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EMPIRICAL STUDY ON CLUSTER ANALYSIS OF THE SMARTPHONE SEGMENT

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Abstract *The purpose of this study is to understand the market dynamics of smartphones. The study aims to investigate the effect of trends, social influences and convenience on consumer's purchasing behaviour. This report is based on quantitative data. The first step that was undertaken was a pilot survey. A sample of 40 respondents was framed using random sampling method. The primary data collected through pilot survey was analyzed. After the successful completion of pilot survey, it was identified that consumers are aware of the smartphone technology and there is a huge scope in the market. Then the main survey was conducted to conclude the purpose of the study. The primary data for main survey were collected from a random sample of 84 respondents. According to the customers' response, data were analyzed using Cluster Analysis. This paper presents the result of a survey on the trend of smartphone from the perspective of end consumers. This study has looked into the familiarity of users towards smart phones, operating platform and different unique smartphone features such as backup, third party application, multi-window, global positioning system (GPS) etc. This study also identified consumer preference for different smartphone brands and most importantly the determinants that influence their purchasing decision. Additionally, the consumer preferences on smartphone specifications such as design, screen size and price were investigated. Furthermore, it was also analysed that consumers are aware of smartphone malicious software and security software in order to protect their device. The statistics presented provides fundamental information regarding the trends and factors influencing consumers buying behaviour, in the smartphone market. Such information is useful for the development in the field, whereas for smartphone manufacturers, application developers and other stakeholders, they will be able to plan their direction for generating revenue as well as maintaining their position in the market.*

Keywords: *Market Dynamics, Pilot Survey, Cluster Analysis, Customer preference*

INTRODUCTION

The Indian telecommunications industry is one of the fastest growing industries in the world. Government policies and regulatory framework implemented by Telecom Regulatory Authority of India (TRAI) have provided conducive environment for service providers, thereby making the sector more competitive. The telecom industry has witnessed significant growth in subscriber base over the last decade, with increasing network coverage and a competition-induced decline in tariffs acting as catalysts for the growth in subscriber base. The growth story and the potential have also served to attract newer players in the industry, with the result that the intensity of competition has kept increasing. Telecom sector has continued to emerge as the prime engine of economic growth. Indian telecommunication sector has undergone a major transformation through significant policy reforms, particularly under NTP 1999. Driven by various policy initiatives, the Indian telecom sector has achieved a phenomenal growth during the last few years and is poised to take a big leap in the future. Available international comparisons show that India has the second largest number of telephone subscribers in the world (among 222 countries), accounting for 12 percent of the world's total telephone subscribers. It is also one of the fastest growing in terms of telecom subscribers. The Indian mobile phone market is highly competitive with more than 150 device manufacturers trying to encourage the consumers with their offerings. Most of these producers focus their efforts on the low-cost feature phone market, which constitutes over 91 percent of overall mobile phone sales, offering a huge scope for growth. In the Indian smartphone market, manufacturers like ZTE, Micromax, Karbonn Mobile, and Huawei are constantly enhancing their smartphone portfolio to compete with big global manufacturers like Samsung and Nokia.

LITERATURE REVIEW

This part of report covers some of the latest literatures regarding smartphone which includes its development and application in education, popularity, versatility, wireless mobility, successful implementation of smartphone and different problems. Smartphones have become an integral part of people's life (Zhou, Zhang, Jiang, & Freeh, 2011). They offer numerous possibilities from the simplest tasks of note-taking through a handwriting recognition system

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(Anquetil & Bouchereau, 2002) to advanced remote controlling of home and office appliances (Nichols & Myers, 2006; Ballagas, Borchers, Rohs, & Sheridan, 2006). The popularity of smartphones is growing strong. Since early 2000s the mobile phones penetration in several countries such as the United Kingdom, Italy, Sweden, The Czech Republic, Taiwan and cities such as Hong Kong have already exceed 100% (Prensky, 2005).

Smartphone technology, with its pervasive acceptance and powerful functionality, is inevitably changing peoples' behaviours. Young adults are especially dependent on smartphones today. In terms of existing smartphones in the market, it has been predicted by asymco's Dediu (2011) that the total number of smartphones worldwide is growing fast. In the three year period from Q3 2008 to Q3 2011, the number of smartphones is predicted to have risen from 40 million to 120 million, representing huge growth compared to non-smartphone devices, which grew from 258 million to 272 million while there have been signs of retardation in the growth of the non-smartphone devices (Sakuraoka-Gilman, 2011). This prediction reflects an uptrend in the demand for smartphones as well as the potential for future smartphone migrants. Such proliferation of the smartphone market is a clear indicator to educators that smartphones are, in the words of Mitchell & Race (2005, p. 2), "genuinely becoming ubiquitous" (likewise as agreed by Prensky (2005), Ballagas *et al*. (2006), Valk, Riva & Kangasharju (2008)) and may well be the next most beneficial tool for teaching and student's learning (Riva & Kangasharju, 2008; Prensky, 2005).

Smartphone adoption by consumers is increasing exponentially, and presents marketers with many new opportunities to reach and serve customers (Ajax Persaud & Irfan Azhar, 2012). The main advantage of smartphone use in the public health arena may be the accessibility and dissemination of information (Poeter D. Pew, 2012). Several studies have investigated the demographic characteristics of smartphone users. Males (53%) are more likely to have a smartphone in comparison to females (47%) (Entner, 2010). Regarding smartphone functions, young people indicate a higher satisfaction level with texting than older people (Balakrishnan & Yeow, 2007).

It is found that the big five personality dimensions are related to the application of smartphone technology (Wilburn Lane & Chris Manner, 2012). Extroverts were found to be more likely to own a smartphone and they report a greater importance on the texting function of smartphone. Extraverts are outgoing and sociable and have a strong desire to communicate with others. Texting is an easy and convenient tool for satisfying this purpose. Extraversion is positively correlated with number of friends (McCrae and John, 1992). It stands to reason that extraverts would find texting important. Bianchi & Phillips (2005) have suggested that extraverts use mobile technology for self-stimulatory purposes rather than socialisation.

RESEARCH METHODOLOGY

This report is based on primary data, collected through questionnaire. The first step that has been undertaken in the report is pilot survey. Pilot survey was conducted to analyse that whether customers are aware about smartphone or not. It was analysed that customers are aware about the smartphone and there is a huge scope of smartphone in mobile market. Then the main survey was conducted to analyse consumers' buying behaviour while purchasing smartphone. The main survey aims at collecting data to determine the factors affecting the customers' buying behaviour and to analyse the consumer preference for different brands of smartphone, different mobile operating system. Sample selection for the final survey was also done using random sampling method and sample size was 84. The responses are analysed using Cluster analysis. It is a data reduction tool that creates subgroups that are more manageable than individual datum. Items in each cluster are similar in some ways to each other and dissimilar to those in other clusters. Cluster analysis identifies groups of samples that behave similarly or show similar characteristics.

DATA ANALYSIS

A pilot survey was conducted with a sample size of 40 people. Sample selection was done by using random sampling method. As per the response given by the respondents, it is found that 65 % of the respondents were using smartphones. People have become more tech savvy and they are adopting new or updated technologies. So, there is a huge scope for smartphone market as well as huge investment opportunities. Again 57% of respondents are using Samsung. Thus Samsung is the market leader in case of smartphone. While Nokia which is very popular and has a good market share in case of normal feature phone, is not commonly preferred by people in case of smartphones. Other brands like Blackberry, HTC and iPhone are also not commonly preferred by people because they are not pocket friendly generally. So, there is a huge scope for Samsung in smartphone market and the company can do a huge investment in R & D for introducing new technologies. As per the response it is found that 63% of the respondents generally prefer Android as it is user friendly and well-known brand. Thus Nokia which has a good market share in case of normal feature phone should use Android operating system to capture a wide area in smartphone market as people generally prefer Android OS. It is found that 63% of the respondents think that they have average knowledge about information technology (IT) and 37% of the respondents think that their IT knowledge is

Table 1: Cluster Formation

		Cluster			
		1	**2**	**3**	**Combined**
USERS	Mean	1.28	**2.00**	1.00	1.30
	Std. Deviation	.454	.000	.	.460
INFLUENCERS	Mean	1.52	**2.50**	2.00	1.55
	Std. Deviation	.573	.707	.	.589
TRENDY	Mean	3.57	2.00	**5.00**	3.55
	Std. Deviation	.836	.000	.	.870
FUNCTIONAL	Mean	4.23	2.00	**5.00**	4.19
	Std. Deviation	.618	1.414	.	.719
CONVENIENT	Mean	4.14	1.50	**5.00**	4.08
	Std. Deviation	.720	.707	.	.824
BRAND	Mean	**2.31**	2.00	1.00	2.29
	Std. Deviation	1.032	1.414	.	1.036
SWITCHING	Mean	2.77	2.50	**5.00**	2.79
	Std. Deviation	1.040	.707	.	1.054
PRICE	Mean	3.67	4.50	**5.00**	3.70
	Std. Deviation	.908	.707	.	.915
REPLACEMENT	Mean	**3.14**	2.50	1.00	3.10
	Std. Deviation	1.262	.707	.	1.267
MULTIWINDOW	Mean	**3.75**	3.00	2.00	3.71
	Std. Deviation	.537	.000	.	.572
GPS	Mean	4.26	4.50	**5.00**	4.27
	Std. Deviation	.685	.707	.	.683
BACK UP	Mean	**3.91**	3.50	3.00	3.89
	Std. Deviation	.883	.707	.	.878
3RD PARTY	Mean	**3.88**	3.50	3.00	3.86
	Std. Deviation	.714	.707	.	.714
SCREEN SIZE	Mean	4.15	3.50	**5.00**	4.14
	Std. Deviation	.743	.707	.	.747
APP	Mean	3.94	**4.50**	2.00	3.93
	Std. Deviation	.913	.707	.	.929
MOBILE OS	Mean	**2.20**	2.00	1.00	2.18
	Std. Deviation	.886	1.414	.	.894
SECURITY	Mean	4.30	**5.00**	5.00	4.32
	Std. Deviation	.813	.000	.	.809
AFTER SALES	Mean	4.33	**5.00**	5.00	4.36
	Std. Deviation	.725	.000	.	.722

Source: Author's calculation

good. Thus most of the respondents are using smartphone with an average knowledge about the term IT. So, there is huge scope for technological advancement.

According to 90% of the respondents, they were aware about different mobile applications and they also use them, which make it easy for them to work in any place without the need to carry a laptop, PC or files. It is found that 77%

of respondents are aware about the term like worm and Trojan horse etc. Thus they are aware about viruses that can harm their mobile operating system. As per the pilot survey response it is found that 60% of the respondents are aware about the security software while 77 % of the respondents are aware about the terms malicious software which can harm their phone. Thus different smart phone brands should try to enhance customer's knowledge about different security software so that they can protect their phone from any kind of malicious terms like worm etc. Different smartphone brands can include an explanation as a note about the malicious software as well as security software in the manual book, which is provided with phone kit. The last question in the pilot survey deals with the special feature of a smart phone like people's awareness about the fact that all photos' geo location are tagged by default when a smartphone is used to take pictures. It is found that 78 % respondents are aware about this above mentioned special feature of a smartphone. Thus this theoretical analysis of pilot survey focus on the conclusion that there is a huge scope for growth of smartphone market and people are adopting new technologies.

Table 2: Cluster Composition

CLUSTER 1	CLUSTER 2	CLUSTER 3
Brand	Users	Trendy
Replacement	Influencers	Functional
Multi-window	Application	Convenient
Backup	Security	Switching
3rd party	After sales	Price
Mobile OS		GPS
		Screen size

Source: Author's calculation

After the successful completion of pilot survey, main survey was conducted with a random sample of 84 people. Initially the numbers of clusters that can be formed with 84 cases were determined. For determining the number of clusters Agglomeration Schedule was created using hierarchical clustering. Based on the difference between coefficients in Agglomeration Schedule 3 clusters were determined. After determining the number of clusters, cluster membership was identified using Squared Euclidean distance of Ward's method, for determining the number of cases that are actively participating in the each cluster. After identifying cluster membership, the number of cases in all three clusters was determined. There were 15 cases in first cluster, 27 cases in second cluster and 42 cases in third cluster. After that the mean and standard deviation for 18 cluster variables in each of 3 clusters were identified using Centroid method. Based on the mean for each cluster variable, the characteristics of each cluster were analyzed and according to that the clusters were named. The first cluster was named as Brand Conscious customers. Consumer buying behaviours of this cluster were influenced by brand, replacement, multi-window, backup, third party application and mobile operating system. The second cluster was named as Rational (well-informed) customers. Consumers purchasing decision of this cluster were influenced by users, influencers, application, security, and after sales. The third cluster was named as Feature Conscious customers. Consumers buying behaviour of this cluster were influenced by trendy, functional, convenient, switching, price, GPS and screen size.

RESULT AND FINDINGS

In pilot survey and main survey, it is found that there is a huge scope in the smartphone market as more than 60% of people are using smartphone nowadays. Friends are the main source of information to 50% of consumers. Newspaper or magazine advertisement and relatives are also important source of information. Thus companies should focus on news paper and magazine advertisement for increasing awareness. Thus companies should have more emphasize on customer retention as existing customers may recommend their friend for purchasing smart phone. Consumer prefer to purchase smartphone as it is trendy, functional as ell as convenient thus companies should consider these factors. Samsung is the market leader in terms of brand preference.

According to consumer responses, more than 50 % of consumers are price sensitive. Thus Blackberry, HTC and iPhone should offer products at low cost also so that they can compete in smartphone market. The reason behind switching to other alternative brand is price, feature and design for most of the consumers. Multi-window and 3rd party applications are the features that have a significant impact on consumer buying behaviour. As consumers want more and more features so smartphone manufacturer should focus on research and design for increasing the number of features. As the consumer prefers word of mouth or consulting someone tech savvy, so smart phone brands must maintain their good will and increase services.

Screen size has a significant impact on consumers purchasing behaviour. More than 50% of mobile phone users prefer Android based smartphones over other mobile operating systems, the availability of Android across various mobile brands and pricing points is probably one of the key reasons of Android's huge market share in India. Security plays an important role as smartphone becomes more powerful and increases the productivity. Due to the popularity, hackers will explore ways to break the security in order to take advantages including monetary advantage. Companies should also focus on after sales service as it helps in customer retention. The companies should try to reach maximum consumers in India by making distribution channel more effective and the companies should continue to work on quality management.

CONCLUSION

This study has revealed various factors that are pertinent in the context of smartphone purchasing decision such as design, performance, security, after sales services, price, and influences from market, and social trend. These specific factors could provide better explanation capability in terms of granularity to the study of smartphones, than those general constructs such as ease-of-use, compatibility, and usefulness. For practitioners, the information provided here would be useful for them to have a better sense of the smartphone market. For manufacturers, the study helps them to get a clear picture about the area that needs improvement for maximising the revenue.

However there were some limitations:

- Time period was short
- Resource constraints.
- Apart from this, the study is based on the prevailing consumers buying behaviour. But the buying behaviour can change according to time, fashion, technology, development, etc.
- The research is based on primary data only as relevant secondary data were not available.
- The sample size was small.

The future works can adopt specific theory or concept to conceptualize these smartphone-related factors and empirically test their relationships. The study can be extended to more number of variables such as different income groups, age, gender, different occupations, and different personality traits and lifestyles of consumers. The future studies may further investigate reasons for differences between different consumer groups. Apart from this, relevant secondary data will also be used to supplement the primary data.

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