBI prescribes to lend 40% of their total advances to priority sector. The priority sector includes agriculture and SME's. The lending to agriculture is 18% and for SME's it is 10%. The banks with the lowest cost efficiency (table 5) or highest NPAs have the highest advances to priority sector when compared with other banks. The priority lending defaults in many cases. The RBI norms have become a burden for many banks. At the same time, the lending to priority sector cannot be neglected as banks are the only source of credit. This brings out another argument.

Financial institutions like NABARD and SIDBI have been set up solely to facilitate credit to agriculture and SME's respectively. It seems the functioning of these institutions is not being effective. And, the responsibility has fallen back to the banks-private and public.

RECOMMENDATIONS:

RBI should revise the functioning of the financial institutions like NABARD and SIDBI to make them more effective for priority sector. According to RBI occasional papers dated march 2010, SIDBI accounted only for 30.08% loans to SMEs and 21.07% loans by NABARD to agriculture. RBI should revive both the institutions from their current debts.

Abolish target-oriented lending to the priority sector. Let the banks decide to whom to facilitate credit. The SME's should adopt the performance culture to receive more credit from the banks. Allow banks to the productive and deserving enterprises.

There should be proportionate rural branches by all banks so that the burden does not fall on only certain banks.

Allocating 40% of lendable resources to the priority sector by every bank should not be insisted upon and freedom to the banks to develop a portfolio of their choice in the interest of improving the asset quality of every bank. Penalty-based system of not meeting priority lending requirements should be replaced with incentive-based system. E.g. faster branch licensing and revising CRR/SLR requirements.

Priority-sector loans should be exempted from income tax of banks.

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Business Analytics- Scenario in India

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INTRODUCTION

Analyst provides an organization, a point of differentiation and an edge to excel. It involves, basically, extraction of useful information from the large amount of diverse data. It enables decision makers to take real time and proactive decisions. According to Davenport, business analytics is the method that involves logical analysis of business data of a company through computation. Earlier in India, the business decisions were taken either on the basis of experience or the gut feeling. With the introduction of business analyst, business decisions are taken on the basis of the facts and enormous pool of data. This has resulted in increase in revenue and reduction in product cycle.

According to Gartner 2011, Business analytics and business intelligence are to going to surpass $8billion in spending per year by 2014. It is growing at the rate of 14.4% per year.

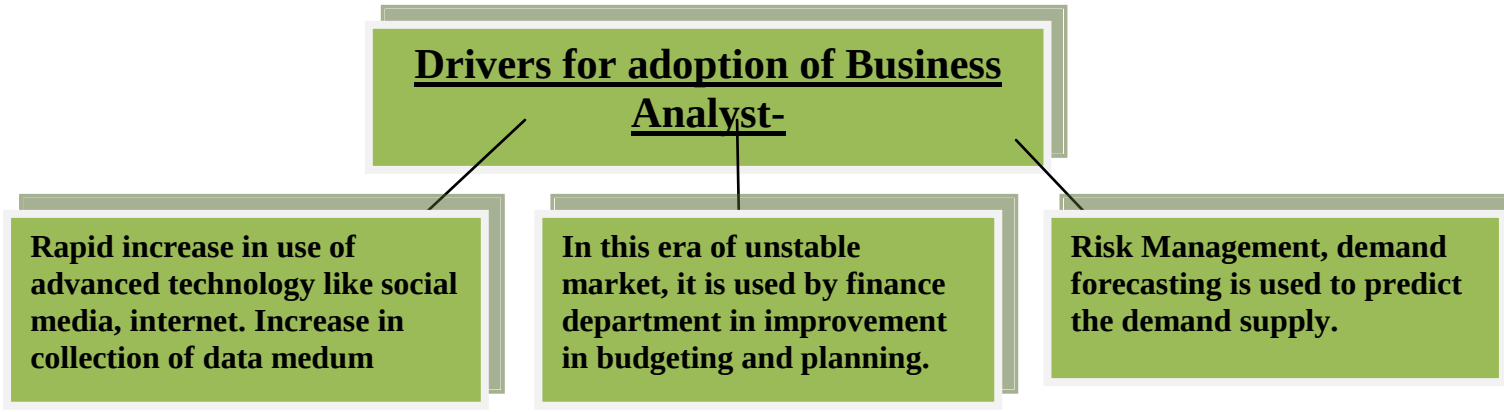
India's progress in business intelligence has seen it accounting for nearly a third of the $17 billion global market for analytics (Kumar, 2008). New analytical software's have been developed which collect, track, analyze and present data which help decision makers. These application and data are used in different categories of analytics such as predictive analytics, marketing analytics, financial analytics, customer analytics, supply-chain analytics, and service analytics etc.

According to Hitachi Consultancy Group, there are two perspectives of business analytics; one is to understand analytics from the organization's point of view involving marketing plans, policies of the company. And developing right schedule for data collection, mining and interpretation and analysis which means that analysis is mainly "looking forward". The second part defines the marketing process as multiple step process from awareness to post sale services. It draws analogy with decision tree with many branches which in turn consist of series of decision trees. This lead to additional challenges and proper utilization of data is the key to success.

TRANSFORMATION STORY-

Risk management, Marketing Analytics, Web Analytics and Fraud detection are some of the components of Analytic Industry. Among them, Risk management is one of the largest components of the analytical industry. And, one of the fastest growing analytical industries is Web Analytics. It has grown at a rate of 20% and above in last few years. Financial crisis in last few years happened as a result of unreasoned assumption and made analytics as an indispensible unit of an organization. In this humongous competition, organization cannot lose in a competition due to uncalculated and intuition based decisions. India is an emerging economy, with increasing purchasing power and domestic consumption. Organizations do not want to lose the competition due to uncalculated decisions. This transformation is also due to rampant adoption of technology e.g. mobile data, internet and social networking sites. Organizations have numerous data sources to pick up data as compared to scenario decade ago. Media and entertainment industry are trying

to build up direct contact with their customers to collect more information which will enable them to build up more efficient model for their company. They are using the information to know the customer preferences deploying business analytics. Internet search engines process unstructured text documents as input for analysis, where as retail industry use structured data stored in relational databases. Retail analytics process both historical and transactional data however search engines process only historical data.



ISSUE AND CHALLENGES-

The rate of adoption of analytics by Indian organization is very minuscule. Very organizations like banking, telecom, media and entertainment industries use business analysts to forecast demand and customer preferences. Real application of analytics has not started yet in Indian companies however certain European and U.S. companies have outsourced their analytical work to many Indian companies. American Express, Citibank, Accenture, Amazon are few companies which have outsourced their analytical services to Evalueserve, EXL, Genpact, Wipro. There is ample amount of opportunities for other industries such as manufacturing and logistics firms to use analytical services to improve the decision making process.

Other issue is poor quality data. Organizations are not able to recognize the difference between the reliable and unreliable data. There are different types of data with different formats. So these companies are not able to process the data accurately and results in fallacious decision making. In some companies, data tampering is one of the pivotal issues. Data available is not integrated and is available to different managers. Instead of it, the organizations should adopt enterprise wide approach. When data is not integrated, it is very difficult for the analysts to apply the data for business analytics. Due to this, the cost of the process becomes very and the ROI decreases.
Another issue is lack of higher educational institutes in India. India has sufficed numerical ability skills and they have to acquire business knowledge and domain expertise. In fact, business schools also have very few Quantitative and analytics related courses. Very few institutes are offering these courses and that too with good quality.

Insecurity also leads to problems in implementing analytical applications. Companies feel insecure in sharing data with the outside analyst. The interaction between external analyst and company executive is on personal basis. Lack of subject knowledge of decision maker makes it more difficult

for the analyst to explain them about the model and results to the decision maker. Therefore, the decisions could be short lived and inconsistent.

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Alternative Goodness of Fit for Continuous Dependent Variable

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INTRODUCTION

1. Why we need an Alternative Goodness of Fit (AGOF) measure?

There are scenarios where standard Rsq algorithm produces results which mislead about true predictive power of underlying model in use. For example this may happen for non-intercept multiple linear modeling (and few other cases) where Rsq might be too high (low) but model fit *may not* be good (bad), also working of the algorithm assumes error distribution is normal. To understand such scenarios let's focus on the individual cases in details.

Cases when Rsq computation might lead to spurious results:

1.1 Rsq can be negative due to unstable algorithm:

In very prelim version of Excel there was some issues with Correl / Rsq calculation. In these instances, through the mathematically impossible values, however, even plausible values can be erroneous. These are caused by using unstable algorithms. In all latest excel versions this problem has been taken care of.

1.2 Rsq can be negative if no intercept model is used: (Ref1)

Rsq values with and without an intercept are not directly comparable. With an intercept, Rsq indicates the improvement of regression over simply representing each value by the mean of all the values. Without an intercept, Rsq indicates the improvement of regression over representing each value by zero. Unless the mean of the data values happens to be zero, Rsq without an intercept will be larger than Rsq with an intercept, but that does not mean that the fit is better.

1.3 Cases when error term/residual don't follow normality benchmarks

Construction and working of the new index does not require normality assumption of error .

1.4 For multiple *non-linear* regressions Rsq is not a very good measure of goodness of fit.

By construction, Rsq works well for linear regression, but for nonlinear regression the concept don't work well. For those situations Generalized Rsq is more suitable to use (Ref2). Whereas the AGOF test statistic does not depend on linearity assumption of predictor relationship.

Note: Rsq don't follow any known distribution with respect to number of observations, whereas AGOF follows an asymptotic relationship with number of obs. Also Adj Rsq can be Negative if a model predicts so poorly that the estimated error variance is larger than the variance of the data. Whereas AGOF can never be negative. The Adjusted Rsq computation we commonly refer to is derived as per "Classical" definition and much better version of Rsq is called "Bayesian adjusted Rsq" which leads to a lower measure of explained variance than the classical adjusted r-square. The classical adjusted r-square could be considered too high, because it does not account for uncertainty in variance. (Ref3)

2. DEFINING GOODNESS OF FIT INDEX:

Alternative Goodness of Fit (AGOF) Index=
{[(IQ Range Difference Percent)/Number of Obs] / [Number of cuts / (Number of Obs - 1)]}
= {[C/n] / [K(n) / (n - 1)]} =[C/K(n)]*(n-1)/n
Where,

Diff :

Difference between Actual & Predicted

IQ Diff:

IQ(Diff>0) – IQ(Diff<0)

IQ range is considered to make sure the difference is not influenced much by presence of extreme values or outlier. 'Scale' is defined as AVG[SUM(Yi/Pred Y)] , if this index is <1 then Over Prediction else Under Prediction. This 'Scale' close to 1 is the desirable value.

Number of Cuts:

Numbers of cuts are defined as *Number of sign change* of variable "diff" post sorted in descending order by predicted value. If number of observation is denoted by 'n' then maximum number of cuts [Let's denoted by k(n)] can be (n-1) . Theoretical possibility of perfect forecast (i.e. Y = Pred Y,) are also counted as 'cuts'

IQ Range Diff Percent:

IQ Diff / ABS IQ Avg,

Let's denoted by 'C', We take IQ Diff Percent instead of simple IQ diff to make our index not affected by scale and origin.

ABS IQ Avg = ABS[(IQ(Diff>0) + IQ(Diff<0))/2] for (IQ(Diff>0) not equal to IQ(Diff<0)
ABS[(IQ(Diff>0) + IQ(Diff<0))/2]+1 for (IQ(Diff>0) = IQ(Diff<0)

Properties:

1. The index is not influenced by Scale and Origin

Due to use of 'IQ Range Difference Percent' as [IQ(Diff>0) – IQ(Diff<0)]/ABS IQ Avg , if Y and hence Predicted Y be multiplied (Scaled up or down by a non-zero constant) or the origin is been shifted (adding or subtracting constant term) then the ratio remains same, hence not influenced by scale.

2. It can be mathematically shown that AGOF is a decreasing function of number of observations

i.e For $n\rightarrow\infty$ $\partial AGOF/\partial n = -Ck'(n)/\{k(n)\}^2<0$

As number of observation increases the number of cuts also increase, hence $k'(n)>0$

3. AGOF reaches its minimum value Zero if numbers of observation are sufficiently large.

For $n\rightarrow\infty$ $AGOF\rightarrow C/k(n)$

For $n=\infty$ $AGOF= 0$

Note:

For infinity large n, numbers of cuts are expected to be large too; theoretical maximum number or cuts can by (n-1)

4. The index has convex curvature and minimum value of AGOF is obtained for $n\rightarrow\infty$

i.e. for $n\rightarrow\infty$ when $\partial AGOF/\partial n = 0$ then $\partial^2 AGOF/\partial^2 n >0$

Note:

For $n\rightarrow\infty$ when $\partial AGOF/\partial n = 0$, it implies $k'(n) = k(n)/(n(n-1))$ which implies

$k''(n)= -2k(n)/(n^2(n-1)) <0$ which is necessary and sufficient condition for $\partial^2 AGOF/\partial^2 n >0$

5. The index does not have any point of inflexion.

i.e. for $n\rightarrow\infty$ when $\partial^2 AGOF/\partial^2 n = 0$ then $\partial^3 AGOF/\partial^3 n =0$

Note:

For $n\rightarrow\infty$ when $\partial^2 AGOF/\partial^2 n = 0$, it implies $k''(n)=2\{k'(n)\}^2/k(n) >0$

Which implies $k'''(n)=6k'^3(n)/k^2(n)$, which together ensures the following

For $n\rightarrow\infty$ $\partial^3 AGOF/\partial^3 n = 0$

6. For $n\rightarrow\infty$ the AGOF index lies between 1 & 0.

Property 3 & 4 ensures min value of the index is 0 and property 1 (Using 'IQ Range Difference Percent') ensures the ratio to be <1

Note: Let IQ(Diff>0)=a , IQ(Diff<0)= -b

IQ(Diff>0) – IQ(Diff<0) = a-(-b)=a+b

ABS IQ Avg = ABS[(IQ(Diff>0) + IQ(Diff<0))/2]+1 = ABS(a-b)/2+1

If a>b then 'C' = (a+b)/[(a-b)/2 + 1] = 2(a+b)/(a-b+2) >2 [As a>1 & b>1]

If a<b then 'C' = (a+b)/[(b-a)/2 + 1] = 2(a+b)/(b-a+2) >2 [As a>1 & b>1]

So AGOF [For $n \to \infty$] = C/k(n) = (a+b)/[abs(a-b)/2+1] / k(n)
We know Numerator is >2 and Denominator k(n) [Number of Cuts], is sufficiently large but $< \infty$
Hence as denominator is larger than numerator the ratio is <1

3. INTERPRETATION:

Rsq value gives "Coefficient of determination" i.e. how good is overall fit. Whereas this AGOF Index reflects more on how close the model fit is along with how good the error correction mechanism of the process is. In ideal scenario 'No of Cuts' (Denominator of AGOF Index) should be high and 'Spread' (Part of Numerator of AGOF Index) should be low.

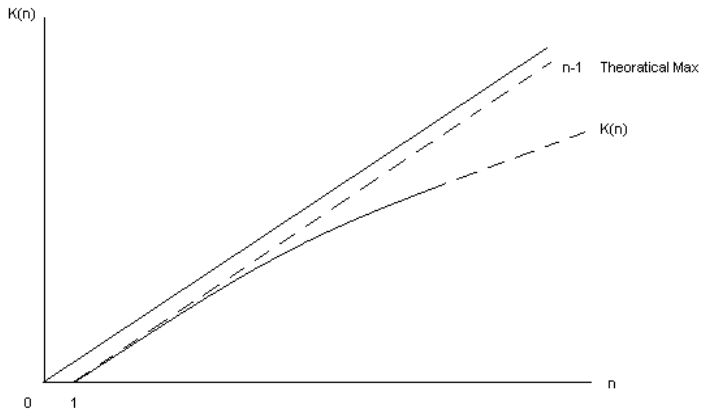
Hence by construction 'Thumb Rule' is:
Rsq: **Higher** is better
AGOF: **Lower** AGOF Index with Scale **close to 1** is better

4. KEY ASSUMPTION(S)

1. From practical sense for real life data, number of observations *cannot* be truly infinitely large hence Cuts 'k(n)' cannot reach to its theoretical maximum (n-1). So we assume if number of observation ('n') is large, then k(n) is also large but significantly less than 'n'.
   Example1 (From one of the test sample):
   'n'=1137, k(n)=438 i.e. Cuts are 38.5% of No. of Observations
   Example2 (From another test sample):
   'n'=61992, k(n)=30451 i.e. Cuts are 49% of No. of Observations
   Example3 (From another test sample):
   'n'=447, k(n)=215 i.e. Cuts are 48% of No. of Observations
2. We assume 'Spread' is not dependent on number of observations ('n').
3. Assumption 1 implies the AGOF index need to be always less than zero and the index is not defined for n=1 as then 'Cuts' cannot be defined.

5.1 PICTORIAL ILLUSTRATION-SPREAD & CUTS:

In this section let's focus on the nature of Cuts [k(n)]. Theoretical maximum of k(n) is (n-1) but in real life data k(n) can never reach to (n-1). It is shown that $k'(n)>0$ and $k''(n)<0$



5.2 Pictorial Illustration-Spread & Cuts:

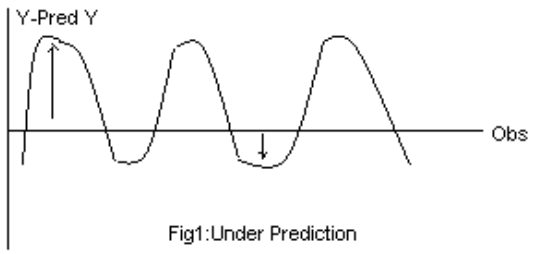


Fig1:Under Prediction

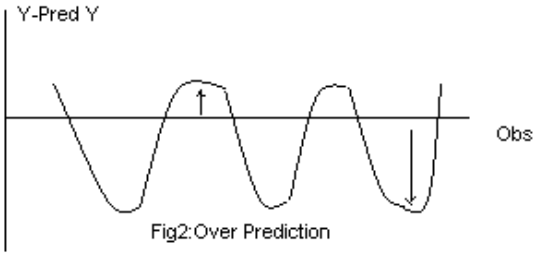


Fig2:Over Prediction

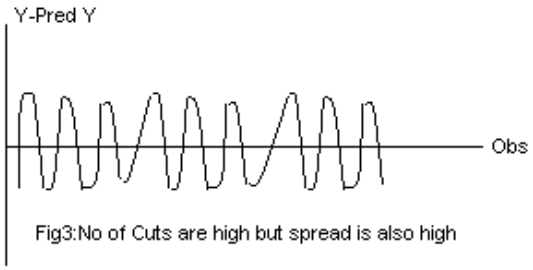


Fig3:No of Cuts are high but spread is also high

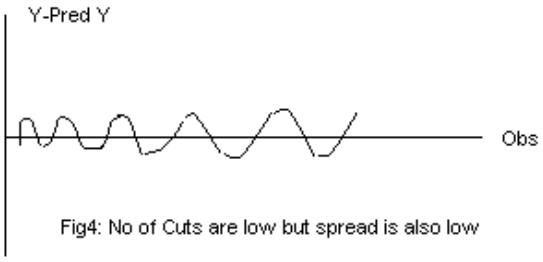


Fig4: No of Cuts are low but spread is also low

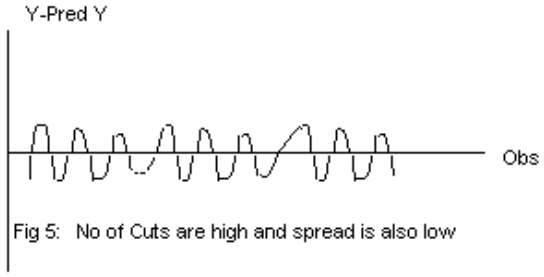


Fig 5: No of Cuts are high and spread is also low

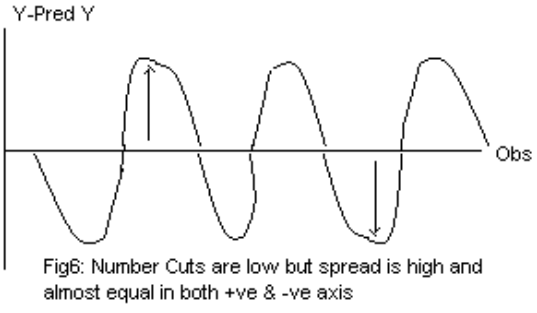


Fig6: Number Cuts are low but spread is high and almost equal in both +ve & -ve axis

Let's consider the above Six cases. Let's difference between Y & Predicted Y is being plotted after sorting the data by Predicted Y.

Fig1: The range of values in +ve axis are much larger than in comparison with –ve axis.
This means at overall or on average Y > Predicted Y, which means 'Under Prediction'.

In other words AVG[Yi/E(Yi)] > 1

Fig2: The range of values in -ve axis is much larger than in comparison with +ve axis.
This means at overall or on average Y < Predicted Y, which means 'Over Prediction'.
In other words AVG[Yi/E(Yi)] < 1

Fig3: This diagram looks much better than Fig1 & Fig2 as it has more number of 'Cuts', which reflects 'Error Correction Mechanism' of the process. Though the numbers of Cuts are high but spread is high in comparison with Fig4

Fig4: This diagram looks better than Fig3 in terms of spread but it has less number of 'Cuts', in comparison with Fig3

Fig5: This is an 'ideal case' where Number of 'Cuts' are high and also spread in both axis are low. More we can trend towards this ideal case is better model as per AGOF index.

Fig6: This diagram shows classic case when AVG[Yi/E(Yi)] is close to 1.
For this case
IQ(Diff>0)=ABS[IQ(Diff<0)] i.e. ABS[(IQ(Diff>0) + IQ(Diff<0))/2]=0,
So, ABS IQ Avg = 1

6. LIMITATION(S):

1. By construction distribution of AGOF follows an asymptotic shape with respect to 'n'. But for the properties discussed the basic assumption as number of observations are too large (theoretically reaches to infinity though in real life it can never happen) the number of cuts increases but always be finite. This assumption on nature of Cuts is a limitation.
2. For very large number of observation the index is majorly dominated by the denominator, hence the index value falls rapidly. This implies the Index works well for relatively *'small'* sample than sufficiently 'large' sample.

Example1 (From one of the test sample):
'n'=1137, k(n)=438 , AGOF=0.0457
Example2 (From another test sample):
'n'=61992, k(n)=30451, AGOF=0.0013
To reduce this impact we can use "log" transformation of the number of cuts to scale down the denominator but that might lead to shoot up the AGOF index above 1.

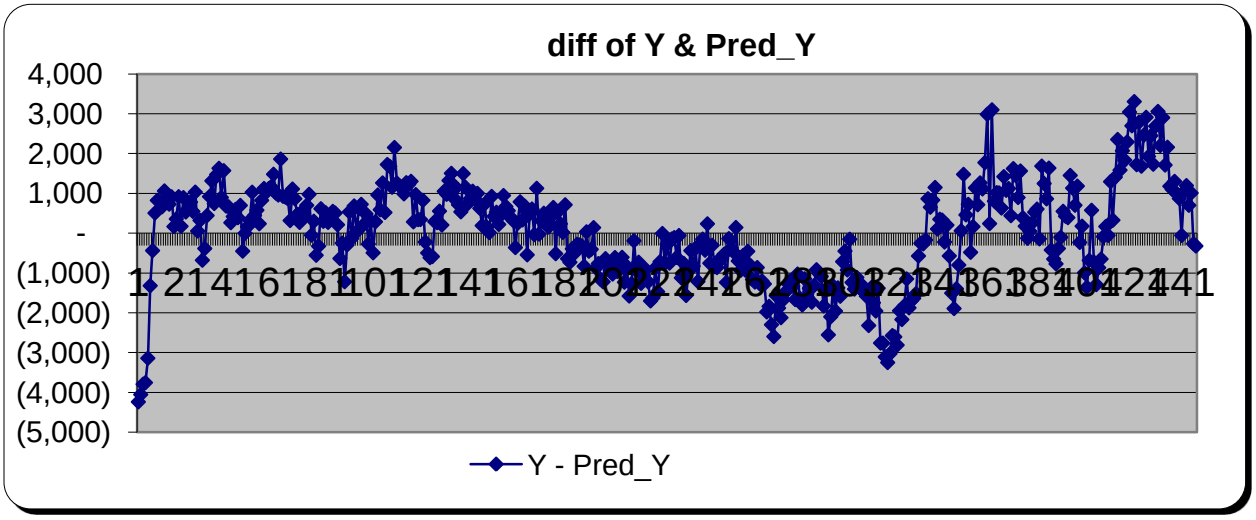
3. It is hard to define a 'permissible range' of AGOF value, like in case of Rsq (>0.5) we can.
4. In case of theoretical possibility when spread of difference in +ve and –ve axis wash off each other (a=|b|) then the index becomes influenced by scale.
5. AGOF index and Scale parameter together can be used to examine how close the fit is, but this does not indicate direction of cause and effect relationship. Similar analogy holds for Rsq, high Rsq between variable might indicate overall good fit but it don't ensure there is real cause and effect

relationship presence. The cause & effect direction of effect need to be ensured by the significance test.

7. TESTING OF THE CONCEPT ON REAL (DUMMY) DATA:

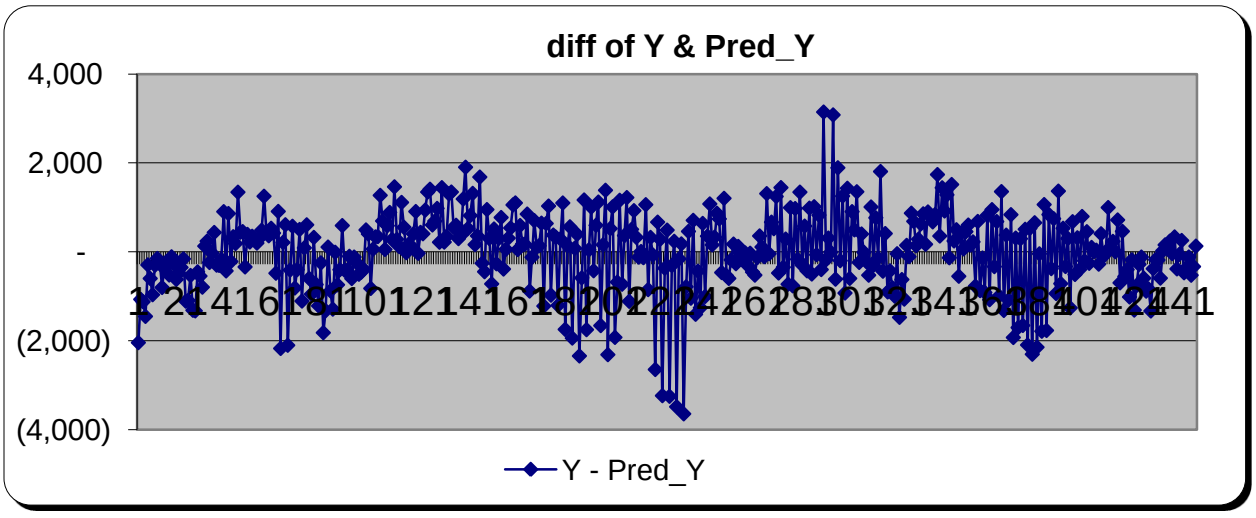
Dummy Data is Used

Case 1: Normal Case: Linear model with intercept (Fig 7)



Rsq=0.11 (Low)
AGOF=0.25 (High) [Obs=447, Cuts=62(14%), Scale=1.002]
Note: Both Rsq & AGOF Index suggests the fit is not good enough.

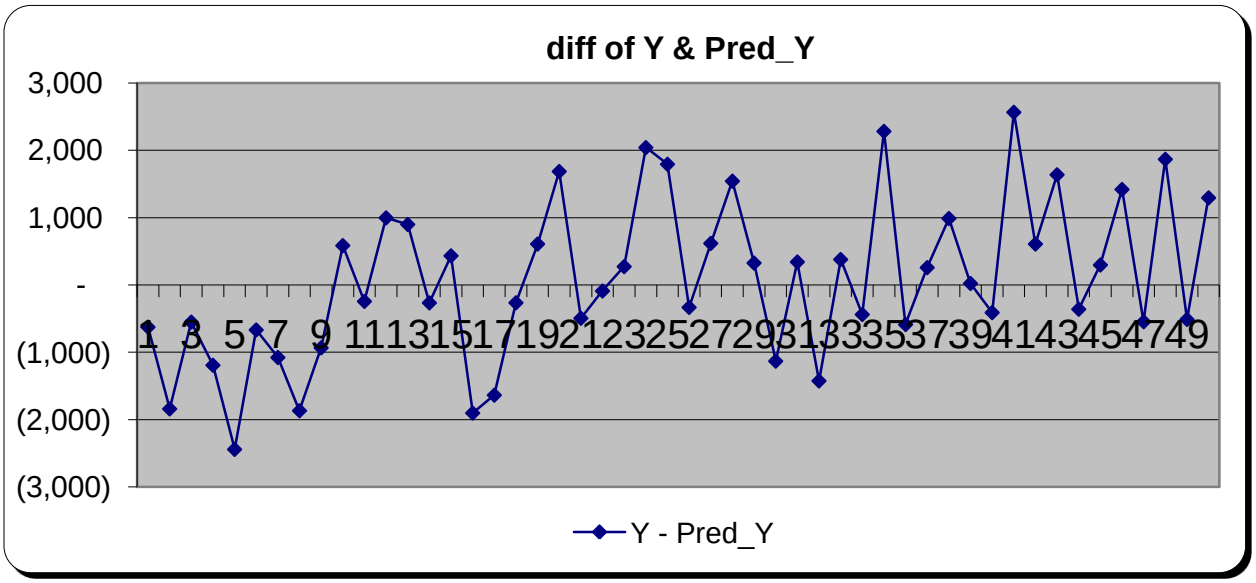
Case 2: Normal Case: Non Linear model with intercept (Sinusoidal Model) (Fig 8)



Rsq=0.53 (Moderate)
AGOF=0.11 (Lower than Case1) [Obs=447, Cuts=215(48%), Scale=0.998]
Note: Both Rsq & AGOF Index suggests the fit is decent enough.

Dummy Data is Used

Case 3: Special Case: Multiple Linear model <u>without</u> intercept (Fig 9)



Rsq=0.98 (High)

AGOF=0.31 (Higher than Case2) [Obs=50, Cuts=27, Scale=0.998]

Note: Rsq suggests the fit is extremely good whereas AGOF Index shows the model fit is not good enough.

8. CONCLUSION:

The paper demonstrates an effort to derive an index which works for scenarios where Rsq fails to produce satisfactory results. The index helps to quantify how close the prediction is and how strong the model error correction mechanism is. This index is not a 'substitute' to the overall concept of Rsq whereas the paper discusses about a stable index which can be looked upon as an 'alternative' and the concept works well for *small* sample. The analysis on dummy data confirms under 'normal' circumstances both Rsq & AGOF leads to similar conclusion, whereas AGOF also performs as expected for special cases.

9. ACKNOWLEDGEMENT:

I am thankful to different Genpact internal modeling teams for their help and time to test the theory with dummy data.

10. REFERENCES:

Given the concept is new and my brain child I have limited number of references for this paper.

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Cash Flow Modeling and Risk Mapping in Public Cloud Computing- An Evolutionary Approach

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Tapan Panda, Great Lakes Institute of Management

INTRODUCTION

Cloud Computing is an on-demand, self-service, location-independent, elastic, measured-metered-paid, zero asset-ownership, zero capital expenditure, energy efficient, flexible substitute to the traditional platform of own-and-use computer systems. In analogy terms, cloud is to computing industry what vehicle leasing is to auto industry. It brings in all the advantages of utilization without the associated risks of ownership. With state-of-the-art innovations, cloud computing has today made possible the migration of applications, software, storage and even platform management to the ethereal cloud.

Though cloud computing can be viewed as both a technology offering and a business alternative, its adoption today is driven more by economic rationale than by technology justifications. In delivery terms, cloud offering is a merger of state-of-the-art concepts like virtualization, server consolidation, interoperability and dynamic CPU provisioning. Yet, its risk-benefit analysis is purely driven by economic and business imperatives. Firms – whether they are constrained for capital or not – would, given a chance, prefer to use up their precious high-cost capital to build assets that drive their revenue growth. In such a capital constrained scenario, any option of deferring capital investment will ease out the initial cash flow pressures and help in better Net Present Value (NPV) modelling. Modern business paradigms like leasing, asset co-ownership and infrastructure outsourcing are all aimed at easing out the upfront capital investment problem. Cloud – as a business paradigm – offers 'deferred CAPEX' driven investment downsizing as its most tangible gain. The ratio of IT investment to the overall CAPEX investment is the *first* modelling parameter of this paper for doing a variability study.

In addition to downsizing CAPEX investment, cloud adoption also offers the possibility of lowering the total IT operating expenses. This reduction of operating expenses with higher cloud adoption has a beneficial impact in the calculation of the present value of future cash flows. The total operating expenses in the cloud environment has been split into non-cloud related operating expenses and cloud related operating expenses. The non-cloud related operating expenses – as will be discussed later – has to be strategically reduced to fully enjoy the benefits of moving into the cloud. The reduction of the non-cloud related IT operating expenses is posited as the *second* modelling component in the NPV modelling.

The cloud related operating expenses introduces the dimension of unknown risk components associated with cloud adoption. The unknown risks associated with cloud are broadly mapped

along 4 vectors (ibid Easwar et al, 19). They are vendor related risk, data security related risk, no-gain risk and system efficiency risk. Fear of lock-in with an incompatible vendor, lack of guarantee of business continuity and service availability, reputation fate sharing with a vendor and unclear licensing issues are some of the components that drive the fear called vendor-related risk. Similarly confidentiality issues, privacy issues, loss of governance and the likes sum up to data security risk. The gains that cloud platforms purport to offer in terms of reduced capital and operative costs might not be sufficient enough to move from existing systems to cloud platforms is the premise for the no-gain risk. Finally effects of latency, downtime, data bottlenecks and any other efficiency impediments add up to create the last risk vector – efficiency risk. The monetization of these unknown risks will critically regulate the NPV modelling. This nebulous unknown risk is the *third* modelling component of this paper's variability study.

LITERATURE SURVEY

Academics have reviewed the emerging area of Cloud Computing along various vectors. This section reviews some of the work that has been already done in terms of definitions of cloud, economics of cloud adoption and risk factors associated with cloud computing. M. Ambrust et al refer to Cloud Computing as a symbiosis of both applications delivered as services over internet and hardware/systems software in the datacenters that provide those services [1]. A paper which has received wide citation, this Berkeley work delineates the roles of the pure cloud provider and the intermediary SaaS model packager. Brian Gammage et al talk about the strategic possibility of the 'power of IT' shifting towards external providers and users. The paper, which is essentially a Gartner report, tries to clearly define core vs. non-core strategies in the context of IT asset ownership and utilization [2]. Talking about the economics of Cloud Computing, Hosseini et al predict that the decision to migrate existing systems to cloud platforms can be complicated since the evaluation of the cost-benefit trade off and the measurement of associated risk in cloud computing adoption is not straight forward [3]. Another paper by Beaty et al talks about building a viable business case on cloud migration by modelling on cost of transformation, ROI and payback period [4]. J.C.Pucciarelli et al write about Cloud being too important to be left to IT Departments alone because it's as much about business' agility as it's about IT cost takeout [5]. M. Klems et al aver that the valuation of Cloud Computing services must take into account its costs as well as the costs resulting from the underlying business model [6]. Federico Etro mentions about Cloud Computing as a large pool of easily usable and accessible virtualized resources (hardware, development, storage and / or services) which can be dynamically reconfigured to adjust to a variable load scenario [7]. This dynamic reconfiguration facilitates the optimal utilization of resources.

Moving to area of risks and obstacles involved in Cloud Computing, C. Christauskas et al have talked about fear for safety, internet failure, control loss, dependency and similar exogenous factors that inhibit cloud adoption [8]. The two extreme options of pure in-house deployment and pure cloud based deployment and the various in-between hybrid options that can offer the best of both worlds have been studied by B.C. Tak et al in the context of certain specific applications [9].

Chinyao Low et al investigate the factors that affect cloud adoption by firms belonging to the high-tech industry [10]. Malden A Vouk maps the journey of cloud from technology to implementation [11]. Tara S Behrend et al examines cloud computing initiatives in the education sector [12]. The paper is in the US context and examines the factors that lead to adoption of this technology from the perspective of both colleges and student community. Vladimir Vujin looks at the education industry and cloud computing, but more from a research support point of view [13]. The paper talks about a reliable and scalable cloud environment that can foster scientific research and educational progress. Alec Nacamuli in what is essentially an editorial piece stresses on the importance of cloud in banking in the days to come [14]. The paper cites that regulation, data recovery, customer trust and innovation would be some of the key thrust areas which come in the cusp of cloud computing and banking. Jeanne Capachin in another well researched article on banking focusses primarily on security issues that would be on top of mind for bankers, when they think of 3rd party data storage [15]. Chris Chatman focusses on another sector which is clearly heading towards cloud adoption – health care sector [16]. The paper dwells on the dual concerns of data security as well as speed of implementation for the healthcare sector. Edward J Giniat offers more insights in the area of cloud vs. healthcare [17].

The literature survey section concludes by quoting the previous work done by some of the authors of this work. Easwar et al (in a work to be published in January 2013) looks at the drivers and inhibitors of cloud adoption with a specific SME sector perspective [18]. The data in this work is Indian SME data. As an extension of this work Easwar et al (another work to be published in May 2013) have compared the relative risk perceptions of cloud adoption across 4 different sectors – SME, BFS, Hospitals and Education [19]. This paper is finally an evolution of the mathematical model which Easwar et all (published work November 2012) offer for Net Present Value (NPV) analysis in the context of cloud adoption [20]. The previous study aims at developing a mathematical model that does a revenue–neutral cash flow modelling for fractional cloud computing adoption. The aim is to find a mathematical fraction, other things being equal, for which the Net Present Value (NPV) maximizes with respect to cloud adoption. The current work elaborates on the sub-factors that drive NPV upwards by doing a multi-parameter variability analysis.

PROBLEM FORMULATION AND MODELLING

The dependent variable modeled in this paper is the Net Present Value [NPV] of a firm that is into the adoption of cloud practices. The independent variable is the fractional cloud adoption coefficient α. As mentioned earlier α is a fraction that varies from 0 to 1. $\alpha = 0$ indicates one extreme of the cloud deployment spectrum – zero acceptance of cloud as a solution. At the other extreme is $\alpha = 1$ which indicates a deployment of all possible and available cloud options. The movement of α (from 0 to 1) is a reflection of the consumer's / market's acceptance of a new technology platform. NPV modelling is done as a function of this fraction α. Another fraction that the paper's modeling takes into account is δ. This fraction is an indicator of the amount of products and solutions options that can actually be moved to the cloud today from the total universe of IT

assets. The two fractions are different in the sense that δ indicates a technology limitation and α indicates a behavioral limitation in the context of cloud adoption.

Figure 1 gives the complete set of equations for the NPV Modelling. Equation (1) is the definition of NPV as the difference between the present values of all future cash flows of the firm and the current up front capital investment. It is a judgmental indicator on the prudence of going ahead with the current investment. Equation (2) indicates that the offset in the current investment is driven by the term $\alpha\delta I_{it}$, which is the maximum possible deferrable investment of IT capital expenses due to cloud adoption. In this equation – as explained earlier - δ gives the technology limit of cloud migration and α gives the behavioral limit of cloud adoption.

Equation (3) models the Present Value based on the assumption of an annualized perpetual cash flow for the firm and separately brings out the two components of IT operating costs – the traditional in-house operating costs O_{nc} which will continue even after cloud adoption and the cloud related IT operating cost O_c. For simplifying the model, the authors have ignored the revenue growth of the firm (annual growth rate of R). Else the denominator of equation (3) would have been (r-g) instead of 'r', where g is the annual growth rate. This simplification however does not affect the analysis and interpretation of our results as offered in the next section.

Equation (4) is a behavioral equation of O_{nc} with the assumption that traditional in-house operating cost would steadily fall with higher cloud adoption because cost elements like maintenance, training, IT staff salary, utilities, supervisory staff salary, hiring, band width and a host of other associated costs would reduce systematically for higher cloud adoption (i.e. as

NPV Modeling for Full vs. Fractional Adoption of Cloud

$$NPV = PV - I \quad (1)$$

NPV=Net Present Value
PV=Present Value of Future Cash Flows
I= Total Upfront Capital Investment (CAPEX)

$$I = I_{total} - \alpha\delta I_{it} \quad (2)$$

I_{total} = Maximum Upfront Total Capital Investment in the absence of cloud (i.e. α=0)
α= Percentage adoption of cloud by the market/firm (from the technology that can be moved to cloud)
δ=Percentage of what can actually be moved to the cloud today from the total universe of IT assets
I_{it}= Maximum Upfront IT Capital Investment in the absence of cloud (i.e. α=0)
$\alpha\delta I_{it}$ is the fraction of total IT investment that can be deferred because of moving to cloud

$$PV = \frac{(R - O_{nc} - O_c)}{r} \quad (3)$$

R= Annualized perpetual cash inflow (excluding IT operation costs)
O_{nc}= Traditional in-house IT Operational Costs which continue even after cloud adoption
O_c= IT Operational Costs incurred because of cloud adoption
r= Discounting rate computed using Weighted Average Cost of Capital (WACC)

$$O_{nc} \approx b\alpha^2 - 2b\alpha + a \quad (4)$$

Where $O_{nc(\alpha=0)} = a$ (maximum value of O_{nc} in the absence of cloud adoption)
$O_{nc(\alpha=1)} = a-b$ (minimum value of O_{nc} on complete cloud adoption)

$$O_c = \alpha (Y_k + Y_{uk}) \quad (5)$$

Y_k= Annualized payouts to the vendor for cloud utilization (at α=1)
Y_{uk}= Non cash-yet 'monetizable'- unknown risk component associated with cloud adoption (at α=1)

Substituting equations (2), (3), (4) and (5) in equation (1)

$$NPV = \frac{-b}{r}\alpha^2 + \frac{[r\delta I_{it} - (Y_k + Y_{uk}) + 2b]}{r}\alpha + \frac{(R - a - rI_{total})}{r} \quad (6)$$

Differentiating to find the value of α for which NPV maximizes (the first order derivative's solution is a maximum function since the second order derivate is negative)

$$\frac{dNPV}{d\alpha} = \frac{-2b}{r}\alpha + \frac{[r\delta I_{it} - (Y_k + Y_{uk}) + 2b]}{r} \quad (7)$$

Driving the first order differential to 0, the value of α for which NPV maximizes is,

$$\alpha_{NPV=max} = 1 + \frac{[r\delta I_{it} - (Y_k + Y_{uk})]}{2b} \quad (8)$$

Figure 1 Equations for NPV Modelling

α value moves from 0 to 1). Irrespective of the value of 'a', a high value of 'b' (i.e. a small 'a-b' value) will indicate a successful strategic reduction of O_{nc}.

Equation (5) explains the behavior of the cloud related IT operating cost O_c. It again has two components – both driven by α – one of which is monetized (Y_k) and the other is currently non-cash, but monetizable (Y_{uk}). Y_{uk} represents the hidden cost element associated with cloud adoption and could include factors as diverse as data security cost, data privacy cost, load variability cost, internet down time cost, loss of control cost, redundancy cost, contract breach costs etc – of which some are exogenous and some are endogenous. Equation (6) is the final equation for NPV. The second order differential of this equation is negative and hence this equation is a maximizing equation. The first order differential equation is given in equation (7). Equating it to zero will give the value of α for which the NPV function maximizes. The same is given in equation (8).

ANALYSIS AND INTERPRETATION

The key final equation on NPV, on which all the three variability studies have been done, is

$$NPV = \frac{-b}{r}\alpha^2 + \frac{[r\delta I_{it} - (Y_k + Y_{uk}) + 2b]}{r}\alpha + \frac{(R - a - rI_{total})}{r}$$

reproduced here with the terms explained once more.

NPV : Difference between the present values of all future cash flows and current upfront investment

α : Fractional cloud adoption coefficient

δ : Fractional indicator of IT products / services that can actually move to cloud today

r : Discounting rate computed using Weighted Average Cost of Capital [WACC]

a : Maximum value of in-house, non-cloud IT operating costs in the absence of cloud adoption

b : Fall on IT operating cost with full cloud adoption [i.e. a (α=0) gets reduced to a-b (α=1)]

I_{total} : Maximum upfront total capital investment [IT and non-IT included]

I_{it} : Maximum upfront IT capital investment in the absence of cloud [i.e. at α=0]

R : Annualized perpetual cash flow for the firm for which cloud adoption is considered

Y_k : Annualized payout to the vendor for cloud utilization (at α=1)

Y_{uk} : Non cash, yet monetizable unknown risk component associated with cloud adoption (at α=1)

As mentioned in the introduction, the variability of the Net Present Value (NPV) is mapped and studied across three parameters, Y_{uk}, b and I_{it}. The Assigned Value table for doing this study is given in Figure 2. NPV (plotted in the y axis) is the dependent variable and α (plotted in the x axis) is the independent variable. The fraction δ has been arrived at by the statistical analysis of data collected from a vendor sample space. The value of δ obtained was 0.595 which has been approximated to 0.6 for plotting. The value of r (the WACC function) has been set at 10%, a value which is in approximately sync with the Indian market's cost of capital.

Parameter	Variable, Constant or Assigned Value	Value	Unit
NPV	Dependent Variable	Variable	Crore INR
α	Independent variable	Variable	NA
δ	Constant	0.6	NA
r	Constant	10% (0.1)	NA
a	Assigned Value	12	Crore INR
b	Study Variable #3	Variable	Crore INR
$\mathbf{I_{total}}$	Assigned Value	200	Crore INR
$\mathbf{I_{it}}$	Study Variable #2	Variable	Crore INR
R	Assigned Value	1000	Crore INR
$\mathbf{Y_k}$	Assigned Value	5	Crore INR
$\mathbf{Y_{uk}}$	Study Variable #1	Variable	Crore INR

Figure 2 Assigned value table on which the variability study is done

The firm under consideration for NPV analysis is posited to have an annual revenue of 1000 Crore INR [One crore is 10 million]. The nature of the firm and its growth in revenue does not change / affect the modelling. The firm is assigned to have a total CAPEX outlay of 200 crores INR. The IT CAPEX, which is a part of the overall CAPEX is one of the study variables. The annual cash out for cloud usage plus costs that are directly allocable to cloud is 5 crore INR. The total non-cloud IT operating cost is assigned as 12 crore INR. The fall in operating expenses 'b' is another study variable. Finally, the nebulous unknown risk component associated with cloud adoption Y_{uk} is the last study variable.

VARIABILITY OF NPV WITH 'Y_{uk}'

Equation 8 of Figure 1 gives the value of α for which the NPV function maximizes. In the equation, the factor $r\delta I_{it}$ is the opportunity saving from not investing in upfront capital. I_{it} is the total IT expense and δI_{it} is the maximum fraction of IT expense which can be deferred from immediate investment. If that is treated as a notional saving, then $r\delta I_{it}$ is the notional positive cash flow where r is discounting rate driven by weighted average cost of capital (WACC). In the real scenario, this savings is larger than the cash payout term Y_k. This is

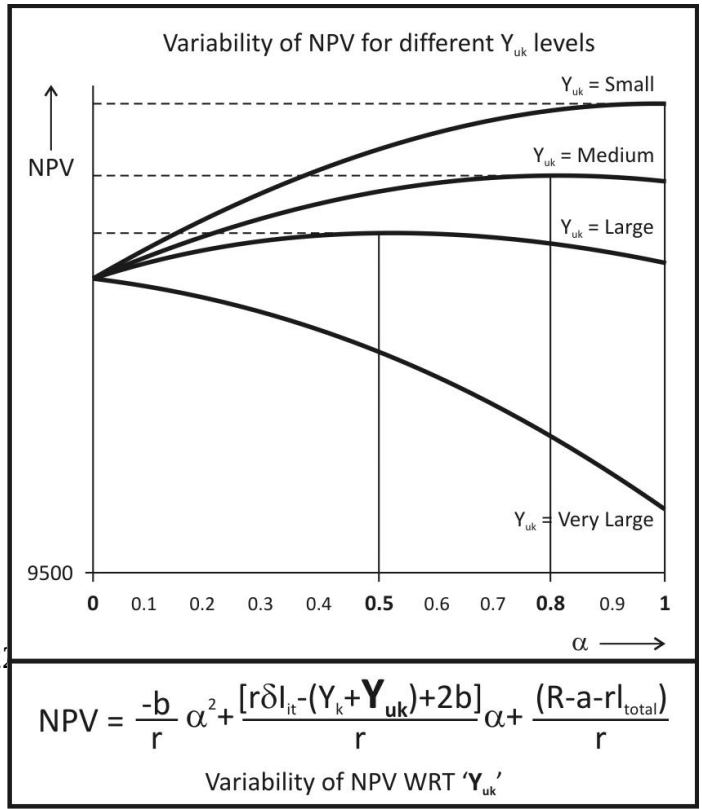


Figure 3 Variability of NPV with Y_{uk}

because the cloud utilization charges Y_k will continue to be small because the cloud vendors have scale, higher capacity utilization, higher risk spread across multiple users, better fixed cost spread and better negotiation for bulk buying of IT assets. Also, cloud is in its nascent phase as far as Product Development Life Cycle (PDLC) goes and vendor firms will go soft on pricing to ensure higher adoption. Hence the term $(r\delta I_{it} - Y_k)$ is positive.

The actual value of α for which the function maximizes is now critically hinged on the unknown risk component associated with cloud adoption Y_{uk}. The plot of NPV maximization for different levels of Yuk is given in Figure 3. Each of the 4 curves is explained below.

If Y_{uk} is set to zero (or has a small inconsequential value) then mathematically, the value of α for which the NPV function maximizes is 'greater' than 1. This possibility is plotted as the top curve (Y_{uk} = Small). What it implies is that there will be no hiccups in a monotonic NPV increase when α moves from 0 to 1, if the costs associated with unknown fears are fully contained. This is an idealistic situation. A more realistic situation is plotted for Y_{uk} = Medium. Here, Y_{uk} and Y_k have been 'assigned' the same value of 5 crore INR. In this case the NPV peaking occurs for a α value of 0.8. For curve #3 (Y_{uk} = Large), a value of 10 crore INR has been assigned to Y_{uk}. Now the NPV curve peaks at an even smaller α value of 0.5. What these two curves indicate is that when significant risks come into play – yielding significant values for Y_{uk} - NPV starts falling after a certain level of cloud adoption. Higher the risk value, earlier the fall. The last curve (Y_{uk} = Very Large) has a hypothetical value of 25 crore INR assigned to Y_{uk}. In such a scenario, there is no NPV increase at all. There is a monotonic fall of NPV for any level of cloud acceptance.

Let us revisit Figure 3 now from a totally non-mathematical point of view. In order to model the cost associated with unknown fears (Y_{uk}), we need to closely examine the Industry vs. Fear Matrix (for cloud adoption). For different industries / businesses, the fears of cloud adoption would be very different. As previously explained, from data security to privacy to intolerance of down time to latency problems, every fear is associated with a cost element. For those industries that are significantly resisting cloud adoption, the cost association of one or more of these risk elements would be significant. This will yield a high Y_{uk} value and thereby the NPV maximization value of α can slip below 1.

Hence, if only fractional adoption of cloud is happening in some sectors, then beyond the current levels of adoption, the industry perceives a high amount of risk. Though it is beyond the scope of this paper to describe all possible cloud adoption risks – real, latent or perceived - a brief of three random risk factors are summarized below. This will give a feel of the valuation of Y_{uk}.

Risk of Lock-in with an incompatible Vendor - Vendor lock-in is a situation in which a customer using a product or service cannot easily transition to a competitor's product or service. The complexities of cloud service migration mean that many customers stay with a provider who doesn't meet their needs, just to avoid the cumbersome process of changing vendor

Risk of loss of Data Confidentiality - Data confidentiality is a property of data resulting from legislative measures, which prevents unauthorized disclosure. It is a parameter which indicates whether the information stored on a system is protected against unintended or unauthorized access. In a public cloud, the fear of data loss / theft will be on the higher side for data sensitive sectors like banking sector.

Response time / Latency effects - In a cloud scenario, response time is the sum of network and transaction response time. On the server side, server latency (the time it takes for processing and I/O), application latency (the time it takes the application to respond) and database latency (assuming one is part of the design) are all key contributors to server response time. For sectors where data changes dynamically and snap shot decisions are required, any response slackness due to latency will critically affect operations.

Summing up, for ensuring higher cloud adoption, the onus is on the cloud vendor to assuage the fears related to Y_{uk} on a sector by sector basis to all cloud adopters.

VARIABILITY OF NPV WITH 'I_{it}'

The total CAPEX deployed in any firm is a sum of IT CAPEX and non-IT CAPEX. Non-IT CAPEX goes into land, building, plant and machinery and has no bearing on cloud computing driven calculations. Thus, for gaining tangible increase in NPV by way of deferred CAPEX driven investment downsizing, a significant percentage of the total CAPEX has to move to IT. Figure 4 gives a variability analysis of NPV for different levels of I_{it} / I_{total}. Plotted are 4 curves at 4 levels of I_{it} / I_{total} – 0.25, 0.5, 0.75 and 0.95. When the IT CAPEX is only a quartile of the total CAPEX, then the fraction of that quartile that can be clouded is also very small. Thus the possible gain in NPV is very small. For this variability study, Y_{uk} has been taken as 'large' to get the inverted parabola shaped curve. For every increase in IT CAPEX, there is a jump up in the NPV curve. This is fairly intuitive in the sense that a significant gain in Net Present Value can be obtained only for those firms whose IT investment is a large fraction of the total CAPEX investment of the firm. Even from a mathematical point of view, a curve of I_{it} / I_{total} = 1.0 is not plotted since there can be no firm having a 100% IT only investment. There is an important note to be added here. Firms / industries

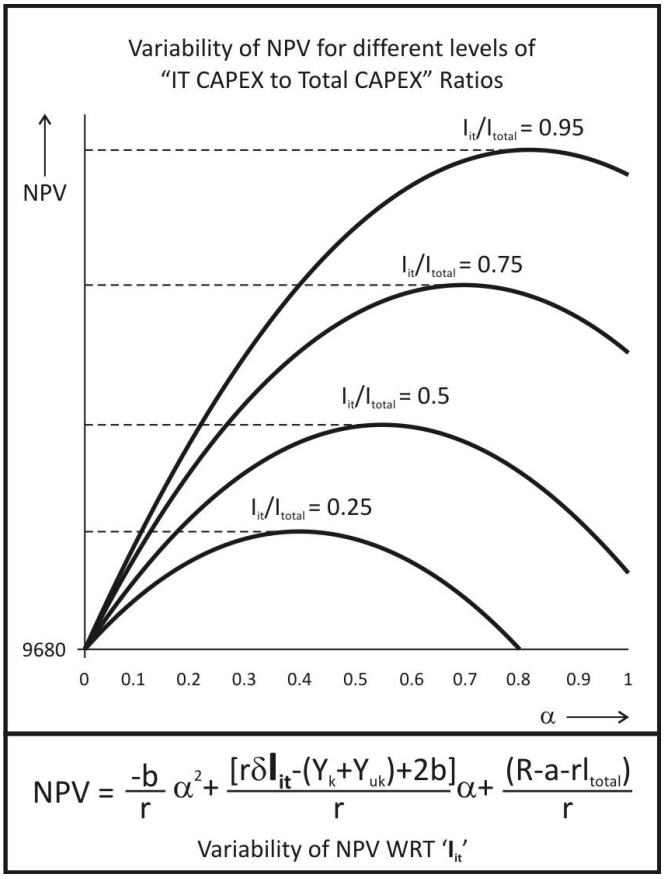


Figure 4 Variability of NPV with I_{it}

who's IT CAPEX would only be a small fraction of their total CAPEX would still stand to gain all the advantages that the cloud platform offers. Figure 4 is not a contradiction to that. Gains like server consolidation, last mile customization, ease of deployment, up/down scalability and the likes are open to all user classes irrespective of their I_{it} / I_{total} values. What Figure 4 indicates is that for getting a tangible NPV gain in the process of cloud adoption, the IT CAPEX has to be significant fraction of the total CAPEX.

VARIABILITY OF NPV WITH 'b'

For all the gains of an NPV increase because of deferred CAPEX, unless conscious efforts are taken in systematically reducing the non-cloud operating expenses (O_{nc}), the true gains of cloud computing cannot be realized. The fall in O_{nc} has to be driven by a strategic initiative. It only implies that when higher cloud adoption happens, there has to be a conscious effort to trim down the traditional in-house operating costs. The step function indicated in Figure 5 is actually the posited outcome of such a strategic initiative to phase out the value of O_{nc} in a step-wise manner. In the absence of such a strategic initiative, the NPV maximization through cloud adoption cannot be completely achieved. The equation '$b\alpha^2 - 2b\alpha + a$' and the plot of the same is an approximation of the step-wise cost fall behavior. 'a' is the no-cloud operating cost and 'a-b' is the full-cloud operating cost. Thus 'b' is the fall in operating cost.

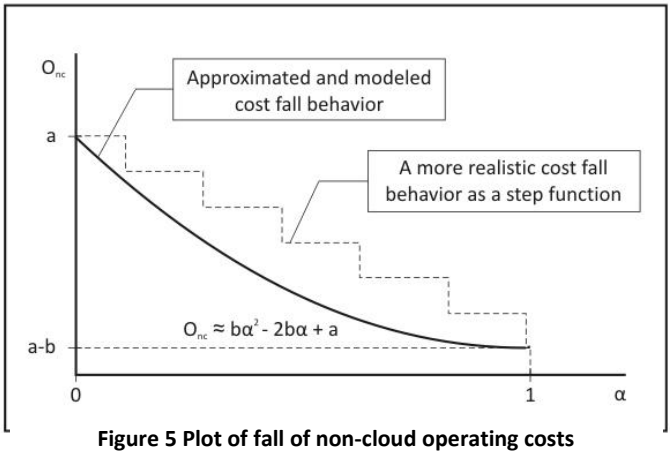
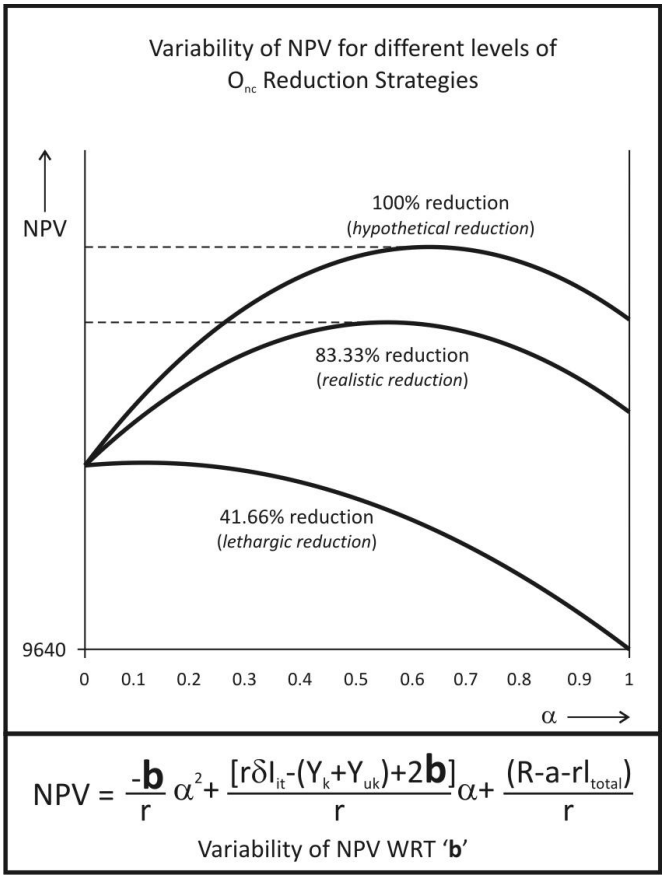


Figure 5 Plot of fall of non-cloud operating costs

Figure 6 plots the variability of NPV for different values of 'b'. For all the three curves, Y_{uk} has been taken as 'Large' and Iit / I_{total} = 0.5. This is to ensure that the reverse parabola curve is maintained.



The top curve is for a hypothetical 100% operating cost reduction. In this case a≈b and hence the operating cost at full cloud adoption is a-b≈0. Thus maximum NPV boosting is obtained. The second curve is for a more realistic and achievable reduction of 83.33%. 'a' is assigned the value of 12 crore INR and 'b' is assigned the

Figure 6 Variability of NPV with b

value of 10 crore INR. Unless such realistic reductions are aimed at, the gains in NPV would not be there. The bottom curve gives a conservative and lethargic approach in reducing O_{nc}. Here, 'b' is assigned a value of 5 crore INR. So the fall in O_{nc} is only from 12 crore to 7 crore. Since the operating costs do not fall in step with higher cloud adoption, NPV refuses to go up for any levels of adoption. This brings us back to the fact that O_{nc} reduction is not something that naturally happens. It has to be strategically made to happen. Some of the elements of O_{nc} which can be brought down consciously and aggressively are maintenance costs, training costs, IT staff salary costs, utilities cost, supervisory staff salary costs, hiring costs, band width costs and a host of other associated costs. The authors recommend that these cost cutting decisions should not be left to the IT department since they are more users than policy makers. There are systematic 'people and process' transformations required to cut costs and gain the full benefits of cloud computing.

FUTURE DIRECTIONS OF RESEARCH

Two clear future directions of research are possible to take this mathematical modeling to the next level of completeness.

The measurement and quantification of Y_{uk} has been abstract and mathematical in this paper. On a sector by sector basis, one can segment and then do a weightage assignment for the possible risk factors that critically affect cloud adoption. Then, each of these weighted risks can be assigned a probability of the risk occurrence. This duality of relative weightage and probability will help in quantifying the effect of the individual risk. An aggregation of such risks elements – as applicable to a given sector – will yield a realistic value for Y_{uk}. The authors of this work are pursuing the segmentation, weightage assessment and probability assignment of cloud adoption risk for the BFS sector – a sector which has got clear risk perceptions (*ibid* Easwar et al, 19).

Similarly, the non-cloud operating cost reduction drivers can be modeled to find an equation that closely approximates the step function shown in Figure 5. Very preliminary work is on in that direction also.

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Estimating Cost of Delays due to Over Dimension Cargo (ODC) in Power Projects: A Case Study of Power Grid Corporation of India Ltd.

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INTRODUCTION

Timely and efficient logistics plays a vital role in the success of any project, especially in large scale projects. In power sector large scale projects like power generation plants by thermal, hydro or nuclear and power transmission projects like high voltage transmission substations involves transportation of critical machineries and equipments. These large scale projects apart from having usual project logistics also involve a specialized logistics called Over Dimension Cargo transportation.

Any shipment which weighs more than 35tonne or if the dimension is more than 40ft X 8.25ft X 8.25ft it is classified called as Over Dimension Cargo (ODC)[5]. ODC needs specialized personnel, specialized vehicles, specialized approach, proper planning and attention for successful and hassle free transportation. Any delay in ODC transportation will spoil the project logistics eventually affecting the project, its schedule and in turn leading to cost and time overrun.

Power Grid Corporation's (PGCIL) is going to invest more than Rs. 20,000 crore each year for the next 05 years in order to increase its transmission capacity[6]. This augmentation plan will involve execution of lot large scale transmission projects in the coming years which finally leads to an increase in project logistics in PGCIL. These large scale projects involve transportation of heavy equipments for transmission substations like transformer, reactors, converters etc. and surge in transportation demand lead to handling of large scale ODC in PGCIL.

This study tries to find out the role of ODC in Power Grid's projects, its project logistics, its structure and how project logistics are handled. The study attempts to find the extent of project delays in PGCIL because of project logistics and ODC delays in particular. Further, the study attempts to estimate the cost of such delays to PGCIL as well as the entire power sector (except distribution segment).

[5] Working Group report on Road Transport for 12th five year plan 2012-2017
[6] PGCIL Annual Report – 2010-11

1.1 NEED FOR THE STUDY

On an average a power transmission substation requires a minimum of 02 transformers and these transformers mostly falls under ODC category. To increase its transmission capacity Power Grid is investing Rs. 20,000crore per year of which Rs. 12,000crore (60%) will be spent on transmission lines and remaining Rs. 8,000crore (40%) will be spent on transmission substations[7]. On an average a typical 400kv transmission substation cost Rs. 200crore (approx.) in which ODC shares Rs. 40crore (20%) of the substation cost[8]; i.e. approximately Rs. 1600crore will be spent on ODC and its transportation by Power Grid each year which makes project logistics a critical link in PGCIL's projects.

Indian government is planning to add 100GW to nation's power generation between 2012 to 1017 which translates in to Rs. 4,50,000crore of investment in the next five years, in it approximately Rs. 45,000crore (10%) will be spend on logistics[9]. As on 2008 electricity sector occupies approximately 3.5% in India's GDP[10] and taking in to account that India is an energy deficient country any snag in project implementation will not only affect the Indian power sector but will also affect growth of the entire country. Any delay in logistics will definitely delay the projects coming up in power sector which eventually jeopardize these investments leading to cost overruns of projects and in whole affects the growth of the entire power sector.

There are cases of project delays in Power Grid and some of the reasons can be attributed to project logistics; many a times these delays are eclipsed by other issues like delay in environmental clearance, land acquisition etc. and are not given enough importance. The delay in project logistics is 99% due to delays in ODC transportation[11]; same is the case in other verticals of the power sector. ODC logistics delay is not only isolated to power sector, it is omni-present in almost every vital sector like Oil & Gas, heavy industries like Cement, Steel, Minerals etc., which reflects that ODC/project logistics is a keystone of infrastructure sector and is having direct link with nation's economy. This gives rise for an urgent requirement to look into the factors behind those delays in ODC transportation, analyze those factors, find out the ways to minimize ODC logistics mishaps thereby stressing out the need to plan, monitor, optimize and stream line the entire chain of project logistics for the greater benefit of the country.

1.2. OBJECTIVES OF THE STUDY

1.3.1Primary Objective:

- The main objectives of this study are to find

a) Nature of delays in ODC transportation

[7] PGCIL Annual Report – 2010-11
[8] Inputs from CMG department of PGCIL
[9] Inputs from CMG department of PGCIL
[10] CSO's Advance Estimate - CSO
[11] CMG department of PGCIL & Utility wise report indicating status of construction of sub-stations (220kv & above) vis-a-vis programme during 2011-2012 as on 31-mar-2012

b) what role do these delays play in causing overall project delays and

c) analyze the bottlenecks in ODC.

1.3.2Secondary Objectives:

a) Find out how an ODC delay, apart from impinging the respective project logistics, affects the complete chain and in-turn the entire sector.

b) Cost analysis of project logistics with respect to PGCIL.

1.3. RESEARCH METHODOLOGY

Study on this subject has never been done in the country. Lot of data was needed to be collected from Power Grid's records which are of course not a published data. Large numbers of discussions have been done with Power Grid employees. Snowball methodology has been adopted relying on judgment sampling. The study is exploratory and descriptive in nature. The kind of information that needed to be collected has been – nature of project delays in power sector; main reasons for such project delays; and to find out extent of delays caused due to ODC transportation; the impact of ODC delays on overall project costs.

The primary data has been collected through field surveys, personal interviews and discussions with the employees of Power Grid and the various logistic companies. The sample size is 50. The sample comprises of persons who are employees of PGCIL working in various departments like materials management, contracts, corporate working group and operation services. The persons who are working in logistics sector, persons from electrical companies like ABB, L&T Power etc. also form part of the sample population.

The secondary data is gathered from various reports of Govt. of India published by Planning Commission, Ministry of Statistics, National Highway Authority of India, Ministry of Road Transport & Highways etc. Information from websites of government & logistics service providers, news from national dailies, sector related magazines are majorly used as secondary data in this study.

1.4. LIMITATIONS OF THE STUDY

The major limitation of the project is the scarcity of data this is due to the unorganized nature of India's logistics sector. There is no institution that maintains reliable data on movement of ODC in India.

The data which is available is mostly in raw form and is fragmented. There is no specific information or data pertaining to ODC transportation e.g. there is no data on number of ODC accidents in a year; instead we have no. of road accidents per year.

The primary data which is collected through interviews is subjective. Though adequate care has been taken to gather unbiased responses from the respondents yet some respondents may favor

their respective field/department while narrating about the instances of project delays. Since the study followed convenience sampling and the sample size is very small (50 in number), the outcome of the survey and the interviews may not represent and reflect the exact situation of the sector.

Some of the scenarios discussed and analyzed in this report are based on hypothetical assumptions; those scenarios may or may not reflect the exact conditions and situations e.g. economic cost of accidents. Also some data are pretty old which date back to 2004, like NHAI's Planning Report 2004, which may not reflect present conditions of 2012.

This study is primarily based on the conditions prevailing in PGCIL's project logistics and its procedures, the conditions prevailing in other verticals of the power sector may be different. So the suitability of this study for other verticals of power sector may be limited.

1.5. ABOUT POWER GRID

Power Grid Corporation of India was incorporated in the year 1989 for the purpose of transmission of electric power across India. Power Grid is a listed company where Government of India owns 69.42% and 30.58% by public. It's a Navratna PSU and also India's Central Transmission Utility. As on May 2012 PGCIL's transformation capacity is 130,000 MVA[12]; Power Grid's transmission network carries about 50% of India's generated power through its 94,000 Ckt. km transmission line and 153 EHVAC/HVDC substations with an asset value of Rs. 63,387crore[13]. The inter-regional transfer capacity of PGCIL stands around 28,00MW[14].

PGCIL's primary objective is to have maximum system availability and better reliability. In 2011 the average system availability of Power Grid's transmission system is 99.94% and PGCIL wants to improve the availability further. To meet their objective and the growing demand for power evacuation in India, Power Grid is investing vigorously to augment its transmission network. In financial year 2011-2012 PGCIL commissioned assets worth of Rs. 14,000crore and added 5600MW to it's inter regional transmission capacity[15]. In the years 2007 – 2011 Power Grid's capital expenditure (investment) exceeded Rs. 55,000crore and it is the only company in the power sector which exceeds the investment target fixed by XI five year plan[16].

In Government of India's XII five year plan (2012 – 2017), target is set to add 1,00,000 MW to country's power generation capacity. This can be possible and successful only when transmission and distribution is augmented to evacuate and distribute this additional capacity. Power Grid plans a capital expenditure of Rs. 1,00,000crore between 2012 – 2017 to increase its transmission

[12] PGCIL Annual Report 2010-11
[13] PGCIL Annual Report 2010-11
[14] PGCIL Annual Report 2010-11
[15] PGCIL Annual Report 2010-11
[16] PGCIL Annual Report 2010-11

capacity, i.e. coming years on an average Rs. 20,000crore will be the capital expenditure by PGCIL in power transmission sector. In Power Grid augmentation involves setting up of new substations, transformers erection, foundation & tower erection, adding new transmission lines i.e. Ckt. km, upgrading its existing low end substations & transmission networks from 132kv, 200kv, to either 400kv, 765kv or even 800kv and 1200kv (HVDC/AC) lines & substations.

Power Grid is also planning to increase and strengthen its international transmission links which already exists between India and its neighboring nations like Bhutan, Nepal and Bangladesh. PGCIL is also in process of setting up transmission links between India and Sri Lanka. PGCIL's ambitious expansion, capacity addition and up-gradation plan will give rise to handling of large scale projects throughout the year. These projects involve transportation of number of materials and equipments like steel structures, wires, tones of conductors, reactors, various kinds of heavier and high end transformers viz. transformers for electric voltage, current transformers, main transformers etc., also most of these substations and project sites will be in remote locations.

In PGCIL Materials Management Department is the responsibility centre for project logistics (i.e. transportation of project related equipments and materials to the project sites). Project logistics take place throughout the year from various ex-works to the PGCIL's project sites where the suppliers and their ex-works are located all over the world; in addition to that it also involves various logistics service providers and multi modal transportation. Adding to that the equipments which are to be transported will be of bigger size & weight (on an average it will weigh more than 150tonne) which doesn't falls under normal consignment and are called as Over Dimension Cargos (ODC) which also increases the complexity of logistics in PGCIL's projects and underscores the importance of materials management department in PGCIL.

ODC comprises 20% of project logistics cost and project logistics cost constitutes approximately 5% of a project's cost in PGCIL[17]. So, on an average Rs. 1000crore per year will be spent on logistics by Power Grid for the next five years which makes project logistics even more vital in PGCIL. There are cases of project delays due to logistics delays in PGCIL (e.g. Jaipur South substation, Muzaffarpur TPS Konti substation, Dehri substation). These delays highlight that apt and efficient project logistics is vital for successful and timely completion of PGCIL's projects. **If PGCIL is planning to spend Rs. 1000crores per year** on transportation then its project logistics has to be efficient to yield the desired result of timely completion of projects and adhere to its mission of 'setting standards in capital project management and operations'.

Since efficient project logistics is the outcome of proper planning, scheduling and monitoring this project deals with '*Planning, Monitoring & Optimization of Project Logistics* in PGCIL' which introspect project logistics in Power Grid and how project logistics influence or affects PGCIL's

[17] As Estimated by Materials Management department and CMG department of PGCIL for its upcoming 6000MW HVDC project.

projects. In addition to that this study tries to find out how project logistics affects the whole sector and also find out the challenges (if any) present in project logistics with respect to ODC transportation. Finally this study tries to suggest the ways to monitor and optimize PGCL's projects logistics with ODC transportation in its back drop.

2.1 LITERATURE REVIEW

2.1.1 Power Sector Outlook & Logistics:

At present India's GDP is growing at 6% to 7% (in 2008/2009) and efforts are to restore a healthier growth rate despite the weakening global conditions. Electricity sector amounts to 3.7% of India's GDP[18] which indicates the large size and potential of Indian power sector. CEA indicates that in the year 2008-2009 excluding investment in CPP's & Renewables a total of Rs. 95,953.97crore was invested in Indian power sector in which the approx. Rs.19,381.04crore was invested in Power Transmission Sector[19].

As per Indian Planning Commission's 'Report of the working group on Power for Twelfth Plan 2012 -2017' a capacity addition of 76GW(excluding Renewables) in power generation is planned for the 12th plan ; the total fund requirement for the power transmission system development in 12th plan total around Rs. 1,80,000crore[20]. This investment is used for developing HVDC terminals capacity to 26,500MW from present 10.500MW and AC substations capacity to 6,42,894 MVA from 3,72,894MVA (includes 765kV, 400kV & 220kV)[21]. These massive capacity additions in generation & transmission sector will lead to a massive transportation of equipments and materials.

As per National Road Transport Policy – 2008 of MoRT&H road transportation constitutes approx. 4.5% in India's GDP (2005-06); road transport is growing at the rate of 9.5% each year and 61% of freight transport is happening through land based transport modes. The transport policy also estimates that the demand for road freight transport is expected to grow around 10% per annum. In the back drop the unit sizes of the generation stations and transmission substations are seeing an increase which will lead to increase in equipment capacity, sizes, weight and cost. There arises the need for adopting basic changes in load and handling specifications in roads, railways, ports and inland water ways

As mentioned in the 'reports of the working group of power sector & as well as transportation for 12th plan' there will be an increase in the handling of Over Dimension Cargo/Consignments (ODC). The 2006 CEA's report on 'Requirement of Equipment and Material for Development of Power Sector' for 11th & 12th plan forecasted that the power systems (Generation & Transmission) alone require around 22352 transformers. Majority of these transformers will be over dimension

[18] Report on Logistics and Infrastructure by Deloitte, 2009
[19] CEA Economic Policy Summary Report on Investment in Power Sector 2008-09
[20] Key Inputs for XIIth Plan Financing of Power Sector by CEA
[21] Report by CEA on Requirement of equipment and material for development of power sector Generation and Transmission Projects of 11th and 12th Plan

consignments/cargos; this makes transportation of ODC as a key-stone in project logistics. An efficient project logistics is vital for timely completion of the envisaged projects in power sector; any delay will lead to a catastrophe effect and end up in affecting the country's entire economy.

2.1.2 INFRASTRUCTURE:

Infrastructure is the heart of project logistics and vital for proper execution of project logistics. India is having around 41.09 lakh km of road network comprising National Highways of 71,772km; State Highways of 1,54,522km remaining are district roads and around 21% of NH is Single lane[22]. National Highways constitutes less than a percentage of India's roads but carries about 40% of nation's freight transportation which includes ODC and project logistics[23]. But sadly, India's National Highways lacks expressways (04lanes & 06 lanes) which connect major economic centers[24].

Another major infrastructure segment which has a significant role on project logistics especially ODC transportation is water transport which includes ports, inland water ways (IWT) and ocean transport. As per Inland Waterways Authority of India (IWAI) currently India is having 05 National waterways (NW) of which 03 are commercially operational and other 02 waterways are in development stage. IWT apart from handling ODCs IWTs are even capable of handling of Super ODC's quite efficiently e.g. NW – 3 transported an 800tonne ODC from Kochi port to FACT CD in June'09[25].

'Even though IWT is having the capability it is plagued by numerous issues like unavailability of night navigation, scarcity of supporting facilities like jettys, loading stations, insufficient and old type low capacity vessels'[26]. Because of these issues, though India is having around 15,000km of navigational waterways and also proved handling of ODC through IWT is fuel efficient and environment friendly, in 2008-09 it handled only 16mnTonnes of freight[27].

2.1.3 ODC Transportation Bottlenecks:

ODC constitutes around 5% of heavy vehicles market (tractors & trailers) and expected to grow around 34% over the next 03 to 05 years[28]. This reflects the importance of ODC transportation in India, with several new projects coming up in sectors like power, steel, mines etc the contribution of ODC in logistics is definitely going to move towards north.

Indian logistics sector is mostly unorganized and fragmented; this will lead to severe bottlenecks, especially in ODC transportation finally affecting the projects[29]. Since the segment is fragmented

[22] Annual report 2011-12 of MoRT&H
[23] As per MoRT&H – TRW's July 2010 report on 'Basic road Statistics of India 2008'
[24] National Road Transport Policy -2008
[25] As per IWAI's 04.Dec 2009's presentation on IWT
[26] Report on Management of Transport System in India - IFFCO (2009)
[27] Report on Management of Transport System in India - IFFCO (2009)
[28] RACE's Snapshot on the ODC movement in India – Research Desk (2009)
[29] As mentioned in Connect, a logistical magazine's April-June 2011 issue

there is a serious data issues pertaining to road transport like absence of relevant data on number of registered vehicles which are in use, accidents involving ODC, measurement of freight flow in a variety of ways, lack of data on dimensions of vehicles etc. These data issues are mentioned in the 'report of working group on road transport for12th 05 year plan (2012-17)'. Due to accidents, approximately India is losing around 1% in its GNP and the socio economic cost of accidents is around 3% (in 2000)[30]. But due to data issues we are unable to calculate the cost of accidents due to ODC like how an ODC accident will affect the project, cost overrun in a due to ODC accidents etc.

Apart from data issues there are other issues like supporting infrastructure for ODC movement (which is mentioned previously) and policy issues are major hurdles for project logistics. GoI's MoRTH even formed a sub-group to give a report on policy issues which is dampening road transportation. The sub-group mentioned that issues like multiple clearances, interstate check posts, taxations, non-uniformity in procedures between the states etc are major hindrances to road transportation[31]. The subgroup also mentioned that existing Motor vehicle act is outdated; there is no definite set of rules which guides the ODC transportation & MAVs.[32]

2.1.4 Project Delays Due to ODC:

The above mentioned problems make ODC transportation as a biggest challenge in project logistics. There are cases of delays in projects due to ODC issues; NTPC Ltd's Sipat Power Project turbine was stuck at Kasara Ghat on NH 03 (between Mumbai and Nashik) for 06 months because the road could not take that ODC's load[33]. BHEL the country's major power equipment manufacturer is facing serious transportation issues when comes to ODC logistics[34]. The mentioned cases prove the importance of ODC in Power Sector and underscore the immediate need for Planning, Monitoring & Optimization of Project Logistics for successful and timely completion of projects.

3.1 SOME CASES OF DELAY IN ODC TRANSPORTATION

3.1.1 Case 01: Field Study of a Transportation Delay:

On 09th of June 2012 there was a consignment which got stranded on NH-8 in the outskirts of New Delhi (Shankar Vihar, near to Mahipalpur & Delhi International). Following are the details of the consignment.

Project Details:

Supplier	:	Uttam Sucrotech International Pvt. Ltd.
Customer	:	Wonji- Shoa Sugar Factory, Ethiopia.
Project Cost	:	$100 million

[30] National Road Transport Policy (2009)
[31] MoRT&H Sub-Group report September -2011 report on policy issues
[32] The Hindu Business Line, dated 28.07.2011
[33] Liveminit.com (website of Mint business newspaper) on April 22, 2011 at 1:11pm IST mentioned
[34] Liveminit.com (website of Mint business newspaper) on April 22, 2011 at 1:11pm IST mentioned

Consignment Details:

Shipping Mark	:	Wonji-Shoa Sugar Factory, New Sugar
From	:	Ghaziabad
To	:	Ethiopia
EPC Contractor	:	UTTAM
Equipment	:	Juice Sulphitor
Weight	:	37,000kg
Equp. Dimensions	:	9000X5400X5400 (l X b X h) in mm
Cost	:	Rs. 30 to 40 Lakhs (Including Transportation)

Transportation Details:

Vehicle Type	:	04 axles (Mechanical Type)
Crew Members	:	08 persons (Wireman + Driver+ Helpers + Manager or Survey man)
Route	:	Ghaziabad to Bombay (via Delhi, Jaipur, Indore)
Travel Days	:	30 days (20.05.12 starting date of consignment)
Distance	:	approx. 1450km
Transporter	:	Sawaibhaj Trailer Service, Bilwara
Idle Days	:	05 days
Cause of Delay	:	Fouling of foot over bridge with the consignment.

Root Cause:

The consignment height is 5500mm (including the trailer height); as per NHAI's instruction the clearance between the road and the foot over-bridge should be around 5.6m, but the Shankar Vihar foot bridge's clearance from the road is around 5.2m. The shortfall in the clearance is the root cause for the fouling; along with this improper route survey by the transporter is another reason for the mishap.

Delay:

The consignment is stranded around 05 days, to move forward the transporting team has to reduce the height of the consignment by removing the mud present in the bay adjacent to the road, reduce the height of the consignment by reducing air from the tyres and by reducing the height of the temporary (transportation) supporting stands of the consignment. For removing the mud in the bay area the transporter has to get permission from the Roads O&M contractor and NHAI. The O&M contractor's office is present in the nearest toll plaza and the NHAI office is present in Rajeev Chowk, New Delhi. The transporter is trying to get permission from NHAI authority for the past 03 days but so they are unable to get the clearance.

The road's O&M contractor informed that they will not provide any assistance to clear the mud, it has to done solely by the contractor and has to pay the restoration fee; further the transporter has to provide no objection certificate from NHAI to carry forward the work.

Cost Overrun:

The delay of 05 days will overshoot the cost of transportation since it is going to extend the days of transportation. The cost overshoot will be due to haggling for getting the clearance from the O&M contractor and from the NHAI authorities; already the transporter spend Rs. 20,000/- as overheads. In addition to that the transporter has to pay salary to the crew for the extended days which comes around Rs. 20,000 (per day the driver's wage is around Rs. 1700/- and the wages of crew members). So there will be a direct cost run of approximately Rs. 50,000/- . Further the supplier has to reschedule the vessel and berth booking at the port. In addition to that there may be a rescheduling of erection work at site and a possibility of delay in the project which may lead to cost overrun of the project and finally revenue loss to the company.

3.1.2 Case 02: Bridge Collapse due to Heavy Load

Project Details:

Supplier	:	Bharat Heavy Electrical Limited
Customer	:	Gujarat Pipavav Power Corporation (GPPC); Gas based power plant.
Project Cost	:	Approx. Rs. 2000/-crore

Consignment Details:

Equipment	:	Gas Turbine
Eqp. Cost	:	Approx. Rs. 20/-crore
Capacity	:	351MW
From	:	Mundra Port, Gujarat
To	:	Amreli, Gujarat
Weight	:	280tonne (approx.)
Vehicle Type	:	Multi Axle Vehicle – 16 Axles (Hydraulic)
EPC Contractor :	BHEL	
Distance	:	145km (+ 600km)
Delay	:	Bridge Collapse due to Heavy Load
Location of Mishap	:	River Kshatrunji, Talaja, Bhavnagar, NH – 8E
Casualty	:	05 persons dead (crew members)

Root Cause:

No proper survey done. Analysis of bridge strength was also not done; there is no proper alternate route to reach the site. Negligence of the driver was another issue, during ODC transportation drivers are advised not to apply sudden breaks even if there are chances of impact ODC vehicle with other vehicle. In this incident while crossing the bridge the driver applied sudden brake in order to get rid of a collision with a bike. This sudden braking creates impact load over the bridge and eventually lead to caving in of the bridge. The turbine fell into the river along with the trailer and the crew members.

Delay & Cost:

The specified project was already in delay for months, this accident further delays the project by minimum 04 to 06 months. Turbine is critical equipment in a power plant and any delay in it transportation affects the project in various ways like project cost overruns, business lost due generation postponement etc.

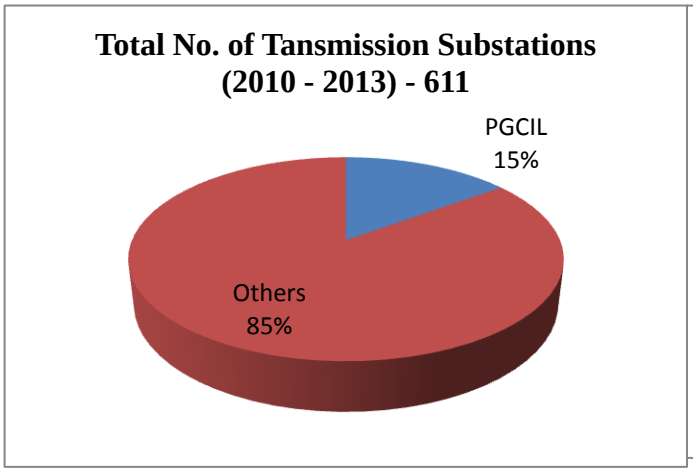
Below is the picture of another mishap that

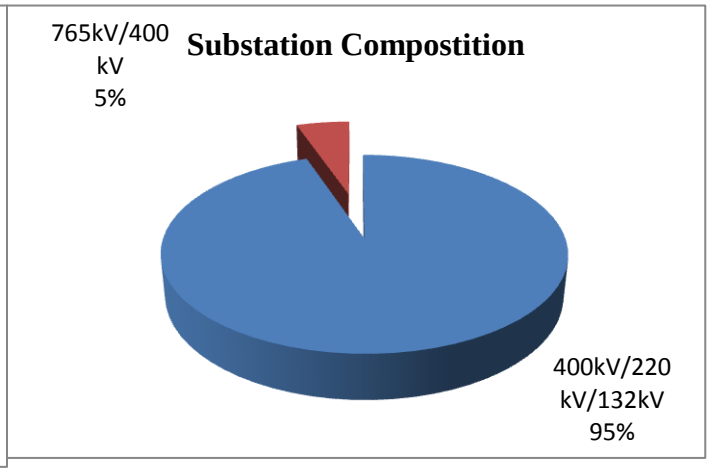
happened between Guwahati and Tripura during the ODC transportation for a power plant project of 700MW where the EPC contractor is ONGC and Tripura Power Plant is the customer. The Project had to be commissioned before March 2012 and this accident occurred during mid 2011.

3.2 ODC in PGCIL's PROJECT DELAYS

3.2.1 Substation Projects:

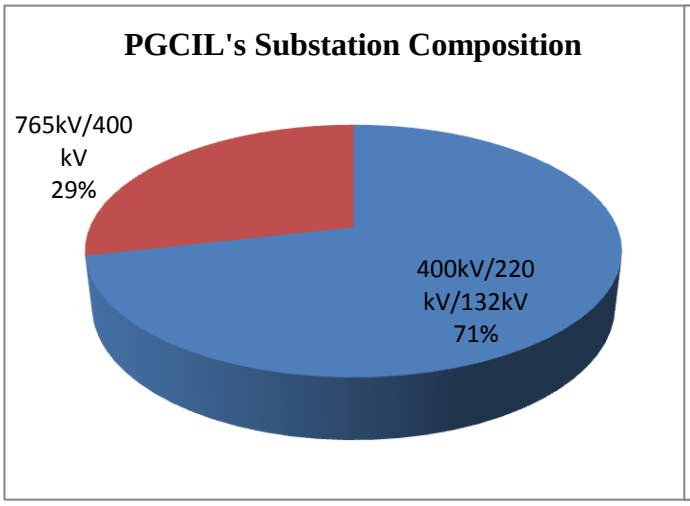
As on 31st March 2012 development of 611 substations projects are on progress in India; capacity of these substations range from 765kV to 132kV and most (around 75%) of the substations fall in the category of 400/220kV[35]. In the 611 projects PGCIL is responsible for the execution of 91 substations (15%) in which around 26 projects (29%) is in the range of 765kV/400kV. In India currently there are only 32 substation projects in the voltage range of 765kV/400kV and PGCIL's share is 81% of these projects[36]. All these projects involve at least 01 ODC cargo movement per project which translates into a minimum 611 ODC transportation i.e. 01 or 02 ODC/day in this

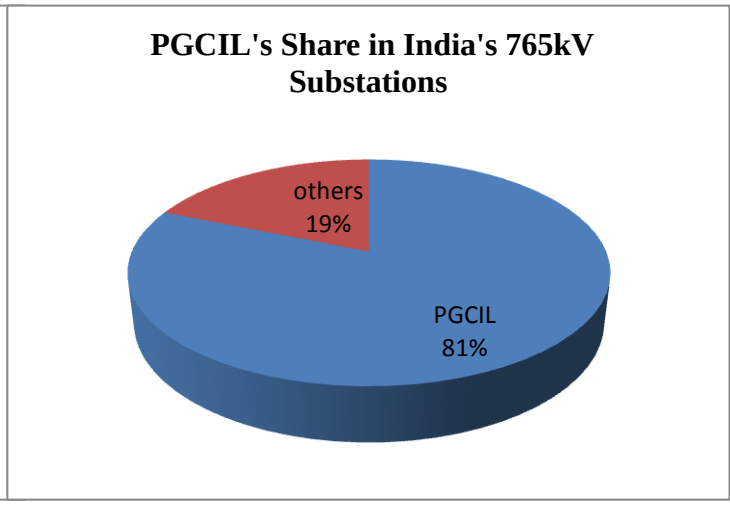




sector.

[35] CEA's Report On Transmission Substation Projects - 2011
[36] CEA's Report On Transmission Substation Projects - 2011

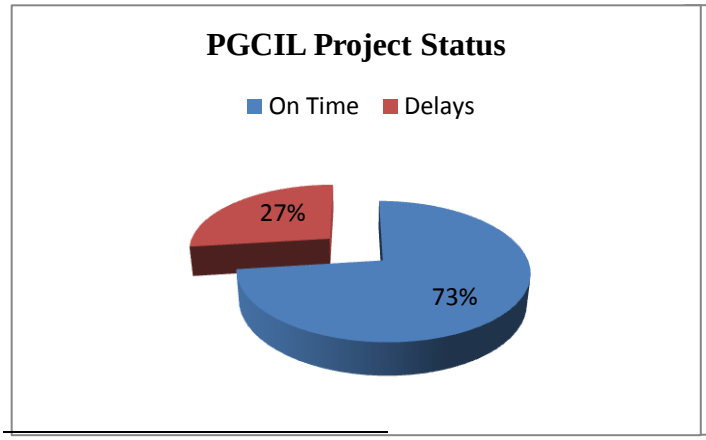


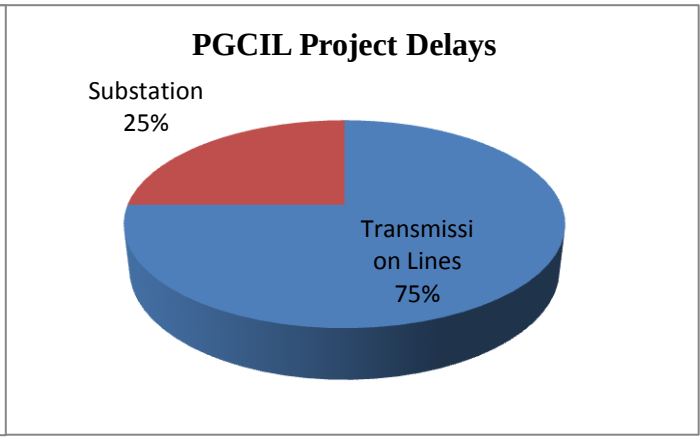


3.2.2 Project Delays:

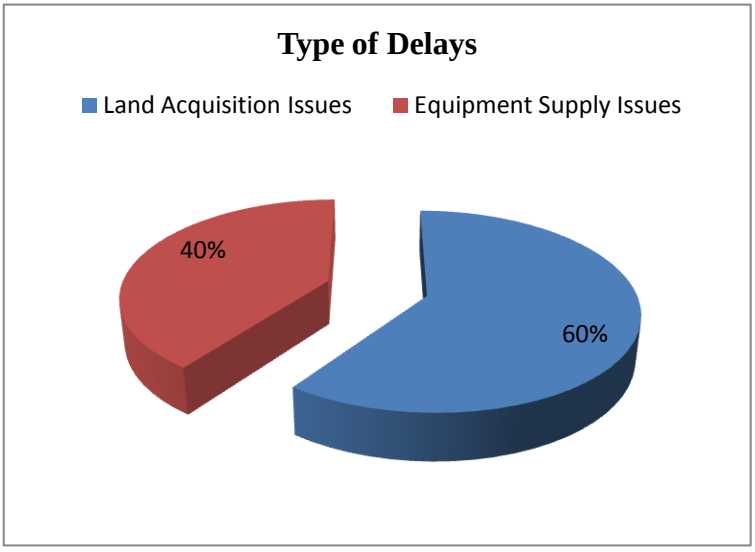
PGCIL on an average is executing around 100 substation project per year and most of these projects include ODC transportation[37]. From Power Grid's project status report of regional offices, from the survey and from the face to face interview with the persons in PGCIL's corporate monitoring group it is confirmed that there are project delays in their transmission projects. Delays are broadly classified into two sections such as transmission line delays and substation delays. Approximately 75% of the project delays are constituted by transmission line delays and the remaining by substation project delays.

As per PGCL status report 25 (27%) projects got delayed in the year 2011-12, in these 25 projects 10 (40%) projects got delayed due to equipment supply to the site premises. Apart from this there is no secondary data available in PGCIL to analyze the project. So there was a need to conduct a survey in PGCIL's CMG (project management department) to find out the reason for the project delays. The survey outcome reflects that land acquisition is the major cause for project delay, followed by delay in equipment supply and climatic conditions. In 10 delayed projects due to equipment supply 06 projects got delayed due to non arrival of transformer to site in the stipulated time due to project logistics delays majorly constituted by ODC transportation problems.



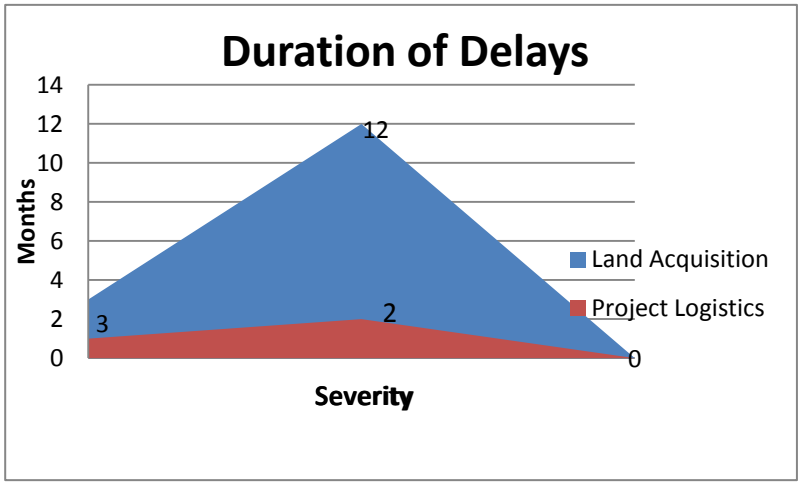


[37] Annual Report, PGCIL – 2010-11



3.2.2 Delay Duration:

Project like Substation 'Missa' which was to be completed in Feb'12 is still not completed due to non arrival of ICT transformer, i.e. around 04 months delay in project completion. As per our study project delays due to ODC transportation delays will be in the range of 20 to 30 days, but the project delays due to land acquisition will be around 03 months to even a year. This is more are less equal to both the transmission line projects as well as substation projects.



3.2.3 Land acquisition Vs ODC:

Most of the (60%) project delays in PGCIL is mainly due to land acquisition problem, also the duration of the delays due to land acquisition span over months even years as of now the delays in project logistics doesn't get noticed in PGCIL projects. Only on extreme cases like Substation Missa delay due to transformer unavailability in site is getting noticed. Even though there are delays in project logistics and delay in ODC transportation, PGCIL is unable to give importance on these issues due to the fact that the delay in project logistics is superimposed by the project delays due to land acquisition problems.

3.3 BOTTLENECKS IN ODC

3.3.1 Barriers to Road Transport

A typical truck operator has to face a number of different agencies for either obtaining clearances for carrying goods or paying certain charges at the check post. These agencies include (i) Sales Tax, (ii) Regional Transport Officer (RTO), (iii) Excise, (iv) Forest, (v) Regulated Market Committee,

(vi) Civil Supplies (check on the movement of essential commodities, black marketing, weights and measures, food adulteration) and (vii) Geology and Mining. These checks are generally conducted by respective agencies at separate points, resulting in more than one detention.

Detention of vehicles causes lower speed, loss of time, high fuel consumption and idling of vehicles, leading to under-utilization of transport capacity and adversely affecting their operational viability. Besides, it imposes economy wide costs which are not easy to assess. By introducing checks at each interstate border the road freight transport experiences significant inequity compared to the freight/cargo transport by the railways, aviation and even inland transport, which do not face such rigorous en route checking.

The system in vogue hinders rather than facilitates smooth flow of freight across the country and has thwarted the formation of single common market. Road transport constitutes 4.7% of India's GDP as on 2009-10[38]. India's Freight Transportation happens 50.1% through road, 36.1% through railways, 0.2% by Inland water transport and 0.02% by air[39].

3.3.2 Policy Issues:

Even though major portion of freight transportation is through road, there are numerous hurdles for road freight transport like,

1. Unclear and outdated policies,
2. Different policies at different states,
3. There is no single window clearance for freight transport,
4. More detention time at both interstate and intrastate check posts,
5. There is no integrated tax administration i.e. tax norms vary from state to state

The above hurdles are common for freight transportation which happens either through trucks, trailers or multi axle vehicles. Trailers and multi axle vehicles are usually used for Over Dimension Cargo transportation. ODC transports have numerous issues in addition to the above mentioned common hassles. Obtaining clearances for ODC transportation is very difficult and time consuming in India due to lack of defined set of rules and regulations. ODC transportation requires more clearances compared to other forms of freight transportation. Clearances from

1. Public Works Department (PWD),
2. National Highways Authority of India (NHAI),
3. State Highways Authority,

[38] MoRT&H Road Transport Year Book - 2011
[39] MoRT&H Sub-Group report September -2011 report on policy issues

4. State Electricity Boards (for live wire clearance),
5. Railways Boards (for ET and level-crossing gate clearance)
6. Environment and forest department clearance

3.3.3 Motor Vehicle Taxation (MVT):

As per Motor Vehicle Act (latest amendment done on 2002) any vehicle which is of the size 40ft X 8.25ft X 8.25ft (length, width, height) is considered as ODC. Also any consignment which weighs beyond 35tonne is assigned as ODC. Indian motor vehicle law has the scope of controlling and guiding only vehicles which transports and weighs up-to 49tonne. There is no law which governs transportation beyond 49tonne.

There are no clear norms or time-lines to get the necessary approval and permissions. These clearances take time and often add to cost overruns and delays in infrastructure projects. Clearances from multiple agencies such as the Public Works Department, the National Highways Authority of India for using roads and bridges; the State Electricity Boards for overhead wires; and the Railway Board for railway bridges is cumbersome and time consuming. Lack of standardized rules across the States makes this difficult.

MVT is being levied in all States and UTs except the UT of Lakshadweep. Existing tax structure for commercial vehicles shows wide variations among States. There are different bases for computation and different rates, leading to differing incidence of taxes per vehicle in different States. In fact, it is not easy to make comparisons of rates levied on different types of vehicles in different States. Inter-State comparisons are difficult for the following reasons:

a) different classification principles for the taxation of vehicles in different States;
b) variations in the application of 'lifetime' and annual tax rates to vehicle categories;
c) use of specific and ad valorem rates; and
d) Multiplicity of rates.

3.3.4 Infrastructure & Overloading:

Except National Highways most other roads like state highways, district ways and village roads in India are not in suitable condition for ODC transport. These roads were built to sustain to a mostly 49tonne and approx. a maximum of 100tonnes load. But mostly the projects which involve ODC transportation are located in the remote locations where there will not be proper roads; even if there are roads those roads and the bridges or culverts present in those roads is not strong enough to take this ODC loads which will be on an average more than 100tonnes. In addition to that these roads are having smaller turning radius which challenges ODC movement in those locations. Even the widths of the roads are not big enough to accommodate the ODC movements and most roads are single lane roads in India.

In addition to the above infrastructure hurdles, the available data shows that the Vehicle Damage Factor (VDF) on most of the National Highways is in the range of 10 to 12 for Northern India and 7 to 8 for the Southern part of the country[40]. These values are more than the VDF of 4.5. Overloading adversely affects the pavement life, accelerates deterioration of pavement structure and also results in safety hazards.

In order to contain the overloading prevailing VDF levels need to be brought down from 7 to 12 to 4.5 by the end of 11th FY Plan. Existing enabling provisions in the MVA 1988 such as sections 113, 114, 194, 199 and 200 are adequate but overloading persist due to inadequate enforcement. The mentioned hurdles lead to slow movement of ODC transportation, extending the transportation days of ODC in turn increasing the cost of ODC transportation and obviously increasing a project's cost.

3.3.5 Accidents:

The above infrastructure hurdles in addition to creating delays in ODC transportation it also give rise to accidents and these accidents increase the delays in ODC transportation. Even though as per NHAI most of the accidents are due to driver negligence, lack of supporting infrastructure is a major problem even for established drivers. Also accidents carry high economic and social costs, which are not easy to measure. The cost of road related injuries and accidents can be viewed in terms of (a) medical costs (b) other cost related to administrative legal and police expenditure (c) collateral damage in terms of damage to property and motor vehicle and (d) loss due to income foregone arising out of absence from work or impairment/disability.

Besides accident survivors often live poor quality of life and have to live with pain and suffering which are difficult to estimate. In economic terms, the cost of road crash injuries is estimated at roughly 1 % of gross national product (GNP) in low-income countries, 1.5 % in middle-income countries and 2 % in high income countries. For India the socio-economic cost of road accidents in 1999-2000 was estimated at 3% of GDP[41].

3.3.6 Freight movement by road – Data Issues

As of now there is no mechanism in place which would provide regular data on freight and haulage (Ton Kilometer-TKM). No comprehensive data on freight movement is available to indicate origin, destination, type and size of freight carried on roads by motorized transport. Most of the data present in transportation sector is fragmented data, there is no data regarding how many transporters are handling ODC, there is no data regarding the efficiency of the ODC transportation, there is no proper mechanism to decide the ODC transportation charges, no data regarding no. of vehicles (trailers & MAV) on road which can handle ODC, no data on accidents which involves ODC, there is no proper data on standard road routes and no proper route surveys to plan a ODC transportation. There is no use of information technology to capture these data and no standard

[40] National Road Transport Policy - 2008
[41] MoRT&H's TRW report on Road Accidents in India - 2009

recording mechanism to save or segregate all these data which are very vital and helpful in ODC transportation.

3.4 COST ANALYSIS OF PROJECT LOGISTICS IN PGCIL & POWER SECTOR

Lack of proper data pushed to take assumption to calculate the cost of project logistics. Most of the assumptions are based on the inputs given by the PGCIL's project management department personnel and materials management personnel during the survey and interviews.

3.4.1 Assumptions:

The HVDC transmission project is planned to transmit a total of 6000MW of generated power over a total distance of 1971 kilometres. The total transmission project costs around Rs. 5300 crore of which 60% i.e. Rs.3180crore is allocated for the laying down the transmission line, while the rest 40% of the project cost is allocated for the substation cost which comes to approximately Rs.2120crore[42].

Two types of transformers are being used in the substations, namely:

- 200MVA 800kv Transformer which costs Rs. 10 crore
- 315VA 400kv Transformer which costs Rs. 7 crore

The substations planned for the transmission project totalled to 9 in which each substation consisted of 3-4 800kv as well as 400kv transformer depending upon the location and the voltage being transmitted. Per substation cost for the project came out to be Rs. 235crore including the transformer while it was Rs.195.55 crore excluding the transformer cost[43].

The breakup of the substation cost consisted of

- 50% EPC cost
- 50% Equipment cost

Thus EPC and equipment costs came out to be Rs.64.97 crore each excluding the transformer cost.

The per km cost of transmission line was calculated by dividing the total cost for laying down the transmission line by the total length of the transmission line which came out to be Rs.1.613crore.

The debt to equity ratio was assumed to 70:30 with a moratorium period of 2 years and a repayment period of 10 years. The interest rate was 6%, as the debt was to be procured from Asian development bank which provides loans at lower rates compared to the domestic banks.

The average land required per substation was assumed to be 100sq.m thus the total land requirement for all the 9 substations came out to be 900sq.m. The land cost per sq.m was assumed to be Rs.50000 from which the total land cost came out to be Rs.4.5crore with land cost

[42] PGCIL's Supply & Erection Contract Document of that specific project
[43] Assumed as per PGCIL - CMG department's guidance

per substation being Rs. 50lakh.Note: Almost all the assumptions were procured from the layout and the BOM of the planned project.

Type of Cost	**Cost Magnitude**
Transformer Cost (800kv)	**Rs. 10,00,00,000.00**
Insurance & Other Cost	--
Freight Cost	--
Total	Rs. 10,00,00,000.00
No of transformers	4.00
Total Transformer cost	**Rs. 40,00,00,000.00**
Total Transformer cost with CIF	**Rs. 40,00,00,000.00**
Substation Equipment Cost	Rs. 97,77,77,777.78
Substation EPC Cost	Rs. 97,77,77,777.78
Total Cost	**Rs. 195,55,55,555.56**
Total cost of substation and transformer	**Rs. 235,55,55,555.56**

3.4.2 Cost to PGCIL:

Transmission Lines Cost	Rs. 353,33,33,333.33
Land Cost	Rs. 50,00,000.00
Cost of the Transmission Project	**Rs. 589,38,88,888.89**
Capital Cost	**Rs. 589,38,88,888.89**
IDC Cost	**Rs. 76,02,64,987.07**
IDC Per day	**Rs. 6,94,305.92**
Total Cost of the transmission per substation	**Rs. 665,41,53,875.96**

The next step involved breaking down the costs for PGCIL per substation including the transmission line to the substation.

The transformer cost taken from the Power Grid included CIF costs and a requirement of 4 transformers per substation were assumed. The substation equipment and EPC costs were added to the transformer costs to get the total cost of the substation. The focus now shifted to the transmission line cost which was broken down into land cost for the transmission line and the cost for laying down the transmission line which were calculated in the assumptions and were linked respectively. The total cost of the transmission project was calculated by adding the transmission line cost to the total substation cost.

The next step involved calculation of IDC from the capital cost of the project. For the same repayment schedule was tabulated and the IDC cost was calculated (refer Exhibit 01) and was added to the total capital cost of the project. Thus the total cost of the transmission per substation was calculated which came out to be Rs.665.41crore. i.e. 13% of the cost of the total project (at max).

3.4.3 Revelation:

The above calculation and cost breakdown reveals that if a substation erection got delayed by one day due to ODC transportation delays then it will lead to a capital lock/ idleness of **Rs. 665, 41, 53, 875. 96/day** in absolute investment terms. If we calculate based on the revenue terms for PGCIL then it come around **Rs. 4.8crore per day**. The revenue loss is calculated on the basis of earnings of PGCIL from transmission charges and wheeling charges, keeping in calculation that for 6000MW transmission capacity which can transmit 2400MU/day.

3.4.4 Sector Loss:

In addition to the transmission sector loss of Rs. 4.8crore per day, since the power generation sector will also get affected. Due to non availability of grid the generators will be forced to either shut down their plants or will be running their plant with lower plant factor. If we assume that there is no other way to transmit the power generated than there will be loss of around 2400MU/day (in generation terms), in revenue terms it will be around Rs. 600,00,00,000 if we take an average tariff of Rs.2.5/unit. The average cost is taken as Rs.2.5/unit since most of the generation plants which

are feeding the power are hydro based generation plants. If we include the capital cost invested in these plants and calculate the loss, then it will be much more than the stipulated revenue loss. In addition to the above losses the generators may lose revenue by losing the business in power trading. Power trading has to be considered since most of the generating stations which feeds power to this network is from north east and most of the north east states are power surplus states. Not only power generating stations are losing the revenue, even the transmission company as well the power exchanges are also losing their business due to non-availability of transmission network. The total revenue loss to the sector will be much more then what the revenue mentioned to the transmission and generation companies.

3.4.5 Limitation of the Cost Analysis:

The limitation of this cost analysis is it assumes that there is no redundancy arrangement involved in the transmission network. It also doesn't consider the other means of delays like construction delays, land acquisition delays, BOP readiness, delay due to environment clearances etc. This analysis only considers the delay due to non-availability of transformers for a project in a single point of view. Taking a holistic view will be more realistic and makes the calculations more realistic; but it involves a complex financial modeling and need more time to frame and execute. So this project just visualizes what will be the loss to a company in terms of revenue if there is a delay in an equipment supply because of project logistics.

4.1 RECOMMENDATIONS

4.1.1 Recommendations for ODC Transportation:

4.1.1.1 Recommendations regarding issues in Data Management:

To get rid of issues like data scarcity, data fragmentation difficulties facing in freight transportation sector and ODC transportation sector some of the suggestions are provided below,

i. There is a need for creating a mechanism for collection of information regarding freight movement by road covering lead, load and other relevant characteristics. The load factor needs to be further disaggregated in terms of broad commodity categories. The information so generated could be integrated through the use of IT to provide data for policy and analysis. In the interim, till the IT based system becomes operational, surveys could be undertaken by agencies such as NSSO.

ii. There is a complete lack of appropriate information on many parameters related to trucking industry like operational cost, cost of financing, vehicle technology (e.g. multi axle), vintage, time and resources cost of detention of vehicles, turnaround time, distance traveled etc. This makes task of evaluation of trucking operations and related policy formulation difficult. Regular surveys at five yearly intervals on these parameters need to be undertaken.

iii. Time Motion Surveys**:** These could be undertaken to assess time spent on various activities related to document compliance/clearances at barriers to ascertain transaction costs faced by road freight/passenger industry.

4.1.1.2 Recommendations regarding Route Surveys:

Internationally, there are defined routes for transportation of OD cargo. Australia which is a federal country like India has envisaged a National Heavy Vehicle Regulator (NHVR) which would be responsible for all vehicles over 4.5 gross tonnes[44]. This is being done to ensure consistency in heavy vehicle regulation and would involve less procedural hassles. This can be followed in India also to remove the problem of ineffective route surveys.

4.1.1.3 Recommendations regarding Overloading:

To eliminate the menace of overloading following steps needs to be undertaken.

- Install WIM (Weigh-in-Motion) to identify violators and install Vehicle Overloading Management System (VOMS) which identify violators and provide the complete axle load spectrum plying on the road on high density corridors. The latter system may be considered for installation along National Highway at select locations to identify overloaded vehicles.
- With a view to discourage overloading strict enforcement needs to be carried at the source of loading, viz. industries, mining areas, ports (objective is not to check overloading but to prohibit overloading in the root level itself).
- Mandatory off-loading of excess load at identified sites with appropriate charges. States to make available land at such sites for storage of the offloaded luggage at transporter/consigner's risk.
- Concessionaires under BOT should be encouraged to place VOMS to check the menace of overloading.
- Discourage modifications (e.g. changing of tyre size, increasing number of leaf springs etc.) in goods transport vehicles by displaying/indicating such parameters in certificate of registration which would prevent overloading.
- Promote use of MAVs through liberal issue of Inter-State/National permits.
- Make carrying of freight in covered containers/carriages mandatory as per section 93(4) of Central Motor Vehicle Rule, 1989. Only specific commodities such as equipments, machineries including their parts etc. should be allowed to be loaded on open trucks.
- Enforcement of has to be strict, bribes and speed money has to be eliminated.

4.1.2 Suggested Measures for Policy Issues to Overcome Barriers in ODC:

• Integrate Tax administration with inter-state road freight and passenger movement through online communication network system at National, Regional and Local level. This will help move towards border less and paper less movement of freight traffic across borders aided by IT in a time bound manner. This will greatly reduce transaction cost and logistics cost of domestic trade.

• Presently checking/verification work is being done manually at check posts. However, electronic surveillance and computerization will significantly speed the process.

[44] Working Group Report on Road Transport for 12th Five Year Plan (2012-2017)

• Adopt concept of “Green Channel”. Currently, “Green Channel” is being implemented in Gujarat and needs to be replicated. Freight with single destination accounts for a large proportion of consignment and is likely to go up with containerization. Such cargo by road could be accorded “Green Channel” treatment provided papers are prepared in advance and sent to the check post.

• Initially high value freight and sensitive commodities could be covered under “Green Channel”. Implementation of this proposal will also need some modifications to existing truck fleet, which can be locked/sealed and certified for the journey to their destination; introduction of smart cards for vehicle registered and driving license will be a pre requisite. Similarly development of national Registers for Vehicles and the traders, who are frequent users of Check Posts, will also be required.

• Adopt “Single Window Clearance System” for all authorized charges/clearances both at origin and at Check Posts. Most of the States are collecting various taxes at border check posts. Owing to non-integration of various offices (Motor Vehicles, Excise and Taxation, Forests, Sales Tax, etc.) dealing with taxes/checking of goods in many States, goods vehicles are detained at several places en route.

In addition, manual processing of tax papers at inter-state check posts, lead to delays and hampers smooth traffic flow. Single window integrated border check posts would help in drastic reduction of waiting time and smooth flow of traffic at State borders.

• Need to emulate innovative approach of State Governments of Andhra Pradesh and Gujarat towards automation and computerization of the Inter State Check Posts (ICPs). In case of Gujarat this has enabled 100% checking of vehicles and more than 4 fold increase in revenue collection from Rs. 56crore to Rs. 237crore within three years of introduction.

Similarly, Andhra Pradesh through common software has ushered in a Single Window Checking Facility covering 8 major departments at 5 ICP on NHs bordering adjoining States. This will result in faster delivery time, fewer opportunities for rent seeking and predictable revenue cash flows.

• Freight agents and brokers are important actors in the trucking industry. They have now been brought under the purview of legislation carriage by Road Act, 2007. This provides for registration/accreditation of brokers and freight agents.

• Abolish requirement of a transit pass.

• The question about erection of check barriers was considered by the Transport Development Council at its meeting in August 1980. The Council had emphasized that all efforts should be made by the States to unify check barriers along the National Highways having single combined ones at

inter-state boundaries and that they should be proper design with separate lay – so as not to hinder movement of the through traffic.

4.1.2.1 Recommendations regarding Taxation:

• Replace various road transport related taxes/levies (road tax, goods tax, passenger tax) etc. by a single composite tax. This will both reduce collection cost and compliance cost of vehicle owners/operators.
• Phase out Central Sales Tax
• Provide tax credit for the inter-state movement of goods under State VAT.

4.1.2.2 Recommendation regarding Motor Vehicles Act Amendment:

• Amend the Motor Vehicle Act, removing penalty payment clause and retaining only removal of excess load from the trucks.

• Install WIM (Weigh-in-Motion) to identify violators.

• The colour of truck number plate of interstate vehicles should be different from the intra state vehicles. This will help segregate goods vehicle and reduce the intermediate checking of inter-State freight movement.

• For enhancing inter-State road transport efficiency following amendments to existing MV Act are suggested: Punishment to common carrier found responsible for overloading; Deletion of Section 194 from the recitation of Section 200 for discontinuation of compounding vehicles;

• Repealing Section 158 of MV Act for limiting police powers for checking vehicle documents without the preliminary requirement of commission of any offence.

4.1.2.3 Recommendations regarding Road Transport Regulator

To ensure level playing field for road transport services, operating in public and private sector, there is a need for Independent Regulator in Road Transport Sector. Such independent Regulator should be provided with statutory authority, fixed service tenure with provision for removal on grounds of inappropriate act or incompetence.

Besides, financial autonomy needs to be provided through levy of fee on service providers. The Independent Transport Regulator at State level should be entrusted with the following task:

i. Fix price band for different kinds of services in an objective and transparent manner;

ii. Ensure service coverage across regions (including rural, remote and hilly areas) and provide mechanism for compensation for discharge of universal service obligations (provision of service on non-remunerative routes and remote rural sector);

iii. Benchmark quality of road freight service;

iv. Impartially address various operational issues like access to terminals and other common infrastructure facilities to all operators and;

v. Promote competition to curb anti-competitive practices. The Independent Transport Regulator could mandate ISO 9001-2000 Certification for the Transport Service Providers, consistent with reasonable tariff.

4.1.2.4 Automate and use of IT for cross border road freight transport management

Activities at borders involve checking parameters related to vehicle, driver and cargo. Origin, destination, value, weight, tax paid and type of cargo is checked which either lead to compliance or violations related to weight and taxation. Non-compliance leads to payments of penalties and detentions, both of which require safe parking for both, short and long term. Issuance of tickets for complying as well as non-complying vehicles is also an activity.

Also checking at the borders are compliance related to vehicle and its driver including various certificates and licenses. It needs to be kept in view that IT also makes it possible to spatially segregate many of the activities from the exact border locations.

• Weigh-in-motion (along with Automatic Vehicles Identification which can be remotely communicated to the Border Check-Posts.

• Commodity certification for unitized cargo (in a manner similar to dry-ports) and communication of the same at check post enabling early preparation for inspection and regulation.

• Attempts at moving clearance centres away from the border with inland inspection, in a manner similar to dry ports in case of export cargo.

4.1.3 Recommendations to PGCIL w.r.t Project Logistics:

• In PGCIL's materials management department which is responsible for project logistics **ERP** has to be implemented. So far there is no material management software of proper working procedure for material management department. ERP will reduce these disadvantages by means of proper

flow of information, minimizing repeated and unnecessary information flow and centralized information sharing & flow.

• Most of the project logistics depends on email or telephonic call follow up, there is no continuous tracking system of the equipment or the material which is transported. Once the project is finalized and order is placed for the equipment supply there is no communication between the regional offices (site offices) and the head quarters. PGCIL doest even know who will be transporter for the equipments which are to be supplied. PGCIL will come to know about the transporter only after the CHA clearance. This has to be changed, while awarding contract to supplier Power Grid must ensure that the transporter is competitive enough and capable of executing the work. For this they have to maintain a database which provides information about qualified logistics providers.

• **PGCIL** must ask the supplier that whoever may be logistics provider they must be capable of making use of and adhere to **Intelligent Transport System (ITS),** since ITS can increase the efficiency of existing logistics. ITS is based on information technology. The main information resources of the ITS include real time traffic flow management, parking or berth availability, vehicular traffic, and a basic geographic information system.

Cargo that uses more than one mode, sea-to-road or rail-to-road for example spends a lot of time stationary in depots or warehouses or at border checkpoints. Using vehicle ITS technologies in transport systems combined with electronic tagging and documentation, can greatly reduce waiting/transit times.

According to studies, ITS can reduce journey time and thereby facilitate savings. Applications like electronic toll collection that facilitate Automatic, contactless collection of tolls using surveillance methods and vehicle guidance and automated operations can contribute significantly to reducing delays.

• Apart from implementing the above operational changes PGCIL should also give due to management perspective like as of now there is no logistics department in PGCIL. Only materials management department is taking care of project logistics, stores as well as all other material requirements in Power Grid. There must be a dedicated department which will be the responsible center for project logistics and ODC transportation. Even though currently there are no major project delays due to ODC delays, in future there are chances that transportation will play a major role since PGCIL is trying to augment its transmission capacity vigorously.

• As of now there is no proper monitoring and planning mechanism for project logistics, there isn't even proper work break down structure for project logistics. There is only a start and end date for logistics for an equipment shipment. In between there are numerous activities involved (involving more agencies) which is not mentioned in the project planning also there is no proper allocation of time line for these activities, no proper indication of responsibility centers for these activities and the cost and human resource involved in these activities. These things have to mentioned in the

project planning especially in logistics planning; and continuous tracking, updation, adherence to timelines has to be followed.

- There is no standard post project analysis procedure for the completed projects. This has to be followed so that it will be helpful in avoiding repeated errors which can improve the process flow and save time.

5. CONCLUSION

Project delays in PGCIL due to ODC transportation difficulties & delays lead to a revenue loss of approx. Rs.4.5crores/day per substation. Any delay in transportation will cause a tremendous impact on project cost and its overrun. In future numerous number of transmission substation projects with higher capacity are about to be executed by PGCIL; this will increase the complexity of project logistics in PGCIL projects.

Any transportation delay in PGCIL's projects not only affects PGCIL but it will affect the entire chain of power sector. Absence of PGCIL's transmission infrastructure will lead to congestion or non-availability of network and the force the power generators to operate with low plant load factor or may force them to shut down. This on the other hand will also lead to load shedding (power cuts) in the distribution side of power sector which in turn affects the productivity of a state or region thereby affecting the economic growth.

Transportation sector which contributes around 6% of India's GDP if performs well by get getting rid of its bottlenecks and assists power sector (3.5% of GDP) in its ambitious capacity building plan, then together these sectors are having a great potential to boost Indian economy and its growth.

So it will be good if we start planning, monitoring and optimization of project logistics from now onwards by means of implementing proper project logistics scheduling, ERP and integrated transportation system by integrating all the stake holders of the project like supplier, contractor, logistics service provider etc to minimize mishaps, unwanted surprises and by having a standard, efficient logistics methodology and procedure.

Exhibit: 01

IDC Calculation - Repayment Schedule		
Repayment Years	Interest 13%	Capital Repayment
	Rs. 4,125,722,222.22	Rs.
1	247,543,333.33	4,373,265,555.56
2	262,395,933.33	4,635,661,488.89
3	250,325,720.40	4,172,095,340.00
4	222,511,751.47	3,708,529,191.11
5	194,697,782.53	3,244,963,042.22
6	166,883,813.60	2,781,396,893.33
7	139,069,844.67	2,317,830,744.44
8	111,255,875.73	1,854,264,595.56
9	83,441,906.80	1,390,698,446.67
10	55,627,937.87	927,132,297.78
11	27,813,968.93	463,566,148.89
12	0.00	0.00

Repayment per year	Rs.463,566,148.89
Interest (IDC) for the first 03 years	Rs.760,264,987.07
Per-day Interest cost	Rs.694,305.92

ABBREVIATIONS

CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CHA	Custom House Agent
CPP	Captive Power Plants
EHV	Extra High Voltage
EPC	Engineering, Procurement and Construction
ERP	Enterprise Resource Planning
ET	Electric Traction
GoI	Government of India
GT	Generator Transformer
HVDC/AC	Heavy Voltage Direct Current/Alternate Current
ICP	Integrated Check Post (for Interstate)
ICT	Inter Connecting Transformers
IPP	Independent Power Producers
ITS	Intelligent Transport System
IWT	Inland Water Transport
MAV	Multi Axle Vehicle
MoRT&H	Ministry of Road, Transport and Highways
NH	National Highway
NHVR	National Heavy Vehicle Regulator
NSSO	National Sample Survey Organisation
NW	National Waterway
O&M	Operations and Maintenance
S/S	Sub-station
TDC	Transport Development Council
TPS	Thermal Power Station
TRW	Transport Research Wing
VAT	Value Added Tax
VDF	Vehicle Damage Factor
WIM	Weigh-in Motion

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Green It, Roi And Sustainability… In The Indian Context

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INTRODUCTION

GREEN IT

In the Gartner report "Hype Cycle for Green IT and Sustainability in India, 2011", analysts said that green IT and sustainability would be pursued in a very big way in the IT organizations in Indian industries. Though still in a very nascent stage, they will soon emerge as top priorities for businesses, investors and technology professionals across industries and policymakers in India (Gartner, 2011).

Green IT essentially refers to an information technology system which is environmentally sustainable. It is "the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems - such as monitors, printers, storage devices, and networking and communications systems - efficiently and effectively with minimal or no impact on the environment. Green IT also strives to achieve economic viability and improved system performance and use, while abiding by our social, environmental and ethical responsibilities. Thus, green IT includes the dimensions of environmental sustainability, social sustainability, the economics of energy efficiency, and the total cost of ownership, which includes the cost of disposal and recycling. It is the study and practice of using computing resources efficiently (San Murugesan, 2008).

Along the same lines, another author (Pinola, 2011), refers to Green IT, or green computing, as initiatives to use technology in a more environmentally friendly way. The growing green IT movement includes initiatives within companies to use power more efficiently, reduce waste, and create more eco-friendly computing products. Some examples of green initiatives include: leveraging new teleconferencing tools, encouraging telecommuting, implementing power saving policies, and using cloud-based services and applications. At the corporate level, other green IT trends include server and storage virtualization, reducing data center energy consumption, and investing in more efficient hardware (Melanie Pinola, 2011, Jaiswal, Anil, 2011).

For a large number of enterprises, green IT refers to environmental initiatives in IT infrastructure (desktops, laptops and data devices) where better and more modern technologies can be used to conserve energy as well as reduce the carbon footprint(Dandawate, Yogesh, 2011).

The e-waste issue is yet another challenge facing Green IT today. As new gadgets are made available to consumers, large volumes of such products are used widely in the market. However, their disposal is a big environmental challenge and needs to be attended to by all IT manufacturers.

In general, Green IT initiatives can be categorized into four major groups: Virtualization and Consolidation, Power Conservation and Energy Efficiency, Climate Change Initiatives, and initiatives to reduce electronic waste (Green IT: Why mid-sized companies are investing now, 2011).

Virtualization and Consolidation: Initiatives in this area include server virtualization and consolidation, storage consolidation and desktop virtualization. These projects typically improve cost and energy efficiency through the optimized use of existing and new computing & storage capacity, electricity, cooling, ventilation and initiatives in building & real estate.
Virtualization is important for a variety of reasons.

Traditionally there is one server deployment per physical machine. Here the CPU utilization level is quite low (5-15 %) and thus desktop computers are underutilized. All the same it still uses power at the rate of 60-70 %. Through virtualization, multiple underutilized computers can be virtualized into a single physical computer thereby helping to achieve a much better distribution and utilization of resources (Chitnis, Bhaskaran, and Biswas, 2011).

Moving desktops to a virtual environment and employing thin client machines reduces energy consumption and the environmental impact of user infrastructure. Thin clients have no CPU, no RAM, no moving parts, and connect to the virtual desktop environment. While a typical computer uses up to 250-watts of power supply, a thin client uses a 4.8-watt power supply, so the reduction in electricity usage is 97-98 percent, with all the necessary functionality. Energy savings result, as does cost avoidance, thanks to extended refresh cycles provided by thin client equipment (Chitnis, Bhaskaran, and Biswas, 2011).

Power conservation and Energy Efficiency
Power conservation and energy efficiency are interrelated approaches. Initiatives relating to power conservation comprise all efforts for reducing power use. Such efforts comprise turning off air conditioners and electric bulbs when not needed, putting computers on standby mode etc. On the other hand, energy efficiency includes server room upgrades and new builds, IT energy measurement, printer consolidation, managing IT equipment using better technology and PC power management. These projects have energy efficiency or reduction as a major cost saving benefit.

Climate Change Initiatives

Climate Change initiatives are directed towards reducing the generation of green house gases (GHGs), especially carbon dioxide, which are believed to cause global warming and climate change.

These approaches encourage the use of solar energy and other renewable energy sources to power IT infrastructure and enterprise data centers. They also encourage the use of solar powered electric bulbs, water heaters, cooling systems etc. Under this approach, organizations implement and institutionalize technologies such as video and remote conferencing to reduce travel (thereby reducing the generation of GHGs), remote system access and web based collaboration which include video conferencing, tele-work etc.

Initiatives in this area also include collaboration and telecommuting, which again are typically associated with reductions in travel, fuel and commuting costs.

E-waste/ IT equipment recycling and remanufacturing

E-waste or electronic waste comprises discarded computers and other electronic goods often going to landfills. IT hardware contains toxic materials such as lead, cadmium, mercury and chromium. If dumped irresponsibly in the landfills, these toxic materials leach harmful chemicals in the waterways and in the environment. If burnt and incinerated, they release toxic fumes in the air. So E-waste is a very big challenge to the environment (Green IT: Why mid seized companies are investing now, Info tech research group; page 3-14.)

According to research groups working on Green IT, amongst all the green IT initiatives which companies all over the world endeavor to follow, the following list provides the initiatives which have become or may become more prevalent than certain others. These are:

Table 1

- Solar powered workstations, Recycling computer parts, Cloud computing, Virtualization
- Data centers with energy efficient equipment and operations, as well as management best practices, boosting the data transfer rate by 10 times and dramatically reducing power consumption
- Development of more sophisticated models of managing energy consumption, particularly with cloud computing, content distribution, and information logistics, as well as improved energy efficiency of next-generation networks and Internet services
- Energy-efficient infrastructure equipment to significantly reduce their networks' power consumption and carbon emissions

- Including tele-work and videoconferencing to replace energy-intensive activities such as travel energy-efficient behavior such as switching off computers when not in use, using compact energy-efficient light bulbs, and maintaining an optimal room temperature
- Environmentally friendly e-waste disposal / recycling
- Reducing pollution caused by the end-of-life of their products, adopt a take-back option, whereby they take from consumers the computers that they no longer need, and arrange for their disposal in an environmentally friendly manner through an e-waste recycling plant
- Eliminate or minimize the use of toxic materials in computers which some of the computer manufacturers in India are doing. Toxic chemicals such as lead, cadmium, mercury, brominated flame retardants, and leaching plastics are extremely harmful to human health.

Source: http://www.hindu.com/2007/01/23/stories/2007012303521000.htm , Green IT: (Why mid-sized companies are investing now, 2011, Info-tech Research Group, Pinola 2011)

ROI AND GREEN IT

In implementing Green IT the ROI concept is considered important because ROI can often constitute a major driving force for IT companies to incorporate green initiatives into their operation. In other words in addition to providing environmental and social performances Green IT makes business sense also for such companies. Achievement of ROI is indeed a logical possibility because for IT companies in general, energy consumption is one of the major cost drivers (Porter and Linde, 1995). Green IT as an initiative helps the organization take a methodical approach to reducing such costs, with managers implementing green IT having different cost cutting strategies for the top, middle and bottom line of the organization. At its core, green is about doing more with less, which can save an organization's resources quickly. Of course this initiative, like any other initiative will require initial capital. However, the long term benefits far outweigh the initial investment and help achieve a feasible ROI over a period of time.

In India, in recessionary times such as now, when companies are facing reduced demands for their products, reducing the cost of production has become imperative. Green IT initiatives could be one of most innovative methods of reducing costs in a big way (Rao and Holt, 2005). However, many organizations do make a mistake of sidelining their green initiatives during turbulent times (Andrew Winston, 2009). According to this paper, if an organization adopts Green IT initiatives, ultimately they will understand how to get lean, get going, get smart, and get creative.

Today most of the firms that have implemented green initiatives are driven more by cost savings that they bring in rather than by the sustainability of a firm's business in the social environment in which it operates (Prakash, Nivedan, 2010). The most important part of any IT initiative is stepping back and assessing the accomplishments. In his writings on Green IT, Ted Hein (2008) says that pursuing ROI for the green IT program has always been secondary to doing the right thing. All the

same, the numbers had more than validated the program in financial terms. Using virtualization they eliminated the need for new servers. NetApp's data de-duplication technology helped to free substantial amount of disc space. These two measures paid for the cost of the whole drive and the rest came via the solution: energy savings, improved fault tolerance, recoverability and performance (Ted Hein, 2008).

The financial performance of firms incorporating Green IT is affected by environmental performance in a variety of ways. When E-waste, both hazardous and non-hazardous, is minimized as part of Green IT, it results in the better utilization of natural resources, improved efficiency and higher productivity and reduces operating costs. Again, when Green IT improves the environmental performance of the firm, it ushers in tremendous marketing advantages, and this leads to improved revenues, increased market share, and new market opportunities. Organizations that minimize the negative environmental impact of their products and processes through Green IT, recycle post-consumer waste and establish structured Green IT systems, are poised to expand their markets or displace competitors that fail to promote strong environmental performance (Klassen and Mclaughlin, 1996).

Since many believe that Green IT management does lead to improved environmental performance, it implies that greening IT operations at different phases of the operations should directly, or indirectly, translate into enhancement of economic or financial performance, thereby enhancing its ROI.

SUSTAINABILITY AND GREEN IT

Over the last decade, preserving the environment has been a high priority in industry because of the increasing compliance requirements of government and pressure from consumers (Corbett and Kleindorfer, 2001; Pun *et al*., 2002; Pun, 2006). For instance, people are increasingly condemning behaviors that cause damage to the environment (Price and Coy, 2001; Chinander, 2001; Hanna and Newman, 1995; Santos-Reyes and Lawlor-Wright, 2001). Therefore, organizations are constantly under pressure to develop environmentally responsible and friendly products and operations (Price and Coy, 2001; Pun *et al*., 2002). Ponksinska *et al.* (2003) argues that showing care for the environment and establishing a strong environmental image may help organizations to attract environmentally conscious customers and suppliers. Also there is a business case for incorporating environmental initiatives into organizational processes in the sense that initiatives such as greening of the supply chain or green purchasing, in particular, lead to better competitiveness and economic performance (Rao and Holt, 2005; Rao 2004, Rao and Kondo, 2010).

Simultaneously, with increased demands on the strong environmental performance of products and processes, organizations are now being held responsible for the social performance of their own procedures as well as those of suppliers and partners. These pressures are derived from a number of internal and external sources including employees and management, socially aware

organizations, communities, governments and non-governmental organizations (JCLP introduction to special issue, 2010). Thus, in addition to achieving environmental performance, the focus has shifted to a much broader concept called sustainability which encompasses the environmental and social performance of the organization in relation to its products and services and all stakeholder interests pertaining to customers, employees, suppliers, distributors, waste handlers and other business partners.

GREEN IT AND INDIA

India is a major IT outsourcing centre for the whole world. US based multinationals are a major source of such projects. Many organizations in the US are aligning their objectives to Green IT initiatives and they also look for service providers who follow Green IT practices. Considering this, it is important to study the viability of the Green IT initiative in the Indian environment and to analyze whether ROI and sustainability are achieved.

The Indian software industry has grown at a very high compound rate of over 50 % during the 90's from a modest revenue of US$ 195 million in 1989-90 to evolve into a US$ 8.3 billion industry in 2000-2001. This rise represents one of the most spectacular achievements of the Indian economy (Kumar, 2001).

Along with this growth in the Indian software industry, in general there has been a remarkable growth of interest in incorporating environmental initiatives into the company operations in the overall Indian industry scene (Khanna, 2008). This can be attributed to the increasing statutory and regulatory requirements of government and the pressure from consumers and the life-threatening global ecosystem deterioration. Therefore, organizations are constantly under pressure to develop and implement Environmental Management Systems (EMS).

Among the well established state of the art companies, India is among the leading adopters of Green IT initiatives like power saving, cooling efficiency, and server virtualization (http://searchdatacenter.techtarget.in/guide/Green-IT-in-India-Inc).

For instance, when Jindal Steel Limited (JSL) decided to have a proper data center, the issue of data center power and cooling were considered. The company took a unique power-generating approach - power for the data center was taken from water turbines in-house. In case the turbines failed for some reason, there were generators to act as backup. (http://searchdatacenter.techtarget.in/news/1506514/Data-center-power-cooling-success-story-from-Jindal-Steel?vgnextfmt=aiog&cc=eebb1b834f7c9210VgnVCM1000000d01c80aRCRD).

"India's information and communication technology (ICT) industry will be an early adopter of green IT and sustainability solutions as India is one of the fastest-growing markets in terms of IT hardware and communications infrastructure consumption, " said Ganesh Ramamoorthy, research director at Gartner. "As enterprises embrace IT to improve productivity and drive growth,

penetration of ICT infrastructure has been growing rapidly during the past decade, as has the energy consumption and resulting carbon emissions of India's ICT infrastructure"(Gartner, 2011).

Indian IT companies like Wipro, HCL, Infosys and a few others have taken the lead towards adopting green computing; they are incorporating environmental initiatives in their products and services and encouraging their customers and clients to adopt green computing practices. Two Indian companies – Wipro and HCL, have emerged amongst the top five greenest electronics companies in the world. Wipro's Green IT initiatives extend from energy efficient data centres to eco-friendly product engineering designs and PC ranges. It offers ENERGY STAR compliant products and has joined the Green Grid, a global consortium dedicated to advancing energy efficiency in data centres and business computing ecosystems. To promote and drive green computing efforts, the Computer Society of India and industry association NASSCOM has established special interest groups (http://sation.in/?page_id=356).

HCL has recently launched an aggressive drive to educate their customers and the general public about the hazards of e-waste and the responsible disposal of e-waste and has committed to phasing out hazardous materials from its products. Also HCL Learning has launched a new program to educate over 10,000 of its students across the country in a year about green computing (Johri, 2008).

Recently, Cognizant instituted a PC power management program to put their desktop PCs in hibernation mode after-hours, saving an estimated 18.75 million kWhs of electricity annually. This resulted in a $2.5M annual cost savings and an estimated 17,500 metric ton annual reduction of carbon emissions. They have virtualized over 100 servers in their data centers to reduce server energy consumption. They have also initiated a data center consolidation project that will reduce overall data center energy consumption (Greenlaw, 2009).

So there are many enterprises in India which have realized the tremendous potential which Green IT has in the greening of their products and related services, practices during consumer uses and even during the implications at the end of the product life and disposal stage. However, by and large, corporate India is yet to embrace Green IT in a big way. The majority of Indian CIOs often explain that they are familiar with green IT platforms which will cut down carbon footprints, reduce power usage and improve return on investment but, when it comes down to formal strategy, the adoption level is significantly lower. They are investing in green IT slowly and steadily rather than adopting a big bang approach (Prakash, Nivedan, 2010).

In view of the fact that Green IT has such a tremendous potential in addressing the major environmental challenges posed by the production, use and disposal of IT products in India, this research has been envisaged with the following objective:

THE RESEARCH QUESTION

Our research proposes to measure the extent of Green IT adoption in Indian IT related companies in operation today. Further the research would also endeavor to determine as to which aspect of Green IT adoption are found to be significant. The research also purports to explore the linkages between IT adoption, achievement of return on investment and achievement of environment as well as social sustainability in today's context; to check if Green IT would indeed lead to Sustainability in terms of environmental as well as social sustainability, which would lead businesses to act in a responsible manner so as not to compromise the prospects of future generations.

CONCEPTUAL FRAMEWORK

In keeping with the different aspects of Green IT which enterprises are endeavoring to adopt these days, this research contemplated using different Green IT initiatives and measuring the extent of their adoption in IT companies in the country. The Green IT initiatives considered are categorized under the following constructs:

Construct 1: Virtualization

- Incorporation of Local Area Network (LAN) Virtualization in the organization for streamlining efficiencies
- Incorporation of Storage Virtualization in the organization so as to help create savings in data center power and cooling requirements, thus increasing energy efficiency
- Incorporation of Server Virtualization in the organization so as to help decrease future e-waste, improve energy efficiency and reduce CO2 emissions
- Old servers and mainframes replaced with new virtualization techniques
- LAN and WLAN connectivity being replaced by virtualization systems

Construct 2: Energy Efficiency

- Purchasing E-star equipments
- Using sensors in buildings that automatically interact with control systems to shut off lights, power, and air conditioning/heat when the area is not occupied
- Lesser use of electricity on project specific equipments
- Better technology processors to replace obsolete power consuming machines

Construct 3: Power conservation

- Turning off the ACs
- Switching off the electric bulbs

- Putting the computers on the stand by/sleep mode and switching them off during the weekends
- Reducing on printer usage
- Policy of light colored dress code/no suit policy so as not to use the AC much
- Devices are shut down when not in use

Construct 4: Climate Change initiatives

- Use electric bulbs with solar powered bulbs
- Geysers with solar water heaters
- ACs with underground cool air
- Usage of modern low power processors
- Purchase IT technology meeting EPEAT (Electronic product environmental assessment tool)
- Review technology refresh programs to establish environmental compliance on future processors.

Construct 5: E-waste

- Optimization of process to reduce electronic waste with personal computers
- Optimization of process to reduce electronic waste with the help of VOIP devices
- Optimization of process to reduce electronic waste with the help of servers/main frames

With the Green IT initiatives enlisted above, the research next explored the linkages of Green IT constructs with ROI and Sustainability. Sustainability, as literature points out (Seuring, Sarkis, Muller and Rao, 2010) encompasses environmental, business and social sustainability issues.In keeping with this framework the research explored the linkages between Green IT and ROI, as well as Green IT and environmental & social sustainability.

In the research, ROI is defined as:

Construct 6: ROI

- Quality improvement (Deliverables have fewer defects)
- Cost saving (Projects are able to save more on existing costs)
- Increased efficiency (Employee turn-over rate has gone up)
- Profit margin enhancement

Construct 7: Sustainability

- Social commitment (Benefitted the CSR activities)
- Environmental preservation
- Reduced the carbon footprint

Based on the constructs as proposed above, the conceptual framework would constitute two hypotheses to be validated:

1. Green IT initiatives such as virtualization, energy efficiency, power conservation, climate change initiatives and e-waste initiatives would lead to enhanced achievement of ROI (Figure 1).

2. Green IT initiatives such as virtualization, energy efficiency, power conservation, climate change initiatives and e-waste initiatives would lead to enhanced achievement of Sustainability (Figure2).

Figure 1: Conceptual Framework: Linking Green IT to ROI

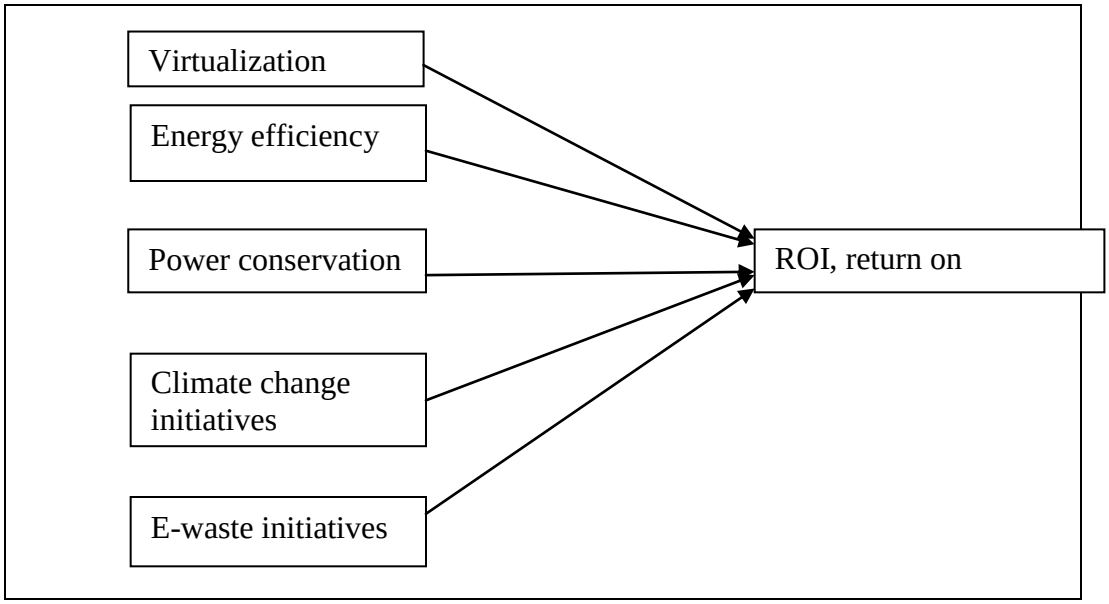
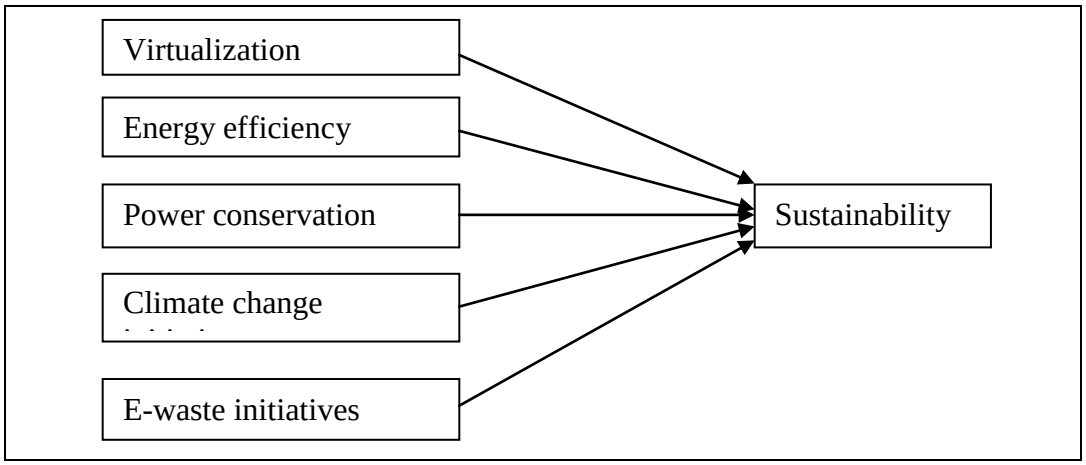


Figure 2: Conceptual Framework: Linking Green IT to Sustainability



METHODOLOGY

In line with the research question followed in this empirical study there were two broad objectives which guided the methodology pursued. The first objective was to assess the extent of adoption of Green IT initiatives in IT related organizations in India. The second objective was to determine linkages between Green IT, ROI and Sustainability. The first part of the objective was achieved by exploratory descriptive analysis. The second part of the objective was achieved using multiple regression analysis

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ASSESSING THE EXTENT OF ADOPTION OF GREEN IT IN INDIAN ORGANIZATIONS

The responses on five constructs depicting the different aspects of Green IT adoption in India, Virtualization, Energy Efficiency, Power Conservation, Climate Change Initiatives and E-Waste related initiatives would be used to test the significance of their extent of adoption.

MULTIPLE LINEAR REGRESSION MODELING

The second part of the data analysis constituted the use of multiple linear regression analysis to validate the model proposed in the section called 'conceptual framework, investigating if Green IT would lead to the achievement of ROI as well as Social Sustainability. In other words the objective would be to find out if there were significant linkages between variables/ constructs such as the ones mentioned above.

Under multiple linear regression, two separate models would be run. In both the models the independent variables would be the five constructs - Virtualization, Energy Efficiency, Power Conservation, Climate Change Initiatives and E-Waste related initiatives. The dependent variable in the first run will be ROI and in the second run will be Sustainability.

Structural Equation Modeling was not targeted to use because the researchers knew the data availability would be a challenge.

DATA COLLECTION

To determine the extent of Green IT adoption in Indian organizations, large and medium companies, multinational as well as domestic companies, operating in the southern part of India, were targeted.

Only such companies/ organizations, which have incorporated Green IT, were identified by looking for the key words 'Green IT' in the annual reports of the companies. The research team also realized that the annual reports of the companies could be a potential source of information on all green IT initiatives that the company has implemented so far and the ones that they plan to invest in. These reports also provided an assessment of the degree of seriousness that a firm has in implementing such initiatives at the organizational level.

Considering the Green IT focus, data was collected using a survey questionnaire as a research instrument, where individuals such as Head of IT, Chief Financial officer, senior managers, information risk and security managers, Senior IT Training Head, IT project manager, IT governance and compliance senior managers belonging to the company were approached and requested to give their responses. They were requested:

- to give their assessment (strongly disagree, disagree, agree, strongly agree) on whether each individual item under the five Green IT related constructs above, has been incorporated in their organizations (In the last two years, the company has taken environmental actions in the following areas - on a four point scale of strongly disagree, disagree, agree, strongly agree)

- to give their agreement on whether there have been benefits in the different aspects of ROI, construct 6, and Sustainability, construct 7 (In the last two years because of implementing better management practices there have been specific benefits achieved in each of the following categories - on a four point scale of strongly disagree, disagree, agree, strongly agree).

The data collection method was thus non probability purposive sampling, the target population comprising companies which have initiated Green IT in their operations.

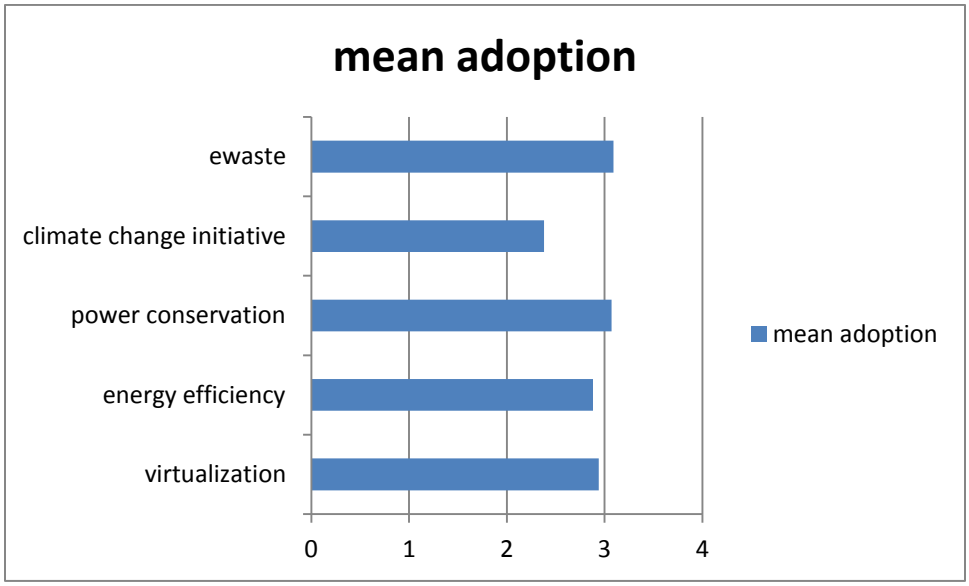
The data collected included responses from 30 leading companies, who have incorporated Green IT, the questionnaire being answered by the manager IT, Head of IT, IT team leader, internal auditor, manager IT, governance and compliance, application analyst, chief financial officer etc. The data collection was carried out during the months of October/ November, 2009.

RESULTS FROM THE DATA ANALYSIS

The following table gives the mean ratings (strongly disagree=1, strongly agree=4) of the Green IT initiatives as obtained from the sample.

Table 2

Green IT construct	*mean adoption*	*t-value*	*significance*
virtualization	**2.94**	**4.63**	**significant**
energy efficiency	**2.88**	**4.01**	**significant**
power conservation	**3.07**	**6.02**	**significant**
climate change initiative	**2.38**	**-1.02**	**not significant**
ewaste	**3.09**	**6.42**	**significant**



From the above table it appeared that with the exception of climate change related initiatives, all other Green IT initiatives such as Virtualization, Energy Efficiency, Power Conservation and E-Waste related initiatives have been significantly adopted by Indian companies.

RESULTS FROM THE MUTIPLE LINEAR REGRESSION ANALYSIS

The multiple regression analysis was run to see which independent/predictor variables significantly correlated with a chosen dependent variable. On the whole, two different regression models were considered in order to validate each of the two hypotheses that were presented earlier. The

dependent variables for each of the two runs are presented below; the independent variables were the same for all four runs.

Table 3: Dependent and independent variables of two runs of regression analysis

	Dependent Variable	**Independent Variables for two Regression Runs**
Regression 1	ROI	Virtualization, Energy Efficiency, Power Conservation, Climate Change related initiatives, E-Waste related initiatives.

The initial results of the two regression runs are summarized in Table 4, which gives R-square, F-significance, β-coefficients, and *p*-values for the two regression runs. If the p-value < .05, it would imply that the associated predictor variable would have a significant impact on the dependent variable.

Table 4: Initial results of the two regression runs, with β-coefficients and p-value

Predictor variables	**Regression 1 (dependent variable= ROI)**	**Regression 2 (dependent Variable =Sustainability)**
Virtualization	-0.19395 (p value=0.255868)	-0.05757(p value=0.815775)
Energy efficiency	0.423532 (p value=0.04066)	0.51963 (p value=0.082869)
Power conservation	0.071373 (0.715545)	0.411367 (p value=0.160295)
Climate change initiatives	-0.04538 (0.762628)	0.229984 (p value=0.301733)
E-waste	0.067075 (0.725467)	-0.24847 (pvalue= 0.378481)
intercept	2.24754 (0.002337)	0.696783 (pvalue= 0.478865)

Multiple R	0.527834	0.657895
Significance of F-value	0.140302277	0.013252

From the results shown above one may observe that the regression model with ROI as the dependent variable is not statistically significant at the 5% level of significance because the significance of the overall F-value is greater than 0.05, the generally acceptable level of significance. However, it is still statistically acceptable at the 14% level of significance.

The regression model with Sustainability as the dependent variable is statistically significant as seen from the level of significance of the F-statistic being less than 0.05.

Hence one may conclude that though Green IT initiatives do not significantly impact ROI, ***they significantly lead to the achievement of Sustainability.***

However, the model for Sustainability as the dependent variable is still an interim model because some of the predictor variables in it are not statistically significant as observed from the p-values which are greater than 0.05.

To obtain the final model for Green IT impacting Sustainability**,** the predictor variables have to be dropped one by one, starting with the predictor variable, Virtualization, with the highest p-value (p= 0.815775).The final model for Sustainability emerges as:

Table 5: Final Model for Regression of Green IT on Sustainability

Predictor variables	**Regression2 (dependent variable= Sustainability)**
Energy efficiency	0.813808 (p value= 0.000766)
Intercept	0.720188 (p value= 0.263748)
Multiple R	0.580738
Significance of overall F-value	0.000766

From the above final model for Sustainability, it emerges that the final regression model for Sustainability was highly statistically significant. **The predictor variable which had significant impact on the achievement of Sustainability is Energy Efficiency**.

All the same, though other constructs of Green IT were not directly present in the model, many of the other constructs did have their impact on Sustainability, indirectly, because Energy Efficiency had significant correlations with Power Conservation and Climate Change Initiatives.
The following matrix presents the correlations as well as their significance levels

Table 6: Bi-variate correlations of Green IT constructs

	Power Conservation	*Energy Efficiency*	*Climate Change Initiative*	*Virtualization*	*E-waste*
Powerconservation	1				
Energy Efficiency	0.5671**	1			
Climate Change Initiative	0.4308**	0.4927**	1		
Virtualization	0.06687	0.2642	0.2306	1	
E-waste	0.3537	0.25901	0.465005774	0.3816**	1

Hence one concludes that because energy efficiency, power conservation and climate change initiatives are significantly correlated at the1% level of significance, power conservation and climate change initiatives do impact Sustainability achievement in an organization.

DISCUSSION ON RESULTS OBTAINED

This research was undertaken (a) to assess the extent of the Green IT implementation among companies who are in the process of incorporating Green IT into their operations, and (b) to investigate significant linkages between Green IT, ROI and Sustainability.

(a) From the data analysis which was carried out to address the first part of the research objective, one observes that Green IT initiatives such as those under Virtualization, Energy Efficiency initiatives, E-waste related initiatives, and Power Conservation initiatives, are significantly incorporated in the companies surveyed.

Of these constructs perhaps the simplest to implement in an organization will be Power Conservation comprising turning off the ACs, switching off the electric bulbs etc.

The results obtained showed that on an average these measures were significantly implemented. One also observes that because these initiatives would be perhaps the simplest to implement, any organization that wants to incorporate Green IT, should start with these initiatives first to be followed by more complex ones (Murugesan, 2008).

The next construct which would have ease of implementation would be Energy efficiency including purchasing E-star equipments, using sensors in buildings that automatically interact with control systems to shut off lights, power, and air conditioning/heat when the area is not occupied etc.

Again the results above demonstrate that this Green IT has also been found to be significant in terms of adoption by the companies.

Virtualization initiatives and E-waste initiatives comprise incorporating Local Area Network (LAN) Virtualization in the organization for streamlining efficiencies, incorporation of Storage Virtualization in the organization so as to help create savings in data center power and cooling requirements, thus increasing energy efficiency, incorporation of Server Virtualization in the organization so as to help decrease future e-waste, improve energy efficiency and reduce CO2 emissions, etc. For e-waste the initiatives include optimization of processes to reduce electronic waste with personal computers, optimization of processes to reduce electronic waste with the help of VOIP devices, optimization of processes to reduce electronic waste with the help of servers/main frames etc.

These Green IT initiatives (virtualization and e-waste) are much more complex to incorporate than the previous ones in terms of resources, know-how and ease of implementation. Also sometimes the implementation of these require changing the IT infrastructure, investing in newer technology and even reconfiguring the IT process altogether. However, in spite of the difficulty in implementation, virtualization and addressing E-waste have emerged as significant in the results of the data analysis, which validates the fact that, "Of late, Indian companies have adopted technologies and practices including green buildings, green computing infrastructure e.g. energy-efficient data centers, power-efficient computers, sharing infrastructure e.g. shared data centers, addressing issues like e-waste management, etc. They are also deploying IT solutions which help them become green, including cloud computing, video-conferencing, intelligent transport systems, web conferencing, motion and heat detection sensors, amongst others." (Gurvinder Vir Singh, in Corporate India's Green Efforts, nivedan.prakash@expressindia.com http://www.expresscomputeronline.com/20100125/datacentergreenit05.shtml).

The Green IT initiative like those related to Climate Change mitigation initiatives, emerged as not significant from the data analysis. This could be because of the lack of knowledge and corporate awareness on these issues (Nivedan Prakash, 2010).

(b) To address the second part of the research question, one may consider the results of two separate models run on multiple regression analysis.

The first model with ROI as the dependent variable did not emerge as statistically significant at the standard level of 5% significance. This one concludes that Green IT does not impact ROI significantly yet.

The second model with Sustainability as the dependent variable emerged as statistically significant at the 0.0001 level of significance with Energy Efficiency as the significant predictor/independent variable. Thus Energy Efficiency certainly impacts the achievement of Sustainability. All the same, judging from the correlation matrix (Table 6), there exist significant correlations between Energy Efficiency, Power Conservation and Climate Change initiatives. The latter two constructs also do impact Sustainability but in an indirect sense.

Thus, one observes that currently in India, Green IT initiatives, comprehensively considered in five constructs, do not lead to ROI yet. However, Energy Efficiency related Green IT initiatives significantly lead to Sustainability as observed in the regression run.

In his article on Corporate India's Green Efforts, Nivedan Prakash (2010) reiterated that in India, Green IT did start as a Corporate Social Responsibility (CSR) initiative and in most organizations it still gets patronage under the umbrella of CSR. However, slowly organizations have started realizing the cost benefits associated with it as well and are moving towards it at a much broader level. In the research presented above, this is what emerges - that Green IT still leads to sustainability achievements in organizations. Its impact on ROI and cost is still not visible. All the same, this implies that even at this nascent stage, the greater concern of Sustainability was achieved rather than short term ROI, which was the inherent reason why Green IT was incorporated.

CONCLUDING REMARKS

In addition to the empirical findings obtained in the research some other related observations and concerns do need be emphasized. In fact, many of these concerns emerged while the research team conducted in-depth interviews with industry experts during the data collection phase. The authors would like to bring them up for further analysis in future.

1. Energy costs money. Ergo, anything that saves energy (and therefore money), would typically be welcome to any business organization. Commitment to Green IT, as a concept, is a matter of apprehension where there is either no direct connection with cost saving (as there may be to an extent in E-waste related initiatives) or where the initiative may actually involve an increase in costs. However, though industry may not see the connection yet, there has to be a cost saving once Green IT has been successfully implemented. Initiatives such as Energy Efficiency and Virtualization, ultimately would

help a company cut down on energy consumption and server usage, since, for instance, there are fewer physical servers consuming power. In looking at ROI, the focus in the study has been on cost reduction, quality improvement, improved efficiency and profit margin enhancement.

2. Green IT initiatives have also played a significant role in enhancing the image of some companies in the IT industry to the extent that:

   a. Prospective customers have been favorably impressed and have given them work where otherwise they may have found it difficult to enter the market.
   b. As a corollary to the above, where there are multiple vendors, a vendor with superior green IT initiatives might get a larger share of business based on the assumption that he is more sophisticated or more 'enlightened' and therefore, in some way, better as a vendor.
   c. As a further corollary, the company's price realizations might get higher.
   d. Mining companies, despite a dismal record and a crying need for better practices, have not seen fit to emulate IT companies largely because it fetches them no financial benefit from their customers.

If the above aspects are established, in addition to the other points so strongly brought out in the study, they can play a significant role in formulating regulatory policy. Instead of focusing regulation on measures which have a strong financial justification anyway, such measures are best directed at areas where financial or business justifications are weak and therefore a combination of external reward or coercion is necessary. For all such measures it may also be emphasized that though financial justification is not immediately observed, the linkage of Green IT to Sustainability is clear and that itself would encourage many Indian organizations to incorporate Green IT into their operations. "Not only should that improve reliability and ultimately save everyone money, but it will go a long way to protecting our precious planet and it should evaporate much of the green guilt of computer users, and silence some of those sustainability wars on blog discussion threads." (http://www.thedailygreen.com/green-homes/latest/7316#ixzz1ogcT61Di)

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