

BUSINESS PERSPECTIVES

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**Identification and Analysis of Factors Affecting
Consumer Behavior in Fast Moving Consumer Goods
Sector**

*Kajal Chatterjee, Krishnendu Adhikary,
Srimani Sen & Samarjit Kar*

**Customer Experience Management: Evolution and the
Paradigm Shift in Marketing**

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From the Editor's Desk

Fit no stereotypes. Don't chase the latest management fads. The situation dictates which approach best accomplishes the team's mission.

– Colin Powel

Dear readers,

Welcome to the fresh issue of Business Perspectives (BP). The journal has entered into seventeenth years of existence now. It is a journey that we believe put an indelible mark in development and growth of management research publication.

At BP, we continuously look for scope of improvements. To make the journal more focused, and current, we modified the aims and scope. It will now have special focus on, impact of human behavior on management decisions and influence of emerging technology on managerial process. BP will also prefer a qualitative research and mixed methods approach in answering research questions.

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This issue of BP carries some very good research papers and a case in the area of business management. We will look for your feedback. Do write to us.

Jagdish Shettigar
Editor-in-Chief

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Identification and Analysis of Factors Affecting Consumer Behavior in Fast Moving Consumer Goods Sector

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Krishnendu Adhikary*
Srimani Sen*
Samarjit Kar*

Abstract

With the changing mindset of consumers and the fast progressing social and economic background, lowermost portion of the market pyramid will be the fastest growing consumer market. Global fast moving consumer goods (FMCG) industry dealing with distribution and marketing of consumer products are coming with innovative plans to tackle the challenges due to intense competition, brand loyalty, and intensifying expectations of the customers. This study first examined the socioeconomic factors of FMCG to explore significant variables that affect the purchase intention of the consumers and find the gap in existing literature. Interpretive Structural Modeling (ISM) helps in examining relationships among these factors. The driving and the dependence power of several factors is recognized by the end results of ISM and is used as an input to the fuzzy Matriced' Impacts Croise's Multiplication Applique'ea UN Classement (MICMAC) analysis. The findings of the study reveal that the consumer buying behavior is influenced to a great extent not only by advertising strategy (AS), brand influence (BI) and celebrity endorsement (CE) but also by virtual merchandising.

Keywords: Fast moving consumer goods, interpretive structural modeling, fuzzy set, MICMAC

Introduction

Marketing of fast moving consumer goods (FMCGs) has a crucial part in the economic progress along with the advancement of a country, irrespective of the size and population (Sarangapani & Mamatha, 2008). This sector primarily operates on low margins and strength lies in the strong presence of distribution network, stiff competition between the systematized and disorganized sector, and the strong presence of multinational firms. To become successful in highly dynamic and innovative FMCG segment, a company not only has to be acquainted with the consumer, intense

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brands, well-established and wide-ranging flow arrangement, but also it has to have a sound understanding and knowledge of packaging and promoting (Shaout & Khalid, 2014).

The enhancement in the commercial scenario of the rural and urban customers has assisted the FMCG firms in magnifying their market to the different vicinities of the country bringing along with many challenges in front due to dynamic and highly volatile consumer profile, stiff competition, inconsistent brand loyalty, and mounting hopes of the consumers (Singh & Dar, 2014). To fight with these complications the marketers need to craft creative marketing strategies for which marketer must explore the perceptions of the customers who look for parameters in selecting any brand of FMCG (Attri et al., 2013). So the rise of FMCG consumerism has opened the door of new research in this vast area.

In this study, the existing literature is examined to explore significant factor (variables) that affect the purchase intention of the consumers for the FMCG products and to find the gap in the existing literature based on the secondary data. Because of the stunted exploration in the field of recognition of factors for implementation of FMCG practices, this research can unveil the different marketing policies which firms should inculcate for a good enough understanding of the customers' requirements. From past literature, ten common key FMCG factors with the help of expert opinion are sought (discussed later) and contextual relations are investigated and hierarchy among factors is developed using Interpretive Structural Modeling (ISM) and fuzzy Impact Matrix Cross-reference Multiplication Applied to a Classification (MICMAC) analysis is performed subsequently for removing the hidden relationship.

This paper deals with literature review in FMCG sector regarding research conducted in identifying and discussing, in brief, the factors affecting the behavior of consumers, ISM methodology and fuzzy MICMAC analysis. The paper also deals with result discussion, conclusion, and future direction.

Identification and Discussion of Factors Related to Fast Moving Consumer Goods

Background Scenario of Fast Moving Consumer Goods

Amidst the dynamic sketch and mindset of customers, FMCG segment plays a beneficial and pivotal role in semi-urban, urban slums, and evolving rural areas. According to Anbarasan & Kumar (2014), research was conducted in four districts of Tamil Nadu to ascertain the vital affecting variables by employing factor analysis and it was found that retailers influence played an important role. According to Singh & Dar (2014), customers fondness for FMCG goods is one of the most important factors thriving in rural marketing which is defined by four A's (awareness, affordability, adoptability, and availability). Shukla et al. (2012) examined the effect of publicizing on customer

purchasing attitude for FMCG products using ISM. Srivastava (2013) performed a research regarding the factors that influence the purchasing behavior of customers living in illicit societies in urban India with the aid of semi-structured questionnaire using mixed method research approach. Alam & Choudhury (2011) ascertained that four factors, i.e. manufacturers production standard, managerial efficiency, promotional capability, and customer solution capability were liable on retailer's behalf in the FMCG sector in Bangladesh. Ali et al.(2012) carried out an experiential study and threw light on factors affecting the rural buying behavior of customers in south India and identified the key influencing variables among 24 key variables using factor analysis. Singh (2014) studied the dynamics of FMCG industry and discussed its distinguishing features and key success factors. Joghee & Pillai (2013) studied the magnitude of trademark influences on customer buying decision in the United Arab Emirates, where most of the people are emigrants. Corte et al. (2010) concluded that factors like destination marketing with reference to feature, uniqueness, appearance, and trademark as a weight for advertising and above all destination development in stakeholders collaboration perspective work well.

Identification and Detailed Discussion of the Fast Moving Consumer Goods Factors

This section reviews the factors (variables) in a comprehensive manner and categorizes them into ten categories (Table 1).

Table 1.Variables (factors) identification from literature review

Variable (Factor) No.	FMCG Factors	References
1	Advertising Strategy (AS)	Shukla et al. (2012)
2	Brand Influence (BI)	Joghee& Pillai (2013)
3	Co-Branding (Co-B)	Knape &Rodestedt (2013)
4	Product Related Trends (PRT)	Ali et al.(2012)
5	Retail Loyalty Program (RLP) Effect	Waarden&Benavent (2009)
6	Cultural Orientation (CO)	Lee &Kacen (2008)
7	Liberalization of Economy (LE)	Yuvarani (2013)
8	Visual Merchandising (VM)	Bhatti & Latif (2013)
9	Corporate Branding (CB)	Brown &Dasin (1997)
10	Celebrity Endorsement (CE)	Shukre&Dugar (2013)

Advertising strategy.

Celebrity advertisements, promotional scheme, and communal broadcasting is aiding the communication between customer and supplier to involve and connect with their brands emotionally (Shukla et al.,2012). Due to the poor advertisement, people are unaware of the new FMCG products and it becomes essential to encourage every probable action to boost customers and elevate their longings to buy through an active promotional movement.

Brand influence.

This is an important factor since established brands act as high entry barriers to new products but if brand loyalty is strong, consumers will pay a high price for the product and are reluctant to switch to competitive products (Joghee & Pillai, 2013). Besides BI, dependability, product characteristics, as well as social and economic aspects, have a major influence on purchasing attitude. Brand attributes, brand values, and brand personality emerged as an important factor for selection of FMCG brands.

Co-branding.

The cost of introducing new products in the market or entering new markets has skyrocketed due to intense competition, and simultaneously the success rate is very low urging marketers to reduce the risk by using existing strong and familiar brand names on new products (Knape & Rodestedt, 2013). The use of a Co-B strategy instead of a single brand extension strategy has provided a better assurance of the product quality leading to higher product evaluations and premium prices, facilitate initial acceptance, and increase market exposure while sharing promotional costs with a partner.

Product related trends.

The consumption pattern of customer is either centered on need or want. Besides taking into consideration the effect of the goods on their well-being, the customers are also aware of its impact on the surroundings, there by concentrating on the environment-friendly and sustainable goods and their packaging issue (Ali et al., 2012). Food adulteration norms, a regular check on prices are a few of the many strategies intended to safeguard the interest of customer. Thus, with the increase in the importance of green products, the interest has risen to analyze the factors that can influence consumers green purchasing behavior.

Retail loyalty program effects.

There is a great impact of loyalty programs on repurchase behavior in grocery stores as a loyalty programs target consumers who already buy in the store more frequently, very small changes occur in their buying behavior occur than new customers (Waarden & Benavent, 2009).

Cultural orientation.

Certain factors like consumer's mood, product category impulsiveness, and demographic characteristics have a considerable impact on customers' intended purchase decisions including individualist culture (Lee & Kacen, 2008). These variances in effects can be accounted in terms of CO. It has been stated that collectivist consumers are expected to be more pleased with a predisposition purchase when some other person is present at the time of purchase as compared to individualist customers.

Liberalization of the economy.

The consequences of LE are unaccountable. It has led to the entry of worldwide brands in rural markets without any restrictions (Yuvarani, 2013). Previously companies invested their advertising efforts towards the erudite customers of the urban marketplace, but nowadays with the satiety of markets in the urban area, most of the companies concentrate towards the rapidly developing rural sector.

Visual merchandising.

Visual merchandising (VM) is described as everything that creates a positive image of a business and results in interest, desire on the part of the customer (Bhatti & Latif, 2013). VM ranges from window displays including forum display and floor merchandising along with promotion signage. The retailers today are using the merchandising tool to differentiate themselves from other competitors and to be prominent in the market and attract the customers.

Corporate branding.

The influence of business relations on the customers feedback on manufactured goods is to a considerable extent because of the variations in their dogmas and outlook towards new products manufactured by that firm. Corporate social responsibility (CSR) of a firm determines the knowledge of a customer about a firm (Brown & Dacin, 1997). CA and CSR associations may have diversified effects on customer responses to products, and products of firms with undesirable associations are not always destined to receive deleterious retorts.

Celebrity endorsement.

The usage of CE for the publicity of various trademarks has become one of the most predominant forms of FMCG publicizing. The marketers try their best to uphold their brands and catch hold of the consumer's attention. It has been proven that the use of personalities in promotion produces a lot of persuasive and instantaneous attention (Shukre & Dugar, 2013). CE has a considerable influence on consumers memory and learning approach. Therefore, if the usage of celebs is inculcated effectively, makes the brand distinctive, increases brand reminiscence, and enables spontaneous consciousness.

Research Methodology

After identified the FMCG factors, we used the Interpretive Structural Modeling (ISM) to find the preference relations of the identified factors. The details of ISM are discussed below.

Interpretive Structural Modeling: An Overview

Interpretive Structural Modeling is a co-operative learning process where the elementary notion is to use professionals real-world understanding in order to breakdown an intricate system into numerous sub-systems and build a multi-level structural model (Sage, 1977). The ultimate outcome is displayed through structural technique and the object system gets converted into a well-defined digraph which in relevant contexts become final interpretative structural models (Jain & Raj, 2015).

- This methodology is interpretive as the judgment of the group decides how the different elements are related.
- It becomes difficult to deal with a complex system of enablers which are having a directly or indirectly related.
- It is structural as on the basis of relationship is extracted from the complex variable set.
- It is a modeling technique, as the specific relationships and overall structure are portrayed in a digraph model.

But contextual relation among the variables always depends on the users' knowledge and the biased judging the variables might influence the ultimate outcome (Mandal & Deshmukh, 1994).

Modeling of Fast Moving Consumer Goods Factors by Interpretive Structural Modeling Methodology

Using an ISM technique (Warfield, 1974), constructing a model involves a number of steps, a brief description of which is given next.

Identify and Define Variables

On the basis of literature review and discussion with domain experts and the academia, ten variables (factors) related to the system or problems are first identified (Table1) and discussed earlier. The contextual relationship among various factors is examined in the brainstorming sessions, to identify and examine the pairs of variables.

Structural self-interaction matrix formation.

A structural self-interaction matrix (SSIM) reflects the influence in pairwise relationships among variables of the system. Keeping in mind the contextual relationship for each variable (criteria), the existence and associated direction of the relation between any two factors is questioned. According to Warfield (1974), to construct an SSIM matrix (Table 2), four relationships are defined among factor, using symbols V, A, X, and O defined as follows:

- V: criteria will help alleviate criteria
- A: criteria will be alleviated by criteria .
- X: criteria will help achieve each other; and
- O: criteria are unrelated.

Based on this, the variables (factors) are numbered from 1 to 10 accordingly and ISM is implemented.

Table 2. Self-structural iteration matrix

Variabl e	Factors	Variable (Factors) Number									
		10	9	8	7	6	5	4	3	2	1
Number											
1	AS	V	V	V	V	V	V	V	V	X	-
2	BI	V	V	V	V	V	V	V	V	-	
3	CO-B	O	O	O	O	O	A	O	-		
4	PRT	O	O	O	O	X	O	-			
5	RLP	O	A	A	V	O	-				
6	CO	A	V	V	V	-					
7	LE	O	O	O	-						
8	VM	X	A	-							
9	CB	O	-								
10	CE	-									

Reachability matrix.

The SSIM format is initially converted into the perpetual binary matrix, called the initial reachability matrix by transforming the information of each cell of SSIM into binary digits (i.e.0 and 1) according to the following rules (Jain & Raj, 2015):

- If entry in cell of SSIM is V, then enter 1 in the cell and 0 in the cell .
- If entry in cell of SSIM is A, then enter 0 in the cell and 1 in the cell .
- If entry in cell of SSIM is X, then enter 1 in both cells and.
- If entry in cell of SSIM is O, then enter 0 in both cells and.

Finally, the initial reachability matrix is converted into a final reachability matrix (Table 3) incorporating all transitivity positions using the following rule (Dubey & Ali,2014):“If the element leads to element and element to element , then element should lead to the element .” The final reachability matrix consists of some entries from the pair-wise comparisons and some inferred entries.

Table 3. Final reachability matrix

Variabl e No.	Factors (Variable)	Factor Number									
		1	2	3	4	5	6	7	8	9	10
1	AS	1	1	1	1	1	1	1	1	1	1
2	BI	1	1	1	1	1	1	1	1	1	1
3	CO-B	0	0	1	0	0	0	0	0	0	0
4	PRT	0	0	0	1	0	1	1*	1*	1*	0
5	RLP	0	0	1	0	1	0	1	0	0	0
6	CO	0	0	0	1	1*	1	1	1	1	1*
7	LE	0	0	0	0	0	0	1	0	0	0
8	VM	0	0	1*	0	1	0	1*	1	0	1
9	CB	0	0	1*	0	1	0	1*	1	1	1*
10	CE	0	0	0	1*	0	1	1*	1	1*	1

Level partitions and Interpretive Structural Modeling model development.

The final reachability matrix obtained (Table 3) is now partitioned into different levels constructing the reachability and antecedent set for each factor (Warfield,1974). After the identification of the top-level element, it is discarded from the other remaining variables. This iteration is continued till the levels of each variable are obtained (Table 4). The identified levels aid in building the digraph and the final model of ISM. Removing the transitivity's as described in the ISM methodology, the digraph is finally converted into the ISM-based model (Fig.1).

Table 4. Level matrix

Variable (Factor) No.	FMCG Factors	Levels
3	Co-B	L-1
7	LE	L-1
5	RLPEffect	L-2
8	VM	L-3
9	CB	L-4
4	PRT	L-5
6	CO	L-5
10	CE	L-6
1	AS	L-6
2	BI	L-6

Analysis of Fast Moving Consumer Goods Factors by Interpretive Structural Modeling Fuzzy Matriced' Impacts Croise's Multiplication Applique'ea UN Classement

In ISM model, the relationship between factors having equal importance is denoted by binary number 1. However, in real life problem, the relationship between them cannot be always equal and there is no scope for discussion about the strength of relationship between two variables (factors).

Some relations may be strong, some may be very strong, and some relation may be better. To overcome the limitations of ISM model, the fuzzy relationship is used for increasing the sensitivity of MICMAC analysis (Dubey & Ali, 2014). The ISM fuzzy MICMAC analysis is performed according to the following procedure:

Binary direct relationship matrix

Binary direct relationship matrix (BDRM) is derived from initial reachability matrix, examining the direct relationship among the criterion, ignoring the transitivity, with leading diagonal elements being converted to 0. The BDRM so derived is shown in Table 5.

Table 5. Binary direct relationship matrix

Variable Number	Variable (Factors)	Variable Number									
		1	2	3	4	5	6	7	8	9	10
1	AS	0	1	1	1	1	1	1	1	1	1
2	BI	1	0	1	1	1	1	1	1	1	1
3	CO-B	0	0	0	0	0	0	0	0	0	0
4	PRT	0	0	0	0	0	1	0	0	0	0
5	RLP	0	0	1	0	0	0	1	0	0	0
6	CO	0	0	0	1	0	0	1	1	1	0
7	LE	0	0	0	0	0	0	0	0	0	0
8	VM	0	0	0	0	1	0	0	0	0	1
9	CB	0	0	0	0	1	0	0	1	0	0
10	CE	0	0	0	0	0	1	0	1	0	0

Fuzzy direct relationship matrix

Conventional MICMAC analysis only considers binary relationship which has its own limitation, so we use fuzzy set theory to increase the sensitivity of MICMAC analysis. An additional input of possibility of interaction between factors defined by qualitative consideration on a 0-1 scale is introduced (Table 6). According to experts and academician opinion, the values for the relationship between any two factors is superimposed on BDRM matrix (Table 5) to obtain fuzzy direct relationship matrix (FDRM) as shown in Table 7.

Table 6. Possibility of numerical value of reachability

Possibility of	No	Very	Low	Medium	High	Very	Complex
Reachability		Low				High	
Value	0	0.1	0.3	0.5	0.7	0.9	1

Table 7. Fuzzy direct relationship matrix

Variabl	Variable	Variable Number									
		1	2	3	4	5	6	7	8	9	10
e	(Factors)										
Numbe											
r											
1	AS	0	0.9	0.3	0.7	0.5	0.1	0.3	0.7	0.9	0.7
2	BI	0.7	0	0.5	0.9	0.3	0.7	0.1	0.5	0.3	0.5
3	CO-B	0	0	0	0	0	0	0	0	0	0
4	PRT	0	0	0	0	0	0.5	0	0	0	0
5	RLP	0	0	0.9	0	0	0	0.7	0	0	0
6	CO	0	0	0	0.3	0	0	0.5	0.9	0.1	0
7	LE	0	0	0	0	0	0	0	0	0	0
8	VM	0	0	0	0	0.7	0	0	0	0	0.9
9	CB	0	0	0	0	0.9	0	0	1	0	0
10	CE	0	0	0	0	0	0.7	0	0.5	0	0

Fuzzy Matriced’ Impacts Croise’s Multiplication Applique’ea UN Classementstabilized matrix

Following the fuzzy matrix multiplication law (Kandaswamy, 2007), the FDRM (Table 7) is multiplied repeatedly until the hierarchies of driver and dependence power stabilize. The stabilized matrix (Table 8), categorized factors on the basis of relationships between them and the scale of influencing capability. The driving power of the criterion in fuzzy MICMAC is derived by summing the entries of possibilities of interactions in the rows, while dependence of the criterion is determined by summing the entries of possibilities of interactions in the columns.

Based on the information derived from the fuzzy MICMAC stabilized matrix, the variable (factors) are classified into four clusters in the driver-dependence graph (Fig.2). The detailed discussion is as follows:

- The first cluster consists of autonomous criteria that have weak driver power and weak dependence. These criteria are relatively disconnected from the system, with which they have only few links, which may be strong.
- The second cluster consists of dependent criteria that have weak driver power but strong dependence.
- The third cluster has the linkage criteria, that have strong driving power and also strong dependence. These criteria are unstable in the fact that any action on these criteria will have an effect on other and also a feedback on themselves.
- The fourth cluster indicates the independent criteria having strong driving power but weak dependence. It is observed that a variable with a very strong driving power called the key variables, falls into the category of independent or linkage criteria.

Table8. Fuzzy MICMAC stabilized matrix

Variable Number	Variable (Factors)	Variable Number										Driving Power
		1	2	3	4	5	6	7	8	9	10	
1	AS	0.7	0	0.7	0.7	0.7	0.7	0.7	0.7	0.3	0.7	5.9
2	BI	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	6.3
3	CO-B	0	0	0	0	0	0	0	0	0	0	0
4	PRT	0	0	0.5	0.3	0.1	0.5	0.5	0.5	0.1	0.1	2.6
5	RLP	0	0	0	0	0	0	0	0	0	0	0
6	CO	0	0	0.1	0.3	0.5	0.3	0.5	0.7	0.1	0.5	3
7	LE	0	0	0	0	0	0	0	0	0	0	0
8	VM	0	0	0.5	0	0.7	0.5	0.5	0.5	0	0.7	3.4
9	CB	0	0	0	0.3	0.5	0	0.5	0.7	0.1	0.5	2.6
10	CE	0	0	0.7	0.3	0.5	0.7	0.7	0.5	0.1	0.5	4
Dependence Power		0.7	0.7	3.2	2.6	3.7	3.4	4.1	4.3	1.4	3.7	

Result Discussion and Finding of the Study

The first objective of this research is to analyze the effectiveness of various factors in the success of FMCG products in the current volatile market.

- An insight into the ISM model (Fig.1) indicates that Co-B (3) and LE (7) are the top-level variables. These are the ones which are being affected by lower-level variables.
- The second, third, and fourth level variables, viz., RLP effect (5), VM (8), CB (9) are operational level variables which are very much necessary for the successful operation and running of FMCG.
- AS (1), BI (2), and CE (10) and their strategy have highest drive power and lowest dependence. Hence, they appear at the bottom level of the hierarchy which implies that they play a significant role and work as the main driver in the successful implementation of FMCG.

The second objective of this research is to analyze the driving power and dependence power of FMCG factors through fuzzy MICMAC analysis.

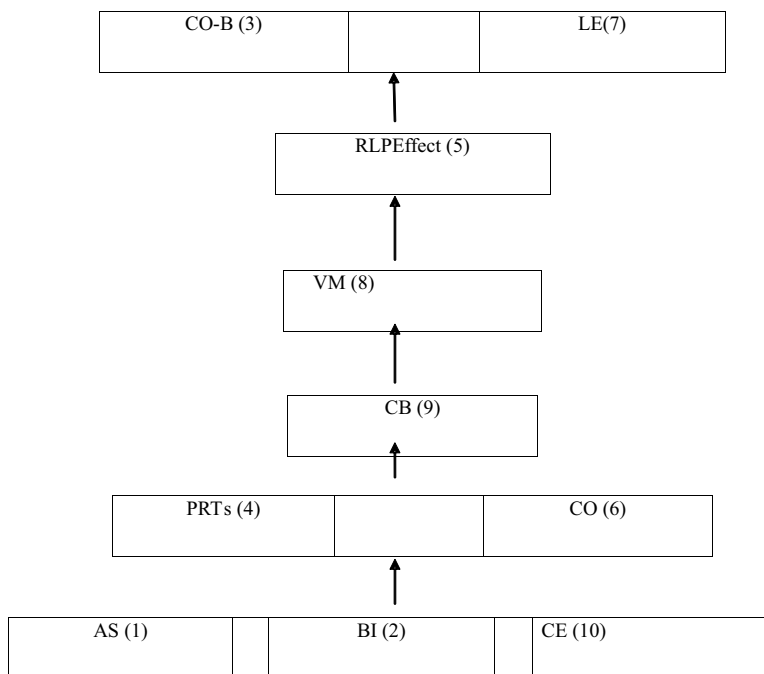


Fig.1. ISM-based model for FMCG key factors

- Figure 2 shows that there are three autonomous variables, viz., Co-B (3), PRTs (4), and CB (9) that have weak driving power and weak dependence. The absence of this variable indicates that all considered variables play a significant role to make the successful implementation of FMCG. LE (7), CO (6), and RLP effect (5) are variables having weak driving power but are strongly dependent on the other and so special care be taken into consideration to handle them.
- VM (8) and CE (10) are in linkage category that has a strong driving power and also a strong dependence (Fig. 2). Any change occurring in FMCG factors SCMEs will have an effect on others and also a feedback on themselves. If they are implemented in a proper way they can create a positive environment for successful implementation of FMCG.
- Variables like AS (1) and BI (2) have strong driving power but weak dependency on other variables and placed in a driving category.

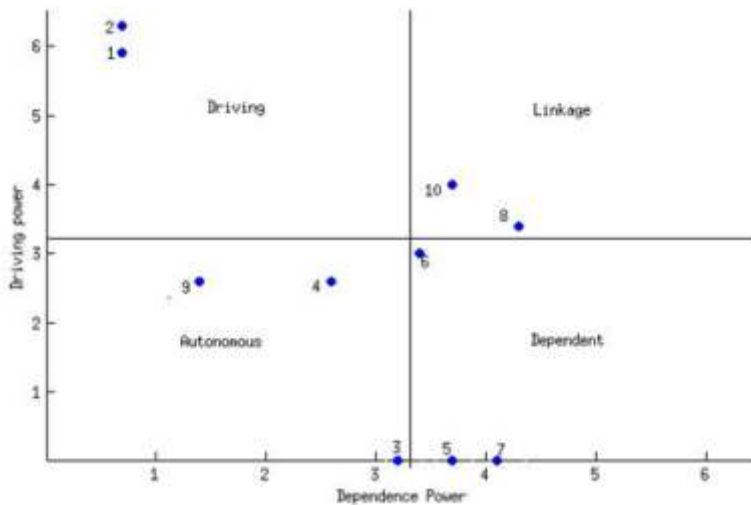


Fig.2. Cluster of variables (Driving and Dependence Variables)

Concluding Remarks and Future Direction

The result helps in implementing and identifying the factors responsible for its success in the current volatile market. Based on the inputs from experts from industry a hierarchical model is developed using ISM- fuzzy MICMAC analysis. This is performed to categorize the factors by taking their driving and dependence power as a base. From the driver-dependence illustration, a few vital discernments about the comparative significance and the interdependencies among the web quality key factors can be inferred. The integrated model using ISM and the fuzzy MICMAC methodology can be of great advantage to administrators, who by using this system, can recognize and categorize the important FMCG factors for their requirements. It is only an individual decision and any prejudice by someone who is arbitrating the FMCG factors has the potency to influence the absolute result.

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Customer Experience Management: Evolution and the Paradigm Shift in Marketing

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Abstract

The world of marketing has changed dramatically in the past two decades. The evolution of customer experience has changed the whole paradigm. The impetus has shifted towards customer-centric approach and keeping the customer in focus. The advent of social media, self-service technologies, and various other digital advancements has changed the shopper's behavior. Digital and analytics have emerged as key enablers for marketing professionals and organizations are trying to harness the benefits of these advancements. The role of customer has evolved quite significantly as an enabler in the overall success of a product/brand. The managers now require new tools to measure and understand the performance of organization in totality. In this context, paper examines the reported work on evolution of customer experience management and provides a theoretical framework for comparative understanding of changes/shifts in customer experience management and marketing.

Keywords: Customer experience, customer insights & analytics, Omni channel, self-service technologies, customer journey.

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Introduction

In the prevailing and dynamic world consumers enjoys enormous choices and opportunities in the market. The marketers and businesses have now shifted towards customer-centric approach and the impetus on offering complete customer experience in the market. Customer experience management is like the lifeblood of the organization which enables them to drive towards their objectives. In order to achieve competitive advantage in the market orchestrating meaningful customer experience are considered very important (Bolton et al., 2014) and loyal customers (Badgett et al., 2007). Many companies have benefited by incorporating the customer experience in their business strategies. T-Mobile Netherlands is one of the largest Dutch mobile telecommunication companies and offers a leading portfolio of mobile telecommunication. The company was able to cut costs while improving the customer experience using sound social media strategy. Orbitz Worldwide was able to harness the benefits of customer experience management by embedding the customer insights into the company to become the number one travel website and Orbitz Rewards is the number one travel rewards program. So the impetus for customer experience management is quite obvious. Even though the practitioners in the industry have recognition of the importance of the customer experience as a construct, yet the academic literature doesn't throw enough light on the construct. Therefore, further research is required to understand the evolution of the construct of customer experience and its impact on the marketing.

Customer Experience: Origin

The term customer experience as such is not owned by anyone but it is generally attributed to Bernd Schmitt (2003) who defined it as "the process of strategically managing a customer's entire experience with a product or company." According to De Keyser et al. (2015) customer experience comprises the cognitive, emotional, physical, sensorial, spiritual, and social elements that mark the customer's direct or indirect interaction with other market actor—in essence, the raw data contained in all direct or indirect interactions that then come together as an overall experience'. According to Meyer & Schwager (2007) customer experience is the internal and subjective response customers have to any direct or indirect contact with a company. Customer experience management is used for understanding the customer satisfaction and loyalty levels.

Customer experience management as an idea was highlighted by Holbrooke & Hirschman (1982) in the Journal of Consumer Research. The highlighted experiences are the overall outcome of the customer's perception which is created when they try to understand and utilize the product. Moreover, it was found out social encounters facilitates the development of social bonds (Crosby & Nancy, 1987).

Pine & Gilmore(1998)highlighted that services are becoming more commoditized and the foremost companies have started competing on experiences.The experiences delivered to customers have to

be planned, managed, staged, and delivered to the customer. Customer experience has emerged as a great differentiator for the organizations. In the initial 1970s and 1980s, quality and functionality were the key differentiators. In the 1990s, brand and pricing of the product were the key and subsequently the flow of information, the quality of service and delivery became the norm (Shaw & Ivens, 2002). The customer was offered product and service by the companies based on their assumptions; what customer expects from the product. Creating value for the customers became the emphasis of the marketing managers as they shifted their approach (Mc Alexander et al., 2002). Subsequently the concept of relationship marketing became the focus of the marketers. Relationship marketing remains challenged by evidence that customers who are enjoying good relationship with the organization still might not return to the Service provider (Gerpott et al., 2001). At an operational level, buyer-seller relationships in business to consumer markets have generally failed in their attempts to emulate the interpersonal relationships (Palmer, 2010). Brand and emotional attachment became the subject of interest for the marketers in the academic literature in context of customer experience in the mid-2000s (Narayandas, 2005; Anderson et al., 2006). Creating favorable customer experience is the most preferred way to generate customer loyalty and competitive advantage for the company (Badgett et al., 2007). Experiences are about the perceived value which is derived by the individual from such interactions (Helkkula et al., 2012).

Evolution From Traditional Viewpoint Towards Customer Experience

The emergence of customer experience management has significantly impacted the whole gameplay. Earlier the focus was on service quality, product quality, but customer experience is not just about the elements the service provider can control (interface, assortment, and price) but it is also about the elements which are out of control—like the influence of customers on each other, influence of devices like smartphones, kiosks and virtual managers on the customers. Researchers have largely studied customer experience from the point of view of moments of truth which considers customer being passive in the whole activity (Normann, 2001).

Though we acknowledge the fact that experiences are created in the end-to-end customer journey, still researchers are relying on one survey. This practice of depending on one-time survey is somewhat flawed, as it is based on the respondent's memory which might not be able to reconstruct the whole picture again (Kristensson et al., 2014). Moreover, the focus has always been on what organization's wants to offer rather than what customers really want. With the expansion of the internet, social media, self-service technologies, and smartphones marketers can easily harness the insights into what the customer is looking for in the market. The era of marketing analytics and consumer analytics has gathered pace across the globe and it is immensely impacting the marketing strategies. Significant numbers of companies have started to use and implement the concept of total customer experience to create lasting customer loyalty (Mascarenhas, Kesavan, & Bernacchi, 2006).

Customer experience is receiving greater attention as a business driver and a key strategic objective for companies (Johnston & Clark, 2008). Some of the companies have emphasized on the experiential-based value while formulating their strategies. According to Berry et al. (2002), whenever a customer purchases a product from a company, he always has an experience. In-store atmospherics, proper service delivery, and post-purchase interactions are critical for customer experience but these days customers want to connect with the product or brand with convenience. Experiences are having utilitarian value along with hedonic aspects (Vargo & Lush, 2006). Therefore companies should aim to design and communicate value propositions in order to generate memorable experiences. Though the importance of customer experience is recognized, the focus of traditional marketing literature is on measuring customer satisfaction and service quality (Verhoef et al., 2009). Verhoef et al. suggested a model covering various elements. The model is comprehensive but the researchers were not able to provide evidence for the validity of the model. Through the years various problems are highlighted, such as the lack of widely accepted definition of customer experience and the lack of corresponding measurements along with lack of complex customer experience framework (Maklan & Klaus, 2011). And this problem still persists due to lack of clarity amongst the companies on how the view customer experience (Klaus, 2013).

Online Customer Experience

In online academic literature traditionally focus has been on understanding the association between the online channel and the total (overall) service quality on the basis of customer's perception (Gallero et al., 2006). However, in the subsequent years, online customer experience has become the emphasis of service marketing researchers (Nambisan & Watt, 2011). The trigger for the shift is largely attributed to the evolution of e-commerce platforms. The portals have become more interactive and dynamic offering a better interface for the customers to explore the offerings. Customers' online buying behavior is influenced by the superb online customer experiences and is being highlighted by the researchers (Bridges & Florsheim, 2008). Researchers have proposed various frameworks highlighting the online and web experiences like E-S-QUAL framework (Parasuraman et al., 2005). Website design and its impact on customer experience are highlighted by Novak, Hoffman & Young (2000). Amongst the various frameworks, the focus is largely on the concept flow on the website which was highlighted by Novak et al. (2000). According to Smith & Sivakumar (2004) the concept of flow is a practical way to understand how consumers interact with web portals. But still, there is lack of clarity on how customers interact on the internet (Weinreich et al, 2008). Researchers submits that existing customer experience and online customer experience conceptualizations can vary based on the contexts. More and more studies have tried to explore the online customer experiences in different contexts subsequently (Verhoef et al., 2009) terming it as a relatively new construct. Hahn & Kim (2009) highlights that consumer's trust can be retained by ensuring offline to online and vice versa seamless transactions, with a minimum of hassle.

Sorooshian et al. (2013) came up with online customer experience (OCE) model to identify factors which affect the customer experience in online channels. Hedonic experience and sociability experience are also key factors in understanding customer experience along with pragmatic experience while availing the services (Sorooshian, et al., 2013). Also, Klaus & Maklan (2013) came up with various dimensions of customer experience which offers a more comprehensive view of the construct.

The evolution of customer experience has forced the marketers to adopt new strategies and tools to grow their business in more holistic manner. We are highlighting certain cases, tools and strategies which have changed the marketing for the good.

From Moments to Journeys

Customer experience professionals live in fear of brand failure: expensive product launches that fail to meet customer expectations; marketing campaigns that miss the mark; and maddening wait times on a customer service line. Every less-than-perfect interaction with your company impacts the value of your brand. Writing for Harvard Business Review, a group of partners at McKinsey described their experience working with a pay-TV provider that, according to the company's internal metrics, was delighting customers at every interaction but somehow left them displeased with the overall experience. Digging deeper to solve the mystery, McKinsey discovered that there was no specific problem area—the problem was in the experience as a whole. The numerous phone calls, technician home visits and email exchanges, even if each one was executed masterfully, added up to an extremely irritating experience for customers who just wanted to watch their favorite programs. Emphasis on customer's interaction at various touch points in purchase and after has been a prime focus for the organizations (Alex & Ewan, 2013). In practicality the narrow focus on enhancing satisfaction levels at specific touch points doesn't always offers you an actual picture, the customer may or may not be happy with the company. The whole customer's journey should be the prime focus. Many brands are now cultivating an interest in optimizing the customer's end-to-end experience and reaping the rewards. According to the analyst firm Forrester, companies that are leaders in perfecting customer experience outperformed, over a 6-year period, the S&P500 by more than 25%. Customer experience laggard's performance fell over the same period by more than 30%. Sensing opportunity and also the risk of failing to act, companies are making big investments in improving customer experience. According to the research firm Gartner, in 2014 companies spent roughly a fifth of their marketing budgets to support and improve customer experience. Unfortunately, many of those efforts have had limited success and the return on those investments has flat lined. Whereas, in 2010, 39% of respondents to a Temk in Group Management survey said their company's efforts to improve customer experience made a significantly positive impact on performance, in 2014 and 2015; just 11% of respondents said the same.

Many companies aim to create a brand that stands for trust, personal attention, and concern for a customer's experience. However, so many companies—whether airlines, banks or insurance companies—have policies and delivery mechanisms that fail to deliver on promise and sometimes work against it. Efforts to drive consistency and lower costs at call centers and stores, often have unintended consequences. Policies that create explicit operating rules for each situation end up disempowering front-line employees. Metric systems that try to implement fairness by focusing on “exactly what the employee controls” reduce the employees' sense of ownership for solving the root cause of an issue. And silo-driven accountability for middle and frontline management often stifle opportunities to find x-silo solutions that would benefit both the customer and the company. This problem is very severe and it can be a very gruesome problem to spot because customer journeys are cross-functional, whereas companies are siloed into different units and functions. And customer journeys span periods of time, while companies often design their services to deliver day-to-day results.

Voice of Customer

The root problem faced by many companies while trying to improve their customer experience is that they depend on feedback from customer satisfaction trackers. Those sources provide plenty of data about a large group of customers, but it's difficult to find in that data meaningful, actionable insight. The data is plentiful but shallow; it only skims the surface of customers' motivations and behaviors. eBay thought it found a solution to this dilemma. In 1999, the company launched a program called Voice of the Customer. eBay wanted to bring a small group of sellers together once a quarter for a phone call or webinar, to get input on planned changes to prices or the makeup of the website itself. At first, the program was a great success: eBay sellers provided regular feedback on the site's functionality and the group was small enough to foster discussion, solicit ideas and, when desired, focus closely on the specific experience of a single seller.

In time, eBay encountered a problem. A little over a decade after starting up Voice of the Customer, the site had more than 150 million users and over a million sellers. Single verticals, like consumer electronics, had become enormous communities unto themselves. In the quarterly Voice of the Customer meetings, getting a cross-section of sellers on the site meant including just one or two people from verticals like consumer electronics. The company deployed traditional surveys with dozens of questions to try to get input from greater numbers of its customers, but those didn't provide the same quality of feedback on the full customer experience as the Voice of the Customer. “We felt like we could get more and better information,” says Brian Burke, director of Customer Experience at eBay. “Wouldn't it be nice to get input from a large group of folks across all our verticals and across all types of sellers?”

The challenges eBay confronted are similar to those faced by nearly all brands today. These are discussed next:

- Features in products are so easily replicable they are almost instantly commoditized.
- Online review sites have democratized access to information about products and social media has given every customer a megaphone.
- The rise of e-commerce has given customers access to a world of shopping options.
- For today's empowered customer, switching from one product to another is increasingly frictionless.

As eBay was learning, it's easy enough to make a few tweaks here and there to improve how customers experience your company. The greater challenge, which, if achieved, will set your company above the competition—is to build a dynamic and comprehensive end-to-end customer experience that anticipates and truly understands the customer's needs.

Self-Service Technologies

Self-service technologies are means which enables transactions which don't require any interpersonal contact between a buyer and a seller. An organization should try to create customer experiences that offer value and create loyalty while customers are interacting with the various touch points within its service system. To do so, however, companies need to understand how customer experiences form and affect customer behavior and, ultimately, company performance and success (Maklan & Klaus, 2011). Kleinaltenkamp et al. (2012) found that both social and economic factors drive resource integration and, therefore, customers' experiences. However, their approach is static. We argue instead that drivers are dynamic and embedded in value co-creation. Customer experiences are resultant of the various experience drivers. Experiences are holistically evaluated by the customers (Verhoef et al., 2009) within service systems. Therefore, managing customer experiences requires systematic frameworks (Grewal, et al., 2009; Payne et al., 2008). This conceptualization is somewhat different from previous versions, which suggest that interaction with factors like employees, brands, technology, and product or service users constitutes customer experience (Johnston & Clark, 2008; Meyer & Schwager, 2007). Self Service Technologies are used across the spectrum via different interfaces like interactive voice response (IVR) for telebanking, flight information, and order status. Online/internet interface is used for package tracking, account information, e-commerce, etc. Moreover, interactive kiosks like ATMs, restaurant, paying guest (PG) checkouts, petrol stations, car rentals, and tourist information. This has been a major enabler for organizations to provide a hassle-free service to customers and improving the overall experience. As these interactions between the technology and the customers are growing there could be some implications of the same in organizations. The employees might feel uncomfortable and demotivated because they are no longer the sole connection between the customer and organization. Moreover, the customer's behavior can be very critical for formulating the future course of strategies because

these behavior patterns are bound to change with the ever-increasing encounters with self-service technologies. Therefore, more research is needed to fully reap the results of adopting self-service technologies.

How to Move from Scorecards to Solutions

Even a revolutionary, billion-dollar idea can be hobbled by a seemingly small misstep in customer experience. In 2009, Airbnb was a floundering company at the startup incubator Y Combinator, with just US\$200 per week in revenue, nervous investors, and three co-founders with maxed-out credit cards. One afternoon, the company's puzzled co-founders realized they needed to pay more attention to how people were experiencing their product—they needed to pay more attention to their customers. The co-founders sifted through their 40 home rental listings in New York City and noticed a pattern: "The similarity is that the photos sucked," realized co-founder Joe Gebbia. They traveled to New York, got a professional quality camera, and spent some time with customers who were renting apartments, taking high-quality photos to promote their listings. Revenue doubled in just a week, the company's first financial improvement in nearly a year. Speaking to *Wired* about the thinking behind this move, Gebbia explained that it was ultimately about getting to a place of deep, personal understanding of the customer experience. The key to Airbnb's successful Hail Mary is empathy. The founders of the company knew they had a problem—their balance sheet told them that with unrelenting persistence every week—but they had to get as close to the customer experience as possible in order to find a solution. The drawback to their process is that it is extremely inefficient and not realistically scalable—the founders of companies can't spend all day flying around the country to meet customers personally. Fortunately, today there is a technical solution to this human problem: insight communities.

Insight Communities:-

Insight communities are hundreds and thousands of customers who willingly opt to be a part of a group which offers regular feedback to improve products and the customer experience. This feedback gives companies the context they need to find actionable insight into the data they're collecting, be it through net promoter score (NPS) or customer effort score (CES). Insight communities offer a deeper understanding of the customers and build trust between the company and the customer. It offers more quality insights than one of the survey methods like NPS or CES because they are based on the interaction across the entire customer journey.

An insight community is a powerful tool for arriving at a deep understanding of the customer experience because it's agile, allowing brands to take, for example, an NPS score, reach out to the right customers, and dig deeper to identify the root causes driving dissatisfaction. With that level of

insight and the ability to go back time and time again—brands can proactively devise solutions to emerging problems. Insight communities allow brands to solicit suggestions from customers and test ideas on a large group of people, with results that can be easily parsed based on any number of factors. In contrast, surveys used to tabulate Customer satisfaction score, NPS & CES and data harvested by the wearable technology and the like are by definition reactive. They can tell you that something went wrong but they can't necessarily tell you what it was or how to do it better. Not only can insight communities offer suggestions for how to improve the customer experience, they can be fertile testing ground for new ideas, allowing brands to rapidly iterate, constantly trying out and improving on new ideas. Because they are such powerful tools for cultivating understanding and empathy between brands and customers, insight communities, unlike forms of feedback like NPS and Big Data, set the stage for exceptional customer experience design. To support responsive, agile design, customer experience pros generally rely on traditional tools to design their key customer experiences. They rely on groups of experts to map the customer journey, they engage with small groups of customers (focus groups and one-on-one interviews) to get feedback on solution design and user interface (UI).

What customer experience designers have lacked in their toolkit is the ability to get customer insight at scale to iteratively co-create and validate that their designs appeal to the broadest range of customers and lower the risk of failed initiatives. Traditionally, a brand launches the best product or service it can and then seeks feedback to identify problem areas and attempts to fix them. Thinking like a designer flips that perspective on its head. Instead of looking for signs of trouble and trying to retrofit parts of the customer journey to improve the full experience, design thinking says you start with an empathetic understanding of what the customer is trying to do, and use that knowledge to build a better experience. As mentioned earlier, eBay had attempted to get feedback from a small group of its customers, but as the company grew, it was unable to get that same feedback at scale. In 2015, the company found a solution by launching an insight community. An insight community allowed eBay to ask about specific ideas, solicit new ideas, and test concepts with speed and flexibility, all while cultivating the sense of community and partnership with its sellers that is essential to the company's success. Insight community allows us to engage with customers at a higher level than doing a survey on its own, highlights Brian Burke, eBay's director of Customer Experience. "The community allows us to highlight individual sellers and make it personal, so it's not just this sterile, 'Oh, we're surveying for information again' thing. Because of that, we're seeing really high response rates." With the agility of its insight communities in its customer experience arsenal, eBay has been able to cultivate close customer relationships. The quality of insight that comes out of those conversations has allowed the company to be proactive and optimize the customer experience.

Big Data and Analytics:-

The emergence of marketing analytics, consumer analytics, and retail analytics has offered tremendous insights into the customer journey, consumer behavior, and interactions over the various touch points. Digital marketing has shown great results in some industries. With the impetuous on social media analytics organizations are able to connect directly with the customers. Moreover, with the advances in artificial intelligence (AI) and Radio Frequency Identification (RFID) technology, some organizations are coming up with smart ideas to offer customer total customer experience (Amazon go, Amazon now).

Personal Assistants and Concierge Programs:-

Even in a digital world, personalized service is a crucial part of customer experience—maybe even more so. That's why now on we will see more companies investing in engagement software and mobile applications that strengthen the relationship between consumer and brand. As customers have become accustomed to talking to virtual assistants like Siri, Cortana, and Alexa, companies are trying to mimic that with digital personal assistants and concierge applications of their own. To encourage guests to book directly rather than through online booking sites like Orbitz and Kayak, many hotels are beefing up their own applications with special features and perks, like automatic check-in and the ability to select your own room.

Human-centered Design:-

According to marketing professors, the design of the whole customer experience as a factor has to be the emphasized upon in the coming years. What sets companies like Uber apart from their competition is ease of use and elegance of design within their applications. Customers expect a tailored experience and applications that deliver content that is relevant to them. They demand experiences designed with their wants, needs, and behaviors in mind. For any size company in any industry, human-centered design is possible—when humans are involved. It's important for actual customers to be involved and consulted in the design process when creating mobile applications or any other digital tools designed for them.

Artificial Intelligence is the New User Interface: Experience Above All:-

According to Accenture Technology Vision Report (2017), AI will act as the face of company's digital brand. AI is undertaking more sophisticated roles within technology interfaces, it has moved beyond the cliché of being a back-end tool. From autonomous driving vehicles that use computer vision, to live translations made possible by artificial neural networks, AI is making every interface more users friendly and smart. An AI system can interact with an infinite number of people at once,

based on the skills built for it as opposed to a human representative interacting with a person at a time. AI has the capability to create and maintain a powerful, 100% consistent brand experience through every interaction, but at the same time can also use learning capabilities to tailor that experience to each individual, and rapidly evolve the experience to cater to any new product or strategy the company wants to implement. The businesses have never had this control over their brands.

Putting the Customer First:-

Getting the right results depends on first focusing on the right problems. That's easier said than done. Greg Bowen, vice president of Dell Commerce Services, told the Internet Retailer 2016 Conference & Exhibition in Chicago that up to 80% of information technology (IT) projects fall short of expectations because retailers' business requirements and objectives frequently overlook the customer.

Time and again, the customer takes a backseat to business goals and management conditions when retailers set out on projects. The first step in project planning needs to be an emphasis on listening to the customer. Bowen described how Dell re-launched its site after implementing customer feedback received via iPerceptions. After listening to shoppers and using their input to shape design, Dell's improved e-commerce site saw a 13% leap in revenue per visit.

For years, the emergence of online shopping portals and companies has spelled the demise of traditional big-box retail stores. Easy access and wide selection—once available through only physical stores—have reached new levels on the internet. To survive in the digital age, retailers need to shift their strategy to providing customers with big experiences and unique discounts, according to Denise Lee Yohn (2016). Now that consumer's (particularly millennial) spend less on products and more on experiences like travel and entertainment, retailers need to introduce revamped value propositions. Just as small specialty stores offer buyers intimate, personal visits, big-box retailers can stage memorable, large-scale and share-worthy events.

Improving the Fan Experience with Technology:-

Wimbledon is tennis' biggest event of the year. To improve the fan experience of the tournament even when players weren't sailing the ball back and forth across the net, Wimbledon's organizers in 2016 turned to digital transformation strategies. Econsultancy reported the first step was to create engaging, easily accessible consumer content aimed at bringing in an international audience. One of the strategies organizers turned to was introducing a new mobile application. The All England Club personalized the fan experience with a "Plan Your Visit" feature customizable to specific matches; shareable slide shows of photos and social media posts; and mobile alerts updating users with

scores, analysis, and news. This was, without question, the most personalized Wimbledon experience ever.

Omni-channel Strategy:-

The focus on customer experience arose because customers now interact with organizations through myriad touch points in multiple channels and media platforms, resulting in more complex customer journeys. Firms are confronted with accelerating media and channel fragmentation, and omnichannel management has become the new norm (Brynjolfsson et al., 2013; Verhoef et al., 2015). The term omni-channel was first time highlighted by Rigby (2011) in academic literature, referring to integrated sales experience which combines the advantages of online (lower prices, convenience, content curation, social media interaction, etc.) and offline (the try and feel of the product, instant gratification, face-to-face interaction, etc.). According to Sunil Chopra (2016) a structured Omni-channel supply chain can be both cost-effective and responsive to customer needs by utilizing the contemporary strengths of offline or brick and mortar stores and the online brings to supply chain (Netflix vs blockbuster case). Omni-channel retail is gaining tremendous emphasis globally. Amazon go, Vanheusen, and Raymond are some of the examples in retail.

Crystal Ball Gazing:-

- Customer in customer experience strategy:-
Understanding the role of customer in enhancing the overall customer experience is still an issue at hand and further research is needed to explore how the customer can be a part of customer experience strategy apart from using the insight communities. Moreover, the behavioral aspect of customers has to be studied in greater depth and how it affects the overall customer experience.
- Customer experience as holistic construct:-
Understanding the end-to-end journey and covering all the touch points holistically is still an important area to be further explored by the researchers. Emotional dimension in the customer experience has to be explored and researched at greater depth.
- Convergence of constructs and impacts:-
How self-service technologies and omni-channel strategies are impacting the overall customer experience. What is the role of a brand in current scenario regarding customer experience construct? Does initial perception of a brand influence the customer experience in a store? What is the impact of in-store atmospherics while offering a totally integrated omni-channel experience to the customer? What are key drivers for the same?

Another major scope for future study is to have a comprehensive tool to measure the customer experience in totality. Moreover, omni-channel customer experience is also lacking a comprehensive model which can be formulated and validated by the researchers.

Conclusion

Ever changing dynamics of customer interactions across the various touch points has made the customer experience management even more crucial for the organizations and can have a significant impact on the performances. Marketers have started to depart from the traditional relationship management approach. The marketing focus has shifted towards the customer-centric approach, analytics has become a crucial part of every marketer's arsenal and has offered a more nuanced understanding of the activities/processes. The evolution of omni channel has deeply jolted the status quo and made marketers to rethink their strategies. Marketing is moving towards a blend of human-centered designs and virtual reality; it requires a tremendous effort on part of the marketers to evolve with the changing dynamics. The shift from moments to complete customer journey has been an important change for the marketers while formulating future strategies. The initiative of involving customers in decision-making via insight-communities has also enabled the marketers to bridge the gap in terms of customer value. As highlighted earlier, the marketing practices have changed for the good, keeping the customer as a focal point for strategic planning and marketing strategies; it can reap great results for the organizations. The use of smart technology (RFID, Kiosks & IVR), digital platforms, Big Data, AI and consumer insights can enable organizations to offer a holistic customer experience. Marketers need to continuously upgrade their skills for emerging challenges and trends in the business world where the customer is getting the due impetus. The role of customer experience management is going to be ever so significant in the near future and smart business will excel by incorporating it in totality.

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Optimum Design Analysis of Arrayed Waveguide Grating Based Optical Switches

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Abstract

Nowadays, in telecommunication industry, the effective bandwidth utilization and high-speed data transfer rate are the two basic requirements. For achieving these requirements, the optical network is the best option available in the market through which the data transfer is achieved nearly with the speed of light. For realizing the concept of optical network, the numbers of optical switches are available. In this paper, four arrayed waveguide grating (AWG) based optical switches are investigated heavily and a performance comparison is conducted between the switches in terms of loss, cost, and scalability analysis. The obtained results clearly set the guidelines for the optimum design of the switch.

Introduction

Data communications are the exchange of data between two devices via some form of the transmission medium; the transmission medium can be of any type which is capable of receiving or sending the data between device. In telecommunication industry, the fast speed communication is highly desirable, and for this purpose, the optical network is the best available option in which data communication network is built with optical fiber technology. In optical communication network, the optical fiber cables are used as the primary communication medium for converting data and passing as light pulses between sender and receiver nodes. For realizing optical communication system the optical packet switching systems are used frequently in which data is divided into small size packets and each packet is further divided into two parts—header and pay load. The payload contains the actual information which is to be transmitted from one node to other node and header contains the actual addressing information. During data transmission process the optical-electrical conversion exists, the header of each packet is converted from optical to electrical domain through

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Optical/Electrical convertors while on the other hand, the payload part of the packet remains in the optical domain throughout the communication (Pleros et al., 2008). There are different types of optical packet switch architectures that are available in the market; some of them are wavelength routed switch (Zhong & Tucker, 1998; Hunter et al., 1999; Sasayama et al., 1997; Shimazu & Tsukada, 1992), broadcast and select switch (Bendelli et al., 1995; Verma, et al., 2002; Singh et al., 2003) and AWG-based switch (Guillernot et al., 1998; Chia et al., 2001; Singh, 2007; Pattavina, 2005; Hunter et al., 1998). In this paper, four AWG-based optical routers are discussed and a detailed comparative analysis has been presented in terms of loss, cost, and scalability analysis. The whole paper provides the brief description about switches, loss analysis of switches, and the scalability and cost of each switch. Finally, the major conclusions of the paper are discussed.

Architecture Descriptions

In this paper four AWG-based optical packet switches are discussed. The switch presented in Fig. 1 is proposed by D.K. Hunter which is a wavelength selective switch in which the tunable wavelength convertors (TWC) are used at each input port of the switch. This TWC converts the wavelength of each packet according to the routing pattern of first AWG router (Hunter et al., 1999). Each of the packets has two available options; either packet is directed towards the appropriate output port or on the other hand, if the situation of contention arises then packets are forwarded towards the appropriate buffer. Here the fiber delay lines are used for buffering of contending packets. In the buffer section, there are set of TWC, Mux, and Demux at each of the fiber delay lines. Finally, at the output port of switch, another AWG is placed which is used to forward the packets towards appropriate output ports.

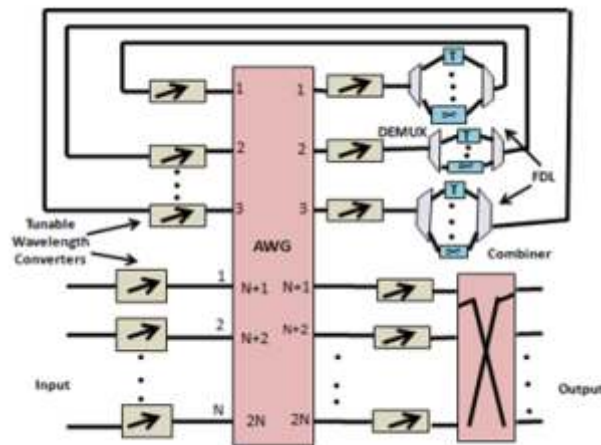


Fig.1. Switch proposed by WASPANET project (A1)
Source. Hunter et. al., 1999.

In Fig. 2 another AWG-based optical switch is presented which is a feedback optical switch. In this optical switch the shared feedback delay lines are used for buffering of contending packets (Chiaet. al., 2001). At the input of switch, tunable wavelength converters are present. These TWC converts the wavelengths of incoming packets and the packets which feels contention are forwarded towards the appropriate buffer where fiber delay lines are used to store the contending packets while on the other hand, direct through packets are forwarded towards the appropriate output port of the switch. The switch consists of "N" modules one for each output port. For a tagged output at most "m" packets can be stored. Hence, in all the modules, at most N packets can have the same delay varying from 1 to m slots, and in all the modules all together at most mN number of packets can be stored. The problems associated with this architecture are as follows:

1. In the architecture exit time, contention may occur.

2. Control unit complexity is high.

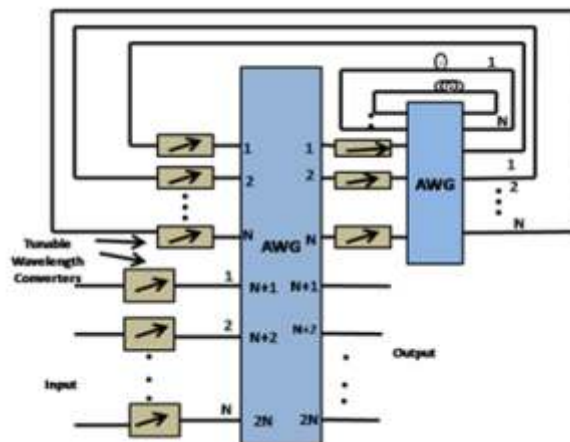


Fig. 2. Feedback optical packet switch (A2)

Source. Chiaet. al., 2001.

Figure 3 shows hybrid optical packet switch architecture (Lin et. al., 2003). The switch has two AWGs and a set of TWC as the core of optical switch. The architecture uses both techniques (feed forward and feedback buffering) for storing the contended packets. Here at the input of switch, the TWC is used to convert the wavelength of incoming packets according to the routing pattern of first AWG router. The noise performance of wavelength routing switch is improved as the wavelength converter can help and regenerate the signal. Due to the static configuration of AWG the complexity of switching stage reduces. The switch shown in Fig.3 has single wavelength input/output (I/O) ports. This can be upgraded to a WDM version by using Mux, combines and multiple of the switch fabric plane.

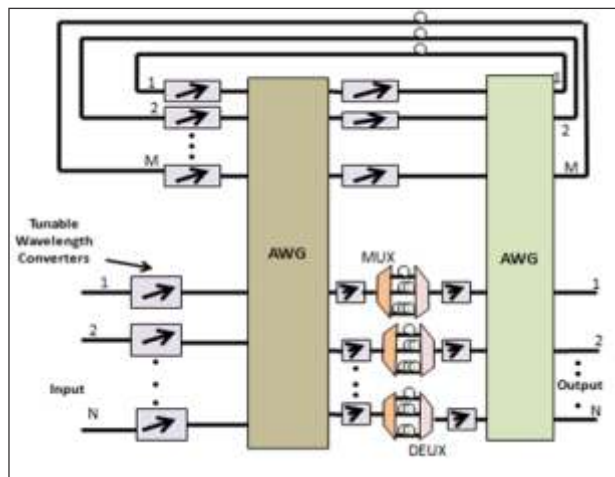


Fig. 3. Hybrid FDL based switch

Source. Linet al., 2003.

Finally, in Fig. 4 an AWG based switch is discussed the switch is proposed by R.Srivastava and further some modifications were proposed by V. Shukla in 2014. The designs structure is very simple and control operations are very less in comparison to other optical switches. At the input port of switch, the tunable wavelength converters are present which are used to convert the wavelength of incoming “g” packets according to the routing pattern of first AWG-based optical router (Rastegarfar, et. al., 2013; Srivastava & Singh, 2010; Shukla et. al., 2016). Here the first N port of AWG is connected with the fiber delay lines while on the other hand, the lower N ports of AWG is connected with the switching section AWG through a set of TWC. When the situation of contention between packets arises then packets are forwarded towards appropriate fiber delay lines for buffering purpose.

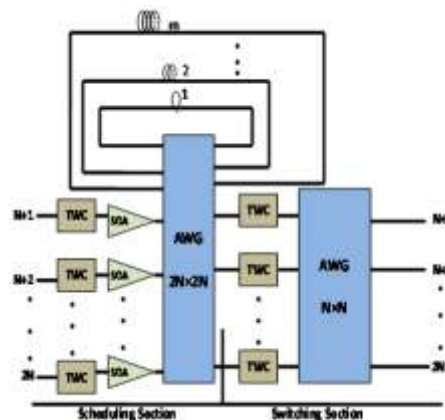


Fig. 4. Proposed switch

Source. Srivastava, & Singh, 2010; Shukla et al., 2016.

Analysis of Switches

In this section, the detailed analysis of each switch is presented and performance comparisons between switches are performed in terms of loss, cost, and scalability analysis.

Loss Analysis

Each of the devices present in the switch is a loss device and each device has its own insertion loss, so the loss of each switch is an important parameter in the case of analysis of switches. In this analysis, the loss equations of each switch are presented. The loss values of various devices are chosen from Table 1.

Table1.Value of different loss parameters

Symbol	Parameter	Value
N	Size of the Switch	4
L_{TWC}	TWC insertion loss	2.0 dB
$L_{AWG}^{2N \times N}$	Loss of Scheduling and Switching AWG (32 channels)	3.0 dB
L_{FDL}	Loss of the fiber loop	0.2 dB/km
L_{SOA}	Loss of SOA	1dB
$L_{Demux}^{N \times 1}$	Demux Loss	$1.5(\log_2 N - 1)dB$
$L_{Mux}^{N \times 1}$	Mux Loss	$1.5(\log_2 N - 1)dB$
L_{TF}	Tunable Filter Loss	2dB

Source. Shukla et. al., 2014

Loss analysis of switch A1 is as follows:

$$A_T^{A1} = L_{TWC}^{in} L_{AWG}^{2N'2N} L_{TWC}^b L_{Demux} L_{Mux} L_{TWC}^b L_{TWC} L_{AWG}^{N'N} \tag{Eq. 1}$$

After inserting various loss values the total loss of switch A1 is calculated as follows:

Loss analysis of switch A2 is as follows:

$$A_T^{A1} = 17 dB \tag{Eq. 2}$$

After inserting various loss values the total loss of switch A2 is calculated as follows:

Loss analysis of switch A3 is as follows:

$$A_T^{A2} = L_{TWC}^{in} L_{AWG}^{2N'2N} L_{TWC}^b L_{TWC}^b L_{AWG}^{N'N} \tag{Eq. 3}$$

After putting the various loss values the total loss of each switch is given by:

Loss analysis of switch A4 is mentioned next:

$$A_T^{A2} = 12 dB \tag{Eq. 4}$$

In this analysis the total loss of each switch is calculated and the obtained results clearly reveal that the loss of switch A4 is in lowest category while on the other hand, the loss of switch A3 is highest while the loss of switch A1 is almost equal to the A3 and for the switch A2 the loss values are almost equivalent to A4.

Scalability Analysis

Each of the switches presented in this paper uses different components and as we all know, more the number of components means more complexity in the functioning of the switch. Since we all know that cost of each component is too high so the switch having fewer component counts are preferable because as less the components means less the cost and loss of switch. Table 2 represents the total number of components in the switch.

Table2. List of various components

Component	A	A	A3	A4
s	1	2		
SOA	×	×	×	N
TWC	4	3	5N	2N
	N	N		
AWG	2	2	2	2
Demux	N	×	N	×
Mux	N	×	N	×

Cost Analysis

As we all know that the cost of optical components are too high so more number of components means more cost of the switch. In this section of the paper, the detailed cost analysis of each AWG-based switch is presented in detail. This analysis is performed with the help of Fiberto Chip Coupling (FCC) model. This model for the optical components are based on FCC which is the number interconnections to the outer world through the components; the cost of the device is measured by counting the number of FCC (Shukla, & Jain, <2016> ; Shukla et. al., 2016; Shukla & Srivastava, <2015> ; Caenegem et. al., 2006). The wavelength conversion range is not considered by FCC model so further a more generalized cost model came into existence which incorporated the effect of wavelength conversion. In this generalized model, the cost of TWC is represented by:

$$C_{TWC} = ad^b \quad (\text{Eq. 5})$$

In Eq. 5 the value of “a” is considered to be 1 while on the other hand, the value of “b” lies between the range 0.5 and 5.

Table 3. Cost values of various components

Symbo	Representatio	Cost
l	ns	
C_{TWC}	Cost of TWC	4
C_{Demux}	Cost of Demux	N+1
C_{Mux}	Cost of Mux	N+1
C_{SOA}	Cost of SOA	2
C_{AWG}	Cost of AWG	2N

Now for calculating the cost of each switch presented in figures 1 to 4 the equations are represented as follows:

Cost of switch A1

$$C_T^A = NC_{TWC} + NC_{TWC} + C_{AWG}^{2N'2N} + NC_{DMUX} + NC_{MUX} + NC_{TWC} + NC_{TWC} + C_{N'N}^{AWG} \quad (\text{Eq. 6})$$

Substituting the cost values of different components, and considering a=1 we get

$$C_{A_1} = 2N(2N)^b + 2N(N)^b + 9N + 2 \quad (\text{Eq. 7})$$

Cost of switch A2 is as follows:

$$C_T^{A2} = NC_{TWC}^{in} + C_{AWG1}^{2N'2N} + N[C_{TWC1}^b + C_{TWC2}^b] + C_{AWG2}^{N'N} \quad (\text{Eq. 8})$$

Substituting the various cost values from Table 3 and after putting the value of a=1 the total cost of the switch is as follows:

$$C_{A_2} = N[2(2N)^b + 8] \quad (\text{Eq. 9})$$

Cost of switch A3 is:

$$C_{A_3} = NC_{TWC} + C_{AWG} + NC_{SOA} + NC_{TF} + NC_{TWC} + NC_{SOA} + NC_{TF} + NC_{TWC} \quad (\text{Eq. 10})$$

Now after inserting the cost value and substituting the value of a=1, we get the total cost of the switch as follows:

$$C_{A_3} = N[2N^b + (N)^b + (N+1)^b] + 14N \quad (\text{Eq. 11})$$

Cost of switch A4 is as follows:

$$C_{A_4} = NC_{TWC} + C_{AWG}^1 + NC_{SOA} + NC_{TWC} + C_{AWG}^2 \quad (\text{Eq. 12})$$

Now the final cost equation after inserting cost values of each device and the value of a=1 is as follows:

$$C_{A_4} = N[2N^b + (N)^b] + 9N \quad (\text{Eq. 13})$$

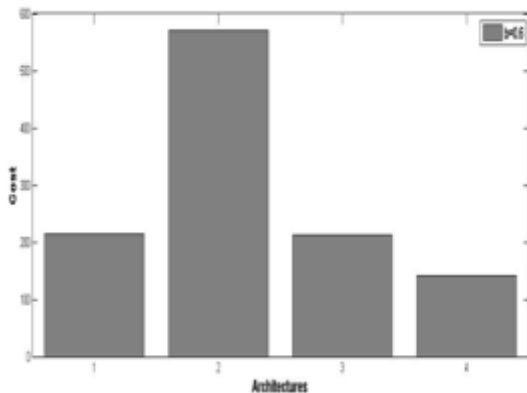


Fig. 5. Cost of the switch when $b = 0.6$

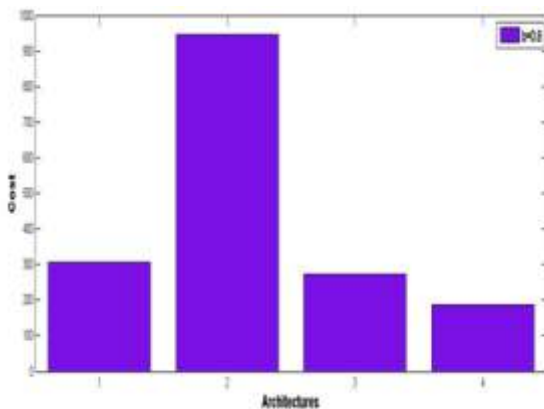


Fig. 6. Cost of the switch when $b = 0.8$

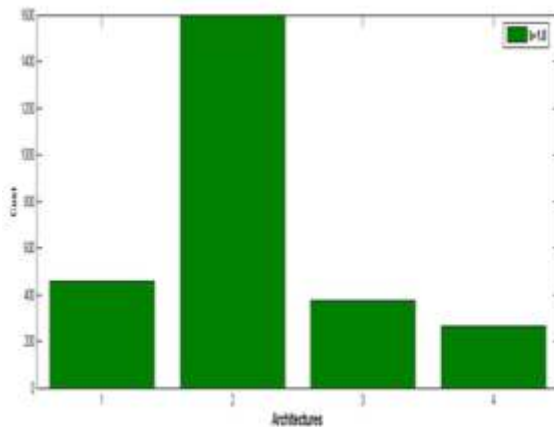


Fig. 7. Cost of the switch when $b = 1.0$

The figure 5,6 and 7 shows the cost analysis of each switch from these graphs the cost of switch A4 is very less in comparison to other switches so the performance of switch D4 is much better in terms of cost parameter.

Conclusion

Nowadays, the telecommunication industry is one of the fastest growing industries; where bandwidth utilization and speed of light is the important parameter. As of now, the optical network is the best available option that provides fastest data transfer speed and effective bandwidth utilization. For realization purpose the concept of optical packet switching and optical burst switching came into existence; many of the researchers are focused on the design of switch. There is a number of optical switches available in the market, which has its own pros and cons. In this paper, four AWG-based optical packet switches are presented and a detailed analysis is shown. The obtained result clearly reveals that the TWC is a dominating device and if more number of TWC are used, it increases the cost of switch exponentially. On the other hand, if less number of components is used in the design of switch then it makes the switch more perfect because less the components mean lesser loss and less power requirement in the operation of the switch.

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Digital Innovations: Breakthrough Opportunities To Build Novel Business Models

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Abstract

The places where marketers find their potential customers have changed with time immemorial. The potential customers do not restrict themselves to the brick and mortar stores and can virtually connect with each other as buyers and sellers. The pattern of customer relationship management (CRM) has changed with the go helps to cut costs and become more efficient. The social sphere wants instant communication using social networking, blog marketing, and online communication. Innovation in today's business marketplace elevates the creativity in research by giving solutions to the world economies in terms of intrinsic diffusion of new ideas in terms of marketing, selling, and even researching before a product launch. It is also a matter of fact that people are accepting social media in marketing with revolutionary high spirits. Taking its root from the reasoned action theories and adaptation theories, current research aims to explore the variations which impact the ease for both the user and the seller through commercialization of social media and benefits within it.

The focus would include the wireless and personal technology digitizing. The present research aims to add new ideas to the relevant literature through factor exploration and benefits of social media technique as an innovative marketing tool both from customers' and marketers' perspective. It would also attempt to bring into light the perspectives of adoption of social media by the stakeholders. Finally, the paper would probe into the challenges in the innovation funnel with respect to social media.

Keywords: CRM, social media, innovation, commercialization, marketing.

Introduction

A revolution in communication has been noticed with the advent of social media's far-reaching aspect (Patino et. al., 2012). Social media has drastically changed the customer's pattern of sharing, evaluating, and choosing information (Smithee, 2011). The market research industry has been

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enormously influenced by improvements in online networking and social communication (Patino et. al., 2012).

The recognition and growth of social networks have emerged in a unique environment within which innovations in different forms have been visualized (Chua & Banerjee, 2013; Flanagin & Bator, 2011). The impact of social media can be seen in everyone's lifestyle as well as the cultural framework; it posits offers creativity and innovation altogether. Social CRM is characterized as the combination of web-based social networking with client relationship as the next cutting edge for organizations who desire to maximize the influence of social associations in order to expand the force of social connections to get nearer to clients (IBM, 2015). Online networking can be characterized as the creation, utilization, and exchange of information over stages for social collaboration. It has continuously permitted people to depend and rely on the internet to communicate and share.

Utilizing social media, clients can connect with almost any organization and express their conclusions. Web-based social networking seems to offer advantages to organizations in all segments (Patil, 2014). With the advent and rise of vast social networking platforms, the client's role has also enriched with a more active participation in maintaining relationships with the organization. In addition, information about competitive products has been made accessible for electronic gadgets, where clients can simply disperse their feelings and views of larger communities, (Schultz, Malthouse, & Pick, 2005). With the universal growth of social media usage, business houses are under extreme pressure to engage their operations where their customers are heading towards; thus, the core of all customer activities is virtual centric placed on a social media platform or a site (Baird & Parasnis, 2011).

Marketers can often use these online networks and communities to endorse their products and services and can significantly increase their new customer acquisition with stronger ties (Castronovo & Huang, 2012). Social networks do not only include network through social sites like Facebook, Twitter, Instagram or Whatsapp, rather it's more of a connection between the customers and the sellers.

The present paper tries to add to the relevant literature by analyzing essential factors and benefits of using social media as an innovative marketing tool both from customers' and marketers' perspective. It would also attempt to bring to light the perspectives of implementation of social media by the stakeholders. Finally, the paper would probe into the challenges in the innovation funnel with respect to social media.

Review of Literature

Social Media and Social Networks Conceptualization

Social media network technology comprises enormous presence and influence on the consumers

providing a user-centric environment of interaction wherein, marketing between brands and users find a commonplace. McKenna & Bargh (2000) have identified that people previously used the internet in an anonymous way, later the realm of social media presence and networking have taken a manifold step ahead in terms of better socialization.

In a market environment driven by technical extension social media usage has become platforms wherein, retailers can communicate with their end users on a wider perspective (Paquette, 2013). Campbell et. al (2011) in their study has highlighted that it is the people's responsibility to use the technology itself; hence, creation and consumption rests on the principles of individuals. Online social networks provide emphasis on the socialization of internet (Sigala, 2012) and smooth the process of sharing knowledge between the users (Sigala & Chalkiti, 2014; Sigala & Chalkiti, 2015). Social media can be termed as "a group of internet based applications that build on the ideological and technological foundations of Web 2.0, and allow the creation and exchange of user-generated content." (Kaplan & Haenlein 2010).

According to Wang et. al. (2009) there can be seen a huge transition in online social networking from niche areas of wide adoption. In order to succeed in any business proper networking is a must (Kelley et. al., 2010). We can see rapid changes in social media tools bringing huge transformations in the organizational relations.

Social Media as a Promotional Marketing Tool

Mangold & Faulds (2009) have stated that customer interaction changes with the advent of various tools and approaches of social media. Web-based social networking promotion is showcasing utilization on the web groups, informal organizations, blog advertising, etc.

In order to bring value to the business, developing social media network's relationships between the brand (marketer) and the online networking community is a must (Odhiambo, 2012). There is a great necessity for an organization to realize the actual networks in order to attract the quality prospects and maintain relationships with the right customer. Web 2.0 a term coined by Tim O Reilly (2009), has remained difficult to define which is all about information sharing and collaboration on the World Wide Web. Morgan & Hunt (1994) recommended that a victorious relationship between a business house and its customers requires loyalty and trust. Looking path once again into the historical backdrop of the web where web-based social networking may have advanced from a reasonable comprehension of related ideas can be determined.

The internet has significantly changed the human experience. We utilize the web to discover data, purchase and offer items, watch television appears, look for mates, and take part in political circles (Gil de Zúñiga, Puig, & Rojas, 2009; Valenzuela, Park, & Kee, 2009). Web-based social networking is progressively executed in work associations as apparatuses for correspondence among the

representatives. It is critical that we build a comprehension of how they empower and compel the open exercises through which work is proficient in light of the fact that it is these extremely progressions that constitute and propagate associations (Leonardi et. al., 2013). Organizations with a definitive competitive advantage are those prepared to do ceaselessly making new learning and effectively handling the information resources (Zhang & Benjamin 2007). Online social networks encourage the association among individuals by giving an element which empowers dialogs, sharing of media content, an association of occasions, and so on.

Social Media: Platform for Market Influence

Web-based social networking presents the organization with different key preferences. The organizations can pick different methodologies to embrace the online networking stage, to communicate with an extensive variety of buyers on a single platform. The definition of web-based social networking is given as the web stage through which online clients can share their thoughts and form a virtual group. Having the capacity to control, oversee and get to various types of achievement through web-based social networking gives organizations an aggressive edge that is boundless. Online networking has permitted numerous organizations to oversee thoughts that originate from various points of their industry. Web-based social networking has a novel place in helping a brand oversee how they speak with others while guaranteeing client relations stay neutral. Analysts have generally utilized the idea of “social capital” to clarify how and why connections between people or associations create values (Bourdieu, 1977; Coleman, 1988).

Interest in business arranges specifically has been appeared to give firms important resources as industry information, new thoughts, financing and correlative abilities and mastery. These benefits can enhance business execution and help firms accomplish a competitive edge over others (Schroeder et. al, 2013).

Technological advancements and the development of online networking are likewise making possible inventive types of business connection and movement including new sorts of business connections. Web-based social networking is an invented instrument for correspondences on a business level. Organizations can speak with their market in regards to items, administrations, and input. There are organizations that have unique offices, or they employ an organization to keep up their online networking nearness. For some substances, they utilize this device to keep up interchanges inside and outside of the organization. On account of the arrival organization’s involvement with using online networking all the time, it has turned into an imperative part of the business and administrative correspondence (Schroeder et. al., 2013).

Leveraging Social Media and Innovations

Online networking is changing the core of communications, with a phenomenal rate of appropriation that outpaces past developments; for example, the radio, phone, TV, and even the

iPod. These instruments are instinctive to utilize what's more, permit individuals to share data, work together, talk about regular interests furthermore, and build connections.

The world is getting to be "Glocal" from worldwide and is pressing its monetary, social what's more, political limits in this way giving it a typical stage for improvement. The merging of the media has extended the use of the web that gave birth to online networking. Online networking is an idea that has given individuals a typical stage for sharing their news, perspectives, and suppositions with respect to the happenings around them. Not just this, online networking is likewise being utilized by the publicists what's more, organizations for their advancements, experts in seeking and enlisting, understudies for entry-level positions, novices for expert work, guardians and instructors as social learning instruments, and so on (Kalia, 2013). Table 1 provides the summary of the earlier discussed details.

Table 1: Literature review summary

Author and Year	Purpose	Findings
Palacios-Marques et. al (2015)	Exploration of the effect of online social networks and competency - based management of innovation capability.	The online social network uses for internal cognitive processes and external cognitive processes positively affects knowledge transfer.
Palacios-Marques et. al. (2015)	Effect of online social networks on firm performance and value generation.	The relationship between online social networks and innovation capacity.
Razak & Latip (2016)	Factors influencing the usage of social media as a marketing tool for the small medium enterprises (SMEs).	By using social media, SMEs will be more competitive in the global economy and are able to access larger markets.
Lekhanya (2013)	Establish and develop an understanding of the effect social media and social network technologies.	Cost benefits and advantages of using social networks as marketing, promotional tools.

Parveen (2012)	Investigate the various factors that influence the social media usage and its subsequent impact on organizations.	The performance of the firm depends on social media usage.
Roblek et. al. (2013)	Investigate the significance of Web 2.0 and social media for organizational development.	The important role of social media in the value-added chain in knowledge-based industries.
Paquette (2013)	Explanation of terminology that defines social media metrics (SMM), followed by a discussion of the four main themes found within current research studies: Virtual Brand Communities, Consumers Attitudes and Motives, User Generated Content, and Viral Advertising.	Retailers can increase awareness of their br and by being creative when engaging customers on social media sites.
Brodie et. al. (2013)	Complex, multi -dimensional and	Consumer engagement process is initiated

Source: Authors' compilation

Social Media: Goodness of Fit for Consumers

Social media ensures inter-connectedness, and it outlines that individuals are exposed to other fellow members' behaviors, and this, in turn, generates normative perceptions about a particular behavior and this is also applicable for individuals' behaviors on social media (Chu & Kim, 2011). And it was also true that people had no scope and opportunity to interact with the media platform. This is where social media has done a revolutionary job to have provided the opportunity for the audience to create, design, develop, and even distribute advertising content. Earlier studies on TRA (Theory of Reasoned Action) have shown that both attitudes and subjective norms do predict individuals' behaviors. In TRA, the most important predictor of subsequent behavior is one's intention to act; here the intention is to engage in social media consuming. One's behavior influences attitude, subjective norm, one has about the behavior, and finally, one's attitude is determined by one's beliefs about both the results and attributes associated with the behavior (Fig. 1).

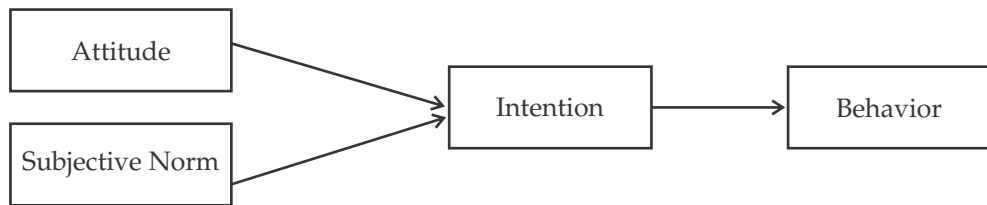


Fig. 1: Conceptual model: Ajzen & Fishbein's (1980)

Martin, Wentzel, Tomczak, & Henkel (2007) states that people have a tendency to collect information about others, mainly their friends and family members, as a credible source of information and they can adopt the behavior that their friends and family members are exhibiting and this will be reflected in the way word-of-mouth influences a customer. Thus, it has become a matter of fact that people are accepting social media in marketing with revolutionary high spirits. Social networks can captivate a huge amount of information about their users, advertising their products on the used social channels permits for a level of targeting unavailable on traditional digital advertising platforms. These sophisticated targeting alternatives can increase the chance of conversion of the displayed ads and get the intended message in front of the exact demographic group the company has a target to reach.

For the customers, the perceived usefulness of social media is another reason for greater acceptability and adoption among consumers. Perceived usefulness relates to a person's belief that if he uses the technology will enhance a salient task (Taylor & Todd, 1995; Davis, et. al., 1989). People consider social media platforms to be functional to the degree that they lessen ambiguity or vagueness across these categories of marketing communications and manipulate customer behaviors (Kaplan & Haenlein, 2010).

Besides, perceives usefulness, the other explanation for SMM tools being accepted by the audience is the perceived ease of use. In a study conducted by Taylor & Todd (1995) it has been found that that perceived ease of use has a positive relation to attitudes toward technology and behavioral adoption. So is the case with social marketing tools. Studies by Milewicz, C., & Saxby, C. (2013) has asserted that perceived ease of use as directly influencing satisfaction with social media for marketing communications and indirectly impacts intentions to use social media for inbound customer communications through satisfaction with social media.

Social Media: Goodness of Fit for Marketers

Social media metrics is endowed with a commanding prospect to engage the target audience of the company directly and engenders buzz around the company's brand or content. For the companies engaging in SMM, it is increasingly becoming relevant for companies to do the following:

- (1) To create important base of consumers, and
- (2) Make them participate in decision-making.

Social media gives marketers a voice and a way to communicate with peers, customers, and potential consumers. It personalizes the “brand” and helps you to spread the message in a relaxed and conversational way.

The SMM targets at the following:

- Boost in website traffic;
- Engender customer leads;
- Gain more social shares on their content;
- Develop brand reach and awareness;
- Build up social communities;
- Target their ideal demographic more efficiently;
- Create consequential relationships with customers;
- Increase an enhanced understanding of their audience;
- Provides an identity about the companies;
- Social media makes companies appear “real” to consumers;
- Used to associate themselves with their peers;
- Provide higher the interaction;

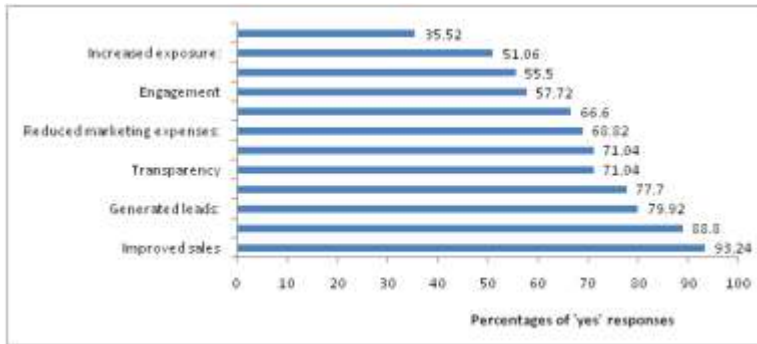
Table 2 shows that looking at the “yes” responses why the marketers engage in SMM, maximum percentage of “yes” response has been received by improved sales, (93.24%), followed by market size (88.80%), generated lead (79.92%), reachability (77.70%) and minimum responses have been received by customer loyalty (35.52%). Thus, it can be seen that marketers are highly optimistic and many of them do expect improved sales and being able to target a bigger market size when they employ SMM.

Table 2: The percentage showing as to the reasons why companies engages in SMM

S. No.	Reasons	Frequencies N=45	Percentage of Yes Responses
1.	Market Size	40	88.80
2.	Transparency	32	71.04
3.	Reachability	35	77.70
4.	Traffic Tracking	25	55.50
5.	Building Brand Consciousness	30	66.60
6.	Customer Loyalty	16	35.52
7.	Engagement	26	57.72
8.	Improved Sales	42	93.24
9.	Increased Exposure:	23	51.06
10.	Generated Leads:	36	79.92
11.	Reduced Marketing Expenses	31	68.82
12.	Provided Marketplace Insight	32	71.04

Source: Author's Compilation

Figure 2 from rank-ordered results shows the responses of marketers' with respect to reasons for engaging in SMM.



Source: Authors' compilation

The basic diagram of how the activities are undertaken in SMM is depicted in Fig. 3.

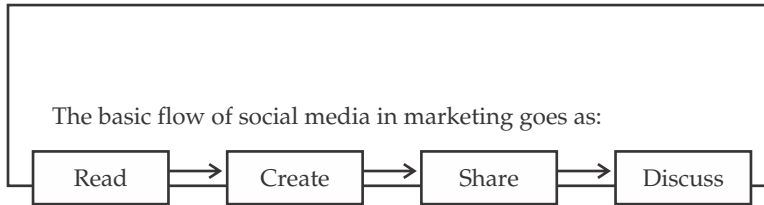


Fig. 3 Flow of social media

Source: Authors' compilation

Companies have multiple benefits from SMM. If people are following the updates provided by the company and if the company is in a particular niche it is very likely that the company will have a very focused following. If the company is active in the social media community and there is a large follower list, then the company will be perceived as an industry leader by those that follow it.

Challenges in the Innovation Funnel

With the overwhelming response towards accepting social media as a marketing tool, though the positivities and benefits come surfaced out, it cannot, however, be ignored that social media also faces numerous disadvantages.

There are a large number of advantages that can be utilized such as speedy viral exposure for products, greater than before search engine rankings, and above all competent leads and sales. Social media platforms enlarge reach and diminish costs by providing three areas of advantage for customers (Watson et. al., 2002; Sheth & Sharma, 2005). There are also some issues to be careful about if SMM has to be done successfully. Social media is a fantastic tool if used properly, but it takes time and perseverance. If specifically looked at, the disadvantages could first be identified as a wrong online brand strategy that can end a company and put the company at a huge viral social

nuisance. Sustained commitment and maintenance of social media is extremely important. Negligence towards social media cannot yield results; rather spreads a very bad word-of-mouth about the company's commitment. Social media is an alive, breathing creature, and has to be fed and watered every now and then. So time and sustained attention are extremely important. Barefoot & Szabo (2010) states that social media needs remarkable time and effort.

The nature of the social media should have the validity that it must do what it purports to do; it should not turn to be a personal blogger's den. Corporate blogs and feeds should be agnostic. They need to be appealing and symbolize the company, and not the content writer. They should be planned in such a way that author's can be swapped out with a limited drop in the following. Keeping a dedicated time for the social media is again utterly important. There has to be somebody continuously responsible to monitor each network, respond to comments, come back with answers, and post product information the customer believe are valuable (Barefoot & Szabo, 2010). Sometimes, companies expect a fast and speedy return on investment; it must be kept in mind that considering a return could take anywhere quite some time, it may vary between some months to a year before a company sees the payback of enlarged customer loyalty and sales.

Besides, Steinman & Hawkins (2010) state that it is indispensable that companies should protect their own trademarks and copyrights if they are being a part of social media to promote their brands and products; sometimes there might be chances of third-party abuse of business trademarks and copyrights. Social media marketers, who use, particularly promotions and user-generated content campaigns, must lay down some rules in place that comprises some definite prohibitions regarding trademark and copyright violation and impersonation (Steinman & Hawkins, 2010).

(Fig. 4).

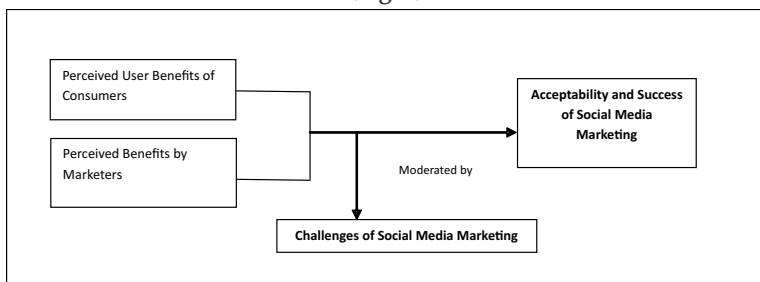


Fig 4: Social media: An impression towards revolution

Source: Authors' compilation

Discussion and Conclusion

The review of this study has been initiated by giving the foundation to the social media relevance at the customer's front. It was perceived how web-based social networking is gradually turning into a critical promoting medium which offers the companies a chance to connect with their business

sectors and find about customers' needs. It is further studied as to how social media impacts the market and how the user benefits can lead to successful social media applications in various fields.

Practical Implications

The present paper outlines the practical utilities and factor in the driving of social media as a marketing tool. It is a matter of fact that some marketers may have bigger advertisement budgets than others, but all companies start off on an identical footing with respect to SMM. Today, the trend has become such that every business is entering into SMM. The paper tries to assert that the social media can be made as an important tool to understand the customers and why do customers relate well to SMM, and for marketers, in order to build and hold on to a gainful customer base by building an excellent CRM why marketers engage in SMM. The paper focuses on a thorough understanding of the use of social media from the customers' perspectives, the marketer's perspective, and how can marketers be careful about the probable nuisances of social media and safeguard every interest of itself and enjoy the rippled benefits of social media. The lesser the challenges of SMM or mitigation of the challenges, higher will be the acceptability and success of SMM.

Limitations and Scope for Further Research

The present paper is limited to the review of earlier researches in the area and outlines the practical importances of using the social media as a marketing tool. It is important to probe whether social media users are truly more demonstrative of general consumers or they come from some particular groups, if yes, who are they? It is also important to know the extent to which social media data are representative of real experience and how much is the only opinion? Most significantly, it is also imperative to explore, how well do SMM correspond to market reality?

Future research should be guided towards understanding the role of SMM in the different demography of consumers. Social media as on date is still fairly new, and the media themselves and the analytic tools available are still evolving. It is also true that social media actually adds to but will never be fully replaced traditional marketing research. It is relevant to explore the new and increasingly crucial foundation of insights.

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Setting Up a Greenhouse: A Case of Investment Decision

Devesh Baid*

Abstract

Ram Singh Jat received an approval from authorities to erect a greenhouse (shade net) on his farmland in November 2015. The approval made him eligible for a subsidy meant for erecting a greenhouse of 2,016 square meters. He had been trying since 2013 to avail of the subsidy for setting up a greenhouse (shade net). He had visited various greenhouses at different places in and out of Rajasthan and also attended a training program on techniques for farming in greenhouses. All these assured him that greenhouse technology helped in protected cultivation which results in higher productivity and hence better profits. Now that the time had come to install the greenhouse, he began thinking about financially evaluating the project.

Keywords: Investment decision, capital budgeting, protected cultivation, green house installation, India.

Introduction

Ram Singh Jat was always concerned about the crop damage caused by extreme summers and winters prevalent in his area. Rajasthan's climatic conditions of extreme weather made him anxious since he started farming. In August 2011, he saw his friend Vimal (an insurance officer) using a laptop for searching information from internet. This gave him an idea to search ways for protecting crops from extreme weather conditions. He was acquainted with computers as his children were learning the same in school. So he bought a computer in September 2011. In November 2011, while searching on the net, he came to know about "Green House Technology for Protected Cultivation".

Ram Singh Jat

Ram Singh Jat was born in 1970 in Chomu, District Jaipur, Rajasthan. His parents were farmers. He completed his schooling from the village and graduated in Maths from Rajasthan University. After completing his graduation in 1992, he joined Western India Company Ltd as an apprentice in Engineering department and worked till 1994. In 1994, he shifted to his village and took up agriculture to support his old father as his elder brothers had separated and his younger brother was still studying.

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Initial Years in Farming

Major crops of the region were wheat, barley, chickpea (chana) and mustard in rabi season (October to March) and groundnut, pearl millet (bajara) and gaur in kharif season (April to September). Jat grew either of these depending on the weather and price forecast. He had 4 hectares of land (1 hectare = 10,000 square meters) but productivity was very low resulting in low income. There are numerous reasons for low productivity in this region which include water scarcity, extreme weather conditions, electricity shortage, etc. This prompted him to motivate his younger brother S.S. Jat to study Agriculture Science.

In October 1998, Ram Singh Jat adopted sprinklers for irrigation. He was the first person to adopt this technology in his village. Sprinklers required less water for irrigation and also saved men hours resulting in cost savings. This resulted in increased productivity and income. This further motivated him to adopt newer technologies in agriculture. In February 2005, he adopted drip irrigation system. This was recommended by his younger brother S.S. Jat who was working as an Agriculture Scientist in Jaipur. He had sent a representative of Kisan Irrigation Ltd (a Mumbai based company with an office in Jaipur) to him. The adoption of drip irrigation helped him to further reduce water usage and wastage of fertilizers, which occurred due to run off or leaching. This technology also saved labor costs as fertilizers were given through drip and not spread manually. This further increased farm productivity and his income.

Installation of Greenhouse

Since the idea of greenhouse came to Ram Singh Jat in 2011, he started exploring the possibilities of installing greenhouse on his farmland. In early 2012, he came to know that greenhouses were recently set up in Rajasthan with subsidy from government. Since these were very new, reliable information could not be gathered about feasibility and productivity of greenhouses. In the meantime, he came to know that there are a lot of greenhouses functioning in Talegaon, 39 kilometers from Pune in Maharashtra. He visited these greenhouses which varied in size and type (polyhouse, shade net, etc). Major crops grown were cucumber, color capsicum, rose, etc. He spent entire 1 day with farmers (operating greenhouses) gathering information about the technology and impact on productivity. Having realized the benefits of using a greenhouse, Jat underwent a training program of 3 days conducted at Jaipur Centre of International Horticulture Institute of Training in June 2012. In November 2012, he also visited Centre of Excellence for pomegranate (anar) at Rajhans farm, Dhindhol, Bassi, Jaipur, which had already a number of installed and functioning greenhouses. With all these visits, he was confident of increased productivity under greenhouse cultivation and opted for a shade net with the intent of growing horticulture crops like cucumber and tomato in a greenhouse.

In May 2013, he applied to the Horticulture Department of Rajasthan Agriculture Research Centre, Durgapura, Jaipur for the grant of a subsidy to install shade net but his application was not selected. He applied again in May 2014 but was unlucky. In May 2015, he made multiple applications and this time two applications were sanctioned for the grant of a subsidy to set up a greenhouse by March 2016. The current scheme provided a subsidy of 50% on the cost of construction. The total cost of a 2,016 square-meter greenhouse was Rs 1.42 million (Table 1) out of which Rs 0.71 million was to be borne by Ram Singh Jat. In 2016, the average conversion rate of US\$ 1 was around Rs 67. This was the biggest investment made by him till date relating to his farm. Although he was confident of returns but still wanted to be sure of his decision and wanted to evaluate the likely gains he can expect from this investment over a life span of 10 years. He also had to worry about the possibility of productivity, cost, and prices moving in the adverse direction. His second concern was that the government approved a limited number of applications to every farmer for grant of subsidy while the land available with a farmer may be large. He himself was interested in four greenhouses whereas the approval was

only for two. The government over the period has been reducing the subsidy earmarked for greenhouses. The question that plagued him was if a greenhouse was profitable without subsidy in case he wanted to bear the entire cost?

Table 1: Capital expenditure for construction of greenhouse

No.	Type of Equipment	Amount (Rs)
1	Cost of erection of shade net house using galvanized iron pipe (shade net, insect net, etc.) for 2,016 squaremeters.	999,600
2	Drip andoverhead sprinkler irrigation system for 2,000 square meters in shade net house	287,600
3	Cost of electric motor pump set for fogger	35,000
4	Cost of farm equipments, civil works, etc.	97,800
	Total	1,420,000

To answer these questions, he estimated the cost(Tables2 & 3) and the expected prices for cucumber, which he planned to grow. In case of greenhouse cultivation, the expected yield of cucumber in an area of 2,000 square meters per season was expected to be 22.5 tons for Terminator F1 variety. Cucumber is a short duration crop and takes 3to 4months. It is consumed throughout the year as vegetable or salad and is also used in skin care products by companies and beauty parlors. In case of protected cultivation, he could take three crops in a year. Although the prices of cucumber fluctuate during the year with prices being high in the off-season and low otherwise, the average price for this variety in the nearest Agriculture Produce Market Committee (APMC*) market last year was around Rs.25/- per kilogram.

Table 2: Annual administrative cost

No	Particulars	Amount (Rs)
1	Supervisor (part-time)	240,000
2	Telephone	60,000
3	Travelling	100,000
4	Overheads	75,000
	Total	475,000

Table3: Cost data of cucumber cultivation in greenhouse for one season

No	Type of Equipment	Amount (Rs)
Pre-Planting Cost		
1	Ploughing, harrowing, bed preparations	2,300.00
2	Sterilization/solarisation**	15,000.00
3	Planting material/seedlings(seed, coco pit, andnursery materials)(6,000 plants)	31,000.00
4	Manures (Farm Yard Manure - rice husk,neemcake, vermi-compost,etc.), fertilizers, insecticides andpesticides	20,500.00
5	Laborcharges for planting seeds andtransplanting	4,250.00
	Total A	73,050.00
Production Cost		
1	Transplanting of plants (500 plants/labor)	3,600.00
2	Maintenance cost	6,300.00
3	Cost of plant production,pesticide, etc.	9,100.00
3	Electricity cost	3,500.00
4	Farmyard manure, fertilizer/fertigationcost	13,000.00
5	Laborcharges for the following:	
	(a) intercultural operations, earthling up, a spray of pesticide, etc.	6,100.00
	(b)pruning, training, etcof plantsfor better production	4,000.00
	TOTALB	45,600.00

Post Harvesting Cost		
1	Packing materials	6,000.00
2	Sorting, grading, packing	5,500.00
3	Transportation charges	23,500.00
4	Miscellaneous expenses	7,000.00
	TOTAL C	42,000.00
	TOTAL OF A + B+ C	160,650.00

***Incurred once in a year.*

As there are no taxes on agricultural income in India, there was no advantage of capital expenditure in terms of claiming depreciation and saving taxes. He estimated that the material used in the shade net at the end of project life will be able to fetch Rs. 0.2 million. While the current fixed deposit rates were around 7% to 8%. Ram Singh Jat felt that a return of 15% per annum should be adequate for such investment in a greenhouse. His income from a 2,000squaremeters area by growing tomato, chili, etc. for the last 2to 3years had averaged about Rs0.04 million per year.

Solve the following questions:

1. Do a SWOT analysis of Ram SinghJat's decision to install greenhouse.
2. Calculate project profitability (with subsidy) over its life using financial techniques.
3. Prepare profit and loss account for the first year of operations.
4. Do a sensitivity analysis by:(a) reducing the price by 15%;(b) increasing the cost by 10%;(c) Reducing productivity by 10%; and (d) reducing productivity by 10%,i. e. reducing the price by 15% and increasing the cost by 10%.
5. Is the project profitable without subsidy?
6. What recommendation would you give to Jat with respect to setting up a greenhouse?

*APMC is a marketing board created by many state governments in India. Farmers bring cultivation to marketplaces created for a purpose which is sold through auction. This is to ensure that farmers get a fair price for their produce.

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