

A Study of Key Decision Criteria for Buying Decision Making Process with reference to Smart Phones using DEMATEL

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ABSTRACT

Smart phones are advanced version of mobile phones having various features and applications. For most people smart phones are like mini computers as they can do most of their professional and personal tasks with the help of various features present in it. The present study helps in understanding and identifying the criteria that are important to consumers while buying a smart phone. Further, the relationships amongst the important criteria were also identified. A questionnaire was prepared with the list of criteria and the responses were collected from the experts. DEMATEL method is employed to analyze the relationship between the identified criteria.

Key words: smart phones, decision criterion, buying behaviour, DEMATEL

Introduction

Marketers spend considerable amount of time in understanding how consumers arrive at a buying decision. Many academicians too have developed models in the past to understand consumer buying behavior and consumer decision-making. Loudon & Bitu (1994) defined consumer behavior as 'the decision process and physical activity in which individuals engage while evaluating, acquiring, using or disposing of goods and services'. It is also explained as an overall customer experience combining intentions, attitudes and decisions exhibited by a customer at the market place while purchasing products or services (Grimsley, S, 2015). It is extremely important for companies to study buying behavior of their respective customers for successful formulation and implementation of marketing strategies (Khaniwale, 2015).

Mobile phones are typically classified under two segments - feature phones and smartphones. While feature phones are simpler models that offer voice and basic messaging facilities, smartphones offer a range of many other features through an operating system abbreviated as an OS. Through an OS, a Smartphone can offer high-speed Internet access and hence web browsing, email and social media connectivity. Through many applications, smartphones also offer engaging gaming experience, distance, temperature and other utility and productivity enhancement tools. Lastly but most importantly through wide range of applications (Apps) supported through the OS ecosystem, a large number of entertainment and productivity improvement tools are offered. To summarize smart phones are advanced version of mobile phones having various features and applications. They are like mini computers as they can provide individuals ability to work, entertain and communicate in a location free environment (Kimiloğlu, 2010). Acceptability of such products has increased

dramatically in the last few years and has large penetration in the market. The present paper is on understanding behavior of buyer, when they while buying a smart phone by identifying the criteria that are important to them while buying a smart phone. Further, the relationships amongst the important criteria were also identified.

Literature Review

The aim of this section is two fold; first a brief review on the work done in consumer buying behavior with reference to mobile phone is discussed. Secondly, DEMATEL method is discussed along with its application and steps to solve the same.

Smart phone industry is growing at a remarkable pace and consumers consider smart phones as part of their lifestyle (Castells et al, 2006). According to one of the reports published by ASSOCHAM (2011) approximately 39% of the respondents said that they switch to a new phone as frequently as less than every two years so as to be able to utilize new applications and technology. Tseng and Lo (2011) have also highlighted in their research that “smartphones are evolving swiftly and have shorter product life-cycles”. As a result, intense competition is prevailing amongst the manufacturers. Companies are releasing their product with new or advanced features more frequently hoping to get acceptance from the customers. E.g. Globally leading brands like Apple, Samsung, Xiaomi or OnePlus release at least 1-2 new iterations in in their existing series with iPhone 8, 8 plus & Iphone X, Xiaomi's Redmi Note 5, Note 5 pro and Mi6, Samsung's S9, S9+ and OnePlus 6 etc. respectively. Unfortunately, not all new features become hit in the minds of consumers, some features like front camera, dual SIM become very popular and create new demand in the market, even a new segment altogether, while many others like curved screen, dual screen etc. are not given much preference by customers and fail to generate the expected demand. The business returns from such features thus may fail to justify the investment in building such features. Therefore, it is important for manufacturers and marketers to understand how consumers evaluate different features, which may be incorporated in the next release of the smartphone.

Before, we go into our research, a look at some of the past research findings on the same issue.

Market Analysis and Consumer Research Organization (MACRO - 2004) in their Mumbai based study on mobile phone usage covered a sample of 165 teens and youth across the 15-30 years age group spanning all Socio-economic-classes (SEC). They found that students prefer to purchase brand leader mobile handsets and they had information about technology before actually purchasing handsets.

Ling et al. (2006), in their study amongst college students, found out that there are five design characteristics of mobile preferred by consumer's viz. camera, screen resolution, browsing, voice dialing and wireless connectivity. Amongst them screen resolution, voice dialing, and browsing predict user's product satisfaction to a significant level.

According to Meirovich & Bahnan (2008), the new attractive feature will satisfy consumers. These features can be 4G VoLTE, camera resolution & capability, design, waterproof, shockproof, connecting capabilities via applications, storage, screen size, processor capabilities, etc. (Oulasvirta, 2011).

Mokhlis and Yaakop (2012) conducted a quantitative analysis of 376 university students in Malaysia on seven independent dimensions: innovative features, image, price, durability, recommendations, and portable aspects, media influence, and post-sales service. Among them innovative features, recommendation, and price were found to be top three factors that influenced purchase decision.

Malviya S., Saluja M. S., & Thakur A.S. (2013) studied factors like Price, Brand Name, social influence and Product Features. Their study found that dominant factors in influencing consumers purchase decision included Product's Price, social influence Brand Name and Product Features.

Qun, et al (2012) carried out a study to explore the factors affecting purchase intention of the smartphone in Malaysia. They studied four factors - relative advantages, price, social influence, compatibility amongst 400 undergraduate and foundation young university level students in Malaysia. The study found that Social Influence, Compatibility, Price had a significant impact on purchase intention together explaining more than half of the total variance of purchase intention.

Knapman (2012) found that more and more consumers are paying attention to brands while making a purchase decision. Consumers will prefer a brand that has a better brand image. (Eze, Tan, and Yeo, 2012).

Dziwornu (2013) researched and concluded that features and design will influence consumers purchase decisions. Product features have a positive impact on purchase decision and intention.

Siddique et al (2013) analyzed the effect of sixteen diverse features of mobile phones under five different factors on purchase decision of students. The purpose of the study was to find out the preference amongst many feature, and their inter-relationship in a purchase decision. Results suggest that factors like internet speed, long lasting battery, camera, brand, technological performance have more impact on purchase decision than features like external memory capacities, warranty period, price, customer-care service, phone memory capacities, country of origin.

Norazah (2013) found that consumers prefer smart phones that have unique features like quick display of information signifying processing speed, graphical interface with touch screen interaction environment.

Vida, The Cosmos, & Samuel (2013) in their study found durability, features and performance influence almost 90% students' purchase behavior. According to Karen Lim Lay-Yee (2013) New functions and innovation in functionality for hardware and operating system are important product feature considered by smart phone users while making a purchase decision .

Mishra, R.S (2014) conducted a study to investigate & understand the behaviour of consumers of mobile phones and their satisfaction level owing to technical and non-technical features. The study reveals price & technical features as most influential factors affecting the purchase of a new mobile phone.

Azira, R. et al. (2015) examined factors influencing purchasing intention of smartphone and found that Three variables out four studied i.e. brand name, product features and social influence have a significant relationship with product purchase intention except for product price.

Mazlan, Sofiyya et al. (2016) in their study of investigating factors affecting purchase intention of a leading brand amongst 200 business school students in Malaysia, found brand consciousness to have the highest positive relationship with purchase intention followed by perceived innovation in the product.

Debasish, D., & Mallick, D. (2015) studied 400 customers from Odisha, India. The study indicates there is no significant difference between rural and urban customers in factors like price and style consciousness. However, a significant difference does exist between rural and urban customers on factors such as quality, functions and brand awareness,. Rural customers are less conscious about quality, functions, and brand and they are mostly influenced by information from friends in their purchase decisions.

Most customers do not change into a new mobile phone until their existing phone is not outdated. One of the reason during discussion with experts is that finding a buyer for existing used mobile phone is very time consuming affair and yet people aren't sure if they did get the best value for their old phone. Many mobile phone companies are using exchange offers strategy to effectively induce such buyers to increase the sales of their new launches. Mostly used on online sales channels, extra value is offered during introductory phase of new launches and is also considered effective tool for price setting. Flipkart.com has used this strategy very effectively.

Research Gap

Lot of research has been undertaken in this area, however most work is concentrated on studying the consumers' attitude towards buying a mobile phone from their own perspective only. This study aims at studying the same from the perspective of the market experts. The literature review helps in giving the important criteria which the consumer look for when buying a mobile phone and subsequently experts are to tell us the relationship amongst those criteria, which the consumers look for at the time of buying. According to them, no consumer looks at any criterion in isolation rather they evaluate and compare with multiple criteria. For instance, price may be important to a consumer, but he evaluates price of a phone with vis-a-vis other criteria, say camera quality, battery, speed, exchange offers, freebies and may be many more. Understanding the relationship amongst these criteria from these experts becomes important because they are interacting with consumers at the time of taking a buying decision. As a result, this study will be helpful to the marketers to understand the consumers' attitude and accordingly plan marketing strategies better.

Objectives

Based on the Literature reviewed and gaps in research identified above, following objectives have been enlisted for our research.

1. Identifying the criteria that are important to consumers while buying a smart phone.
2. Identify the relationships amongst these important criteria using DEMATEL method
3. Build a marketing strategy framework based on these key decision factors with reference to Smart Phones.

DEMATEL Method

Real life decision-making is a complex process, it is often a **Multi-Criteria Decision Making (MCDM)** problem. MCDM involves evaluation of multiple criteria at the same time during decision-making process. While taking a buying decision, a consumer has to consider multiple criteria simultaneously. However, consumer can make poor choice if the decision is complex and involves multiple criteria (Doyle and Green, 1994).

While buying a mobile phone consumer consider many product features simultaneously. Hence, it is MCDM problem (Tan et al, 2012). "Decision-making trial and evaluation laboratory (DEMATEL)" method was first developed by the "Science and Human Affairs Program of the Battelle Memorial Institute of Geneva" between 1972 and 1976 to study the intricate and intertwined problems (Tzeng, 2007, Wu., 2007). Through this technique factors can be divided into two classes namely, cause group and effect group (Hosseini, 2010). DEMATEL approach has widely been considered as one of the best technique to solve the cause and effect

relationship among the evaluation criteria or to arrive at the interrelationships among the factors. (Chiu et. al., 2006, Liou et al., 2007, Tzeng et al., 2007, Wu and Lee, 2007, Lin and Tzeng, 2009).

The phases of DEMATEL method adopted from Tzeng et al (2007) and Wu et al (2007) are summarized as below:

Phase 1: Compute the average matrix

A matrix was constructed where experts were asked to evaluate certain set of criteria based on pair-wise comparison. Each expert was asked to evaluate the direct influence that each criterion has on other by an integer score that varies from 0 - 4. 0 indicates “no influence”, 1 is “low influence”, 2 is “medium influence” and 3 is “high influence” and finally 4 indicates “very high influence”.

Table 1: The designed questionnaire

	Brand & Advertising	Camera	Price Advantage	Recommendations / Reviews	Speed & Performance	Exchange Possibility	Battery
Brand & Advertising	-						
Camera		-					
Price Advantage			-				
Recommendations/ Reviews				-			
Speed & Performance					-		
Exchange Possibility						-	
Battery							-

Let x_{ij} denotes “the degree to which the expert believes criterion i affects criterion j ”. For all $i = j$, (i.e. all diagonal elements) are set to zero. Each expert would provide $n \times n$ response matrix which is non-negative and can be expressed as $X^m = [x_{ij}^m]$, where m is the number of experts with $1 \leq m \leq L$, and n is the number of criteria. Hence, “ X^1, X^2, \dots, X^L ” are the $n \times n$ matrices obtained from L experts. Finally, the average response from all experts is given by matrix “ $A = [a_{ij}]$ ”, also known as initial direct relation matrix and can be constructed as follows:

$$a_{ij} = \frac{1}{L} \sum_{m=1}^L x_{ij}^m \tag{1}$$

Phase 2: Calculate normalized initial direct-relation matrix D

Matrix D is found by normalizing initial direct-relation matrix $D = \frac{A}{p}$, where

$$p = \max \left[\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij} \right] \tag{2}$$

Phase 3: Calculate the total relation matrix

The total relation matrix denoted by T is $n \times n$ matrix and is given as follows:

$$T = D + D^2 + \dots + D^m = D(I - D)^{-1}, \text{ where “} m \rightarrow \infty \text{ and } I \text{ is an } n \times n \text{ identity matrix”} \tag{3}$$

Phase 4: Calculate sum of rows and sum of columns of total relation matrix

“Assume r and c be $n \times 1$ and $1 \times n$ vectors that represents the sum of rows and sum of columns of total relation matrix T respectively.” By using following expression, the two vectors can be obtained.

$$r = [r_i]_{n \times 1} = \left[\sum_{j=1}^n t_{ij} \right]_{n \times 1}, \text{ where } r_i \text{ denotes “sum of } i^{\text{th}} \text{ row in a matrix } T\text{”}$$

$$c = [c_j]_{1 \times n} = \left[\sum_{i=1}^n t_{ij} \right]_{1 \times n}, \text{ where } c_j \text{ denotes “sum of } j^{\text{th}} \text{ row in a matrix } T\text{”}$$

r_i explains both direct and indirect effects given by i^{th} criterion to the other criteria and c_j explains both direct and indirect effects by j^{th} criterion to the other criteria. When $i=j$, “the sum $(r_i + c_j)$ denotes the total effect given and received by criteria i ”, in other words, this also indicates the degree of importance that criteria i plays on the whole system. Alternatively, “the difference $(r_i - c_j)$ denotes the net effect that criteria i contribute to the system.” If the difference $(r_i - c_j)$ is positive, factor i is a net causer and if it is negative, criteria i is a net receiver.

Phase 5: Set a threshold value

The information regarding how one factor affects another can be viewed from matrix T . The expert has to set a threshold value for matrix T to rule out some of the insignificant affects. In the process only the values greater than the threshold value are chosen for drawing influence map.

Survey and Analysis

Based on the literature review and reports on mobile phones released by various consulting companies, a preliminary list of decision factors with respect to smart phone was obtained shown in Table 2. These decision factors are those, which consumers think and evaluate while taking a buying decision, and hence called as decision criteria. Therefore, the questionnaire (see Table 1) was made ready for applying DEMATEL method to study relationship amongst the decision criteria which would be helpful to the marketers for strategy formulation.

Table 2 Decision Criteria

Decision Criterion
Speed & Performance
Brand & Advertising
Recommendations & Reviews
Battery life
Exchange Possibility
Camera Quality
Price Advantage through offers

Thirty experts were invited to fill the questionnaire; they are retail and marketing professionals from mobile phone sector covering retailers, brand and marketing managers from mobile phone companies. Only 25

questionnaires were valid, which represent 83.33% effective response rate. Their responses were obtained to determine the causal relationship amongst the decision criteria. Computation of DEMATEL method is based upon the responses of 25 experts. The professional role breakup of these twenty-five experts is given in table 3.

Table 3 Professional role break up

Professional Role	Number of Experts
Retailers	16
Brand and Marketing managers	9

Step 1: The average matrix A is calculated using Eq(1) and is shown below:

$$\begin{bmatrix} 0 & 3.2 & 1.8 & 3.7 & 3.3 & 2.7 & 1.3 \\ 3.2 & 0 & 1.1 & 1.2 & 1.3 & 2.8 & 1.4 \\ 1.3 & 1.3 & 0 & 3 & 1.3 & 3 & 1.3 \\ 2.3 & 1.3 & 1.3 & 0 & 2.3 & 1.3 & 1.3 \\ 3.3 & 2.1 & 2.1 & 2.9 & 0 & 2.8 & 3.2 \\ 1.3 & 1.4 & 1.5 & 2.1 & 2.3 & 0 & 1.3 \\ 3.2 & 1.6 & 1.3 & 3.1 & 3.3 & 2 & 0 \end{bmatrix}$$

Step 2: Normalized initial direct-relation matrix is computed using eq (2) and shown below:

$$\begin{bmatrix} - & 0.1951 & 0.1098 & 0.2256 & 0.2012 & 0.1646 & 0.0793 \\ 0.1951 & - & 0.0671 & 0.0732 & 0.0793 & 0.1707 & 0.0854 \\ 0.0793 & 0.0793 & - & 0.1829 & 0.0793 & 0.1829 & 0.0793 \\ 0.1402 & 0.0793 & 0.0793 & - & 0.1402 & 0.0793 & 0.0793 \\ 0.2012 & 0.1280 & 0.1280 & 0.1768 & - & 0.1707 & 0.1951 \\ 0.0793 & 0.0854 & 0.0915 & 0.1280 & 0.1402 & - & 0.0793 \\ 0.1951 & 0.0976 & 0.0793 & 0.1890 & 0.2012 & 0.1220 & - \end{bmatrix}$$

Step 3: Calculate total relation matrix by using eq(3)

$$\begin{bmatrix} 0.5371 & 0.5857 & 0.4535 & 0.7653 & 0.6844 & 0.6690 & 0.4550 \\ 0.5540 & 0.3115 & 0.3233 & 0.4958 & 0.4564 & 0.5344 & 0.3522 \\ 0.4443 & 0.3639 & 0.2485 & 0.5634 & 0.4375 & 0.5241 & 0.3368 \\ 0.4846 & 0.3597 & 0.3141 & 0.3945 & 0.4735 & 0.4304 & 0.3311 \\ 0.7285 & 0.5528 & 0.4833 & 0.7615 & 0.5458 & 0.6953 & 0.5603 \\ 0.4279 & 0.3544 & 0.3186 & 0.4969 & 0.4637 & 0.3476 & 0.3261 \\ 0.6796 & 0.4935 & 0.4145 & 0.7198 & 0.6698 & 0.6098 & 0.3649 \end{bmatrix}$$

Direct and indirect effects of seven criteria are portrayed in Table 4.

Step 4: The importance of seven criteria can be prioritized as Speed & Performance > Brand & Advertising > Recommendations / Reviews > Battery > Exchange Possibility > Camera > Price Advantage based on (r + c) values.

For net effects, Speed & Performance, Brand & Advertising, Battery, Camera and Price Advantage are net causes with positive (r - c) values. In contrast, Recommendations / Reviews and Exchange Possibility are net receivers with negative (r - c) values.

Direct and indirect effects of seven criteria are portrayed in Table 4. The importance of seven criteria can be prioritized based on (r + c) values.

Step 5: Finally, a threshold value of 0.54 (average score + 10% added to reduce complications) was set up in matrix T. The digraph of seven decision criteria is shown in Figure 1, the interaction effects amongst the pair of decision criteria are presented in Table 5.

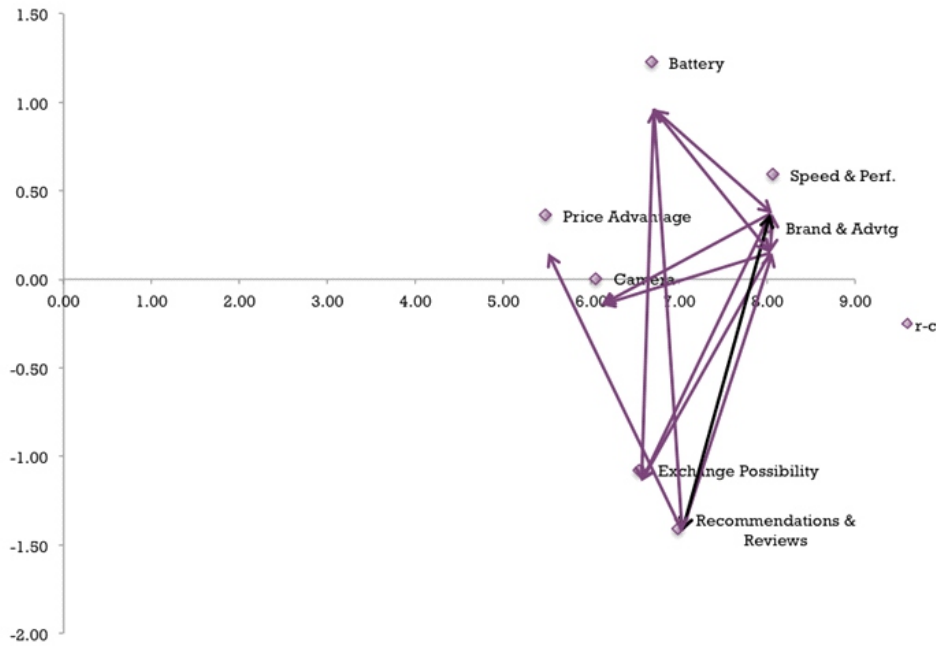
Table 4 The direct and indirect of 7 decision criteria

Notations	Decision factor	r+c	r-c
Df1	Brand & Advtg	8.01	0.29
Df2	Camera	6.05	0.01
Df3	Price Adv.	5.47	0.36
Df4	Recommendations/ Reviews	6.99	-1.41
Df5	Speed & Perf.	8.06	0.60
Df6	Exchange Possibility	6.55	-1.08
Df7	Battery	6.68	1.23

Table 5 Interaction effects between decision criteria

Decision Criterion	Affected Decision Criteria
Brand & Advertising	Camera quality Reviews & Recommendations Speed Exchange possibility
Speed & Performance	Brand Camera Reviews & Recommendations Exchange Possibility Battery
Battery	Brand Speed Reviews & Recommendations Exchange Possibility
Reviews and Recommendations	Brand Price Advantage Speed Battery

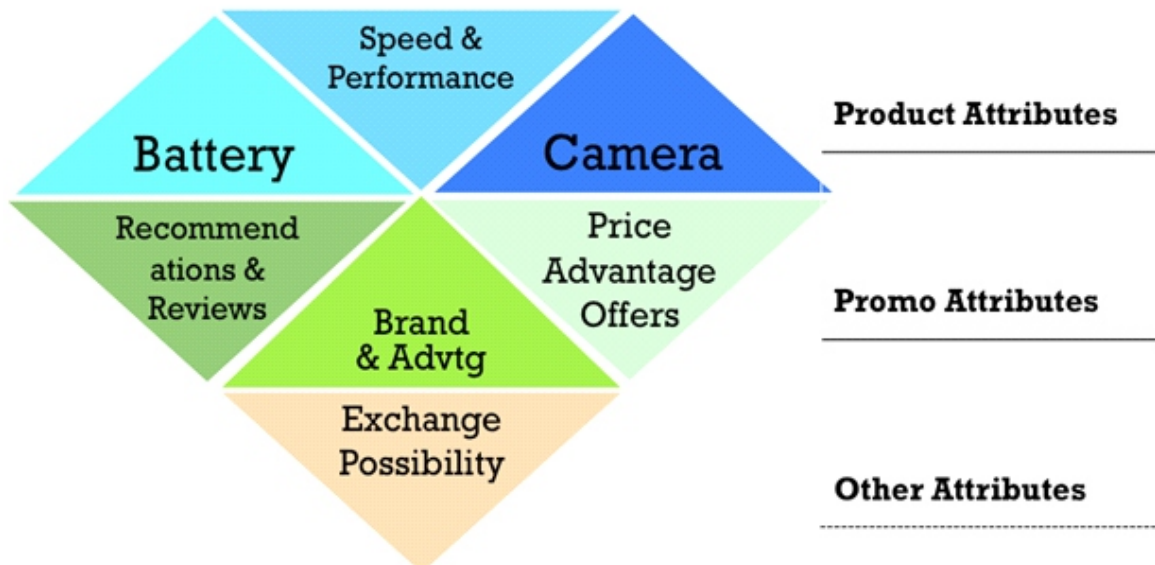
Fig 1 Diagram of Seven decision criteria



Proposing Marketing Strategy Framework by decision criteria relationship

A framework of marketing strategy is proposed based on the decision criteria. As the diagram of decision criteria shows that there exist significant interactions amongst seven decision factors. Speed, Battery and Camera are three attributes that should be central to any mobile phone product strategy. Branding, Reviews & recommendations and value inducing offers that give the impression of price advantage should be central to promotional strategy. Lastly, an opportunity to sell older phone at a good exchange price, it can motivate customers to go for the new purchase.

Fig 2 Marketing Strategy Planning Framework



Conclusion

The paper aims to build a marketing strategy framework based on consumer buying behaviour towards Smartphones by applying DEMATEL technique. Through a questionnaire survey of 25 mobile phone experts, the seven key decision criteria factors identified are Speed & Performance, Brand & Advertising, Recommendations and Reviews, Battery, Exchange Possibility, Camera and Price Advantage. The DEMATEL method is applied to find out the relative importance of these seven criteria and their inter-relationship with each other. The results show that Speed & Performance followed by Brand & Advertising are the most important criteria for consumers buying decision. Based on the relationship between these decision criteria, a marketing strategy framework is proposed that consists of product related (Battery Life, Camera Quality, Speed & Performance); promotion related (Brand & Advertising, Recommendations & Reviews, Price Advantage through offers) and other attributes (Exchange Possibility) as components of the framework which can be used by marketers as positioning platform.

Future Scope

The present study was confined to only Smartphones with selling price range between Rs 10,000 and Rs 20,000. Furthermore this study was limited to state of Haryana only. The scope of similar studies for future can be expanded by Evaluating other product categories like feature phones also, as the feature phone market is also quite big and since there is not much product differentiation possible, what it is that drives customer to certain brands would be useful to understand.

Other consumer goods categories like TV, Car Stereo, and Watches etc, which too are high involvement but yet, have a different buyer-product interaction process. A Car stereo and a TV is used maximum for 2-3 hours in a day as compared to a phone which is used for more than 8-10 hours nowadays.

Within Smartphones, other geographic areas like Punjab, Delhi, and Uttar Pradesh etc can be explored which can also help us understand the difference between urban and rural markets. Off-late a lot of mobile phones are sold in prices higher than Rs 20,000 too, studies in these higher end phone categories too can be taken up to understand thinking and buying behaviour of customers willing to spend up to Rs 80,000 on a phone.

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