Factors Affecting Individual's Intention to Purchase Smartphones from Technology Adoption and Technology Dependence Perspectives.

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ABSTRACT

The aim of this research is to identify factors affecting individual's intention to purchase a Smartphone from the perspectives of technology adoption and technology dependence. This study takes into account the role of cell phone dependence and hedonic aspects of cell phone use, by combining technology acceptance model, diffusion of innovation theory and theory of optimal flow, in order to propose a new model for Smartphone purchase intention. The result of the study indicates that 'cell phone dependence', 'enjoyment associated with using cell phone' and 'exposure to Smartphone' have significant effects on 'intention to use Smartphone' which in turn positively affects 'intention to purchase Smartphone'. This can justify the self-reinforcing increase in Smartphone purchases in recent years. The study concludes that the hedonic aspects of cell phone use and the degree of individuals' dependence on cell phone are important factors attributing to their intention to purchase a Smartphone.

Keywords

Smartphone purchase intention, cell phone dependence, cell phone addiction, enjoyment usage enjoyment

INTRODUCTION

There has been a dramatic growth in consumers demand for Smartphones in recent years. In the third quarter of 2011, Smartphone sales to end users reached 115 million units in the world- a 42 percent increase compared to the same period last year (Gartner Newsroom, 2011). Another survey of 4,028 consumers conducted in June 2010 to understand customers' intentions for purchasing a Smartphone indicates that there is an explosive transformation in demand for Smartphones in the last three years.

The sharp increase in demand for Smartphones has encouraged many software and hardware companies to launch new and expand their existing product lines to develop various mobile applications. These attempts have made the Smartphone consumer market highly competitive, inducing rapid technological advancements and high rate of innovations in Smartphone industry (Teng and Lu, 2010). Addressing successful diffusion and adoption of innovation, De Marez and Verleye (2004) conclude that fast technological evolutions influence the behavior of certain customer groups by causing them delay (or even refuse) purchasing innovative products. This is due to their expectation that further innovations will bring newer generation of more advanced products soon (De Marez and Verleye, 2004). Gartner's 2011 report on Smartphone market confirms De Marez and Verleye (2004) conclusion that some consumers held off upgrading their devices in the third quarter of 2011 because they were expecting new high-end models to be launched by the fourth quarter holiday season (Gartner Newsroom, 2011).

High competition on developing feature-rich, replaceable products not only shortens the product's life cycles, but also increases in the number of unsuccessful innovations (De Marez and Verleye, 2004). This is true for the fast growing Smartphone market with an affluence of innovations and technology advancements. That is why Smartphone manufacturing companies need to understand factors influencing consumers' Smartphone purchasing decision.

The objective of this paper is to examine what factors are affecting individual's intention for purchasing a Smartphone based on a survey conducted among university students. The study will provide a deeper understanding of how individuals' decisions for purchasing a Smartphone is affected by developing a model based on Technology Acceptance Model (TAM), Diffusion of Innovation theory (DOI), and theory of optimal flow.

In the following sections of the paper, there will be a brief review of the existing literature in this area in order to identify gaps. Afterwards, a theoretical model and the research hypotheses are proposed. Hypotheses are tested using the developed survey instrument. Finally, the survey results will be discussed and the conclusion and suggestions for future research will be presented.

LITERATURE REVIEW

Technology Adoption

There are many studies examining human adoption behavior for innovation and technology including mobile devices. Many of them have employed Technology Acceptance Model (TAM) (Davis, 1989) and the Diffusion of Innovation theory (DOI) (Agarwal and Prasad, 1997) in the context of mobile devices (Park and Chen, 2007). Others have used the Theory of Planned Behavior (TPB) (Ajzen, 1991), Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980) to investigate: acceptance of a technology in the workplace (Yang, Lee and Lee, 2007; Moon and Ngai, 2008), consumer adoption behavior for technologies such as WAP (Hung and Chang, 2003), handheld internet devices (Bruner and Kumar, 2005), mobile services (Nysveen, Pedersen, and Thorbjørnsen, 2005), multi-purpose information appliances (Hong and Tam, 2006), mobile payment (Chen, 2008), and automotive telematics (Chen and Chen, 2009). Most of these studies have used 'behavioral intention to use' as the dependent variable to predict and explain consumer's actual technology adoption behavior (Teng and Lu, 2010).

Other studies including Garritty & El Emam (2006), Park & Chen (2007), Carroll & Christakis (2004) and Putzer & Park (2010) investigate factors associated with adoption and use of Smartphones by physicians, nurses and healthcare professionals.

Technology Dependence

The concept of dependence was traditionally viewed as physical and psychological dependence on a substance (Leung, 2008; Orford, 2001). Orford (2001) defines dependence as an excessive appetite and suggests a comprehensive model, which identifies the process through which an individual can become so attached to an appetitive behavior that can seriously disturb his/her life and the life of those around them. However, the study did not consider behavioral patterns resulting from dependence.

Recent studies suggest that dependence covers a broader range of behaviors. Lemon (2002) raises the question of whether behaviors can be addictive in the same sense as psychoactive substances. He concludes that we can accommodate behavioral and substance dependence into a common framework. To support this argument, Shaffer (1996) describes how using internet technology for gambling can be addictive.

The concept of technological dependence as a subset of behavioral addiction was proposed by Griffiths (1996). He defines the interaction between human and device as a non-chemical addiction (Griffiths, 1996). Today many scholars argue that excessive use of technology can cause problems (Griffiths and Hunt, 1998; Griffiths, 1999; Shaffer, 1996; Shotton, 1989).

Previous studies by Beard (2002), Beard and Wolf (2001), Chak and Leung (2004), Griffiths (1998 & 2000), Katz & Akhus (2002), Leung (2004), Young (1996, 1998 & 1999) indicate that in some cases internet dependence occurred in a similar way than gambling, drugs, and alcohol addiction do (Leung, 2008).

According to the theory of optimal flow (Csikszentmihalyi,1990), information technology can develop dependency among individuals. This theory describes a state of intense involvement in which nothing but a specific activity matters to the individual. The experience in this state is so enjoyable for the individual that they will try to keep that state even at high costs (Csikszentmihaly, 1991). Flow is characterized by intensive concentration and the enjoyment associated with the activity (Csikszentmihaly, 1991). Information technology activities have both characteristics of flow. They involve the users so deeply with a simultaneous sense of enjoyment that users keep conducting the activity even at the cost of losing time or money (Porter and Kakabadse, 2006).

Today, cell phones are becoming more and more sophisticated and multifunctional. This makes cell phone users more and more dependent on these devices (Leung, 2008). The concept of technology addiction has been addressed in several studies concerning online sexual addiction (Bingham and Piotrowski, 1996), the effect of internet on students' performance (Kubey,

Lavin and Barrows, 2001), text messaging overuse among university students (Perry and Lee, 2007), Family and work-related consequences of technology addiction (Turel, Serenko and Bontis, 2011), cell phones over-use in public places (Toda, Ezoe, Nishi, Mukai, Goto, and Morimoto, 2008). To date, no study has considered how an individual's cell phone dependence can influence his/her intention to purchase Smartphone (as advanced multifunctional cell phone).

MODEL AND THEORY DEVELOPMENT

The study develops a model for intention to purchase Smartphones based on theories associated with technology adoption (TAM and DOI) and technology dependence (theory of optimal flow). Using TAM, DOI and optimal flow theories, the following model is developed and tested in this paper.

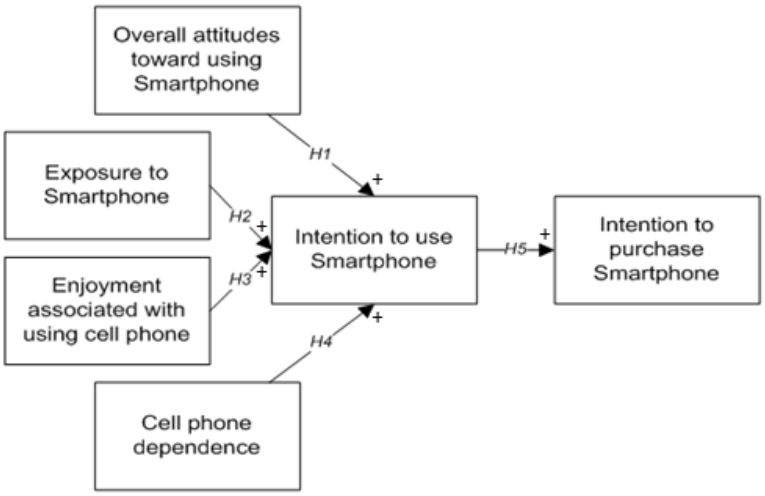

Figure 1: Proposed Research Model

There are six constructs in this model. Purchase intention, extensively used in marketing discipline, looks at the adoption of new technology from the sales perspective (Teng and Lu, 2010). In this study 'intention to purchase Smartphone' is defined as individual's intention to adopt a Smartphone as his/her cell phone. 'Overall attitude toward using Smartphone' is defined as the attitude of the individual and his friends toward using Smartphone. 'Intention to use Smartphone" is the degree to which the user believes that using a Smartphone is beneficial to him/her. 'Cell phone dependence' is compulsive use of cell phone that involves individual's absorption in using the cell phone. 'Intention to purchase Smartphone' is the likelihood that the individual intends to buy a Smartphone. 'Enjoyment associated with using the cell phone' is defined as the level of enjoyment using the cell phone gives to the individual. 'Exposure to Smartphone' is defined as the degree to which the individual is exposed to observe Smartphone being used by others around him/her.

Based on Diffusion of Innovation (DOI) theory, innovations communicate through certain channels under a certain social system (Rogers, 1995). The adoption rate of technology is impacted by five factors: relative advantage, compatibility, trialability, observability, and complexity (Rogers, 1995). Moore and Benbasat (1991) in their study to apply DOI theory to IS context presented eight factors influencing the adoption of IT. These factors are: voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability (Moore and Benbasat, 1991). Thus, this paper posits the following hypotheses:

H1: Individual's intention to use a Smartphone is positively affected by overall attitude toward using Smartphone.
H2: Individual's intention to use a Smartphone is positively affected by his/her exposure to Smartphone.

Theory of optimal flow (Csikszentmihalyi,1990) demonstrates that information technology is characterized by creating such intensive concentration and enjoyment that can lead to excessive use and ultimately technology dependence. Thus the following hypotheses are posited:

H3: Individual's intention to use a Smartphone is positively affected by the enjoyment associated with using the cell phone.
H4: Individual's intention to use a Smartphone is positively affected by his/her dependence on cell phone.

Technology Acceptance Model (TAM) states that users' intention to use the system leads to actual use behavior, thus affecting individual's intention to adopt/purchase the system. Based on this the following hypothesis is posited:

H5: Individual's intention to purchase a Smartphone is positively affected by his/her intention to use Smartphone.

METHODOLOGY

There is a paucity of research measuring cell phone dependency construct and its effects on Smartphone adoption. Most of the studies have used the Mobile Phone Dependence Questionnaire (MPDQ) developed by Toda et al. (2006) to gauge mobile phone dependence. Survey questions were adapted from existing scales in the literature used in previous studies measuring similar constructs. The questions are based on a seven-point Likert scale ranging from *Strongly Disagree* (point 1) to *Strongly Agree* (point 7). Table below shows the survey measurement items for each constructs with their associated sources.

Enjoyment associated with using cell phone	**Adapted from…**
Joy1. I enjoy using the cell phone to do different tasks.	(Kulviwat, 2009)
Joy2. Using my cell phone is fun for me.	
Joy3. Using my cell phone makes me feel good.	
Joy4. I am disappointed when I have to stop using my cell phone.	
Intention to use Smartphone	
Use1. If I have (or had) a Smartphone, I will (would) use it whenever possible during the day.	(Park and Chen, 2007)
Use2. Assuming that I have the Smartphone, I intend to use it.	
Use3. I use/would use my Smartphone to do different things.	
Use4. I intend to increase my use of the Smartphone in the future.	
Overall Attitude toward using Smartphone (Self)	
SlfAtt1. I believe using the Smartphone is (would be) a good idea.	(Park and Chen, 2007)
SlfAtt2. I believe using the Smartphone while working/studying is unpleasant.	
SlfAtt3. I believe using the Smartphone is beneficial.	
SlfAtt4. I like (would like) using the Smartphone for my studies.	
Overall Attitude toward using Smartphone (Friends)	
FrdAtt1. My friends believe using the Smartphone is (would be) a good idea.	(Park and Chen, 2007)
FrdAtt2. My friends believe using the Smartphone while working/studying is unpleasant.	
FrdAtt3. My friends believe using the Smartphone is beneficial.	
FrdAtt4. My friends like (would like) using the Smartphone for their studies.	
Exposure to Smartphone	
Exp1. It is easy for me to observe others using a Smartphone.	(Park and Chen, 2007)
Exp2. I have had a lot of opportunities to see Smartphones being used by others.	
Exp3. I see most of my friends are using a Smartphone.	
Exp4. I see a lot of people around me using a Smartphone.	
Intention to purchase Smartphone	
Pur1. My willingness to buy a Smartphone is very high.	(Dodds, Monroe, and Grewal, 1991)
Pur2. I already have a Smartphone or I plan to buy one.	
Pur3. I intend to buy a Smartphone next time I buy a cell phone.	
Cell phone dependence	
Dep1. I feel bad when I am in a place with poor signal strength.	(Toda et al., 2006)
Dep2. I feel lost when I do not have my cell phone with me.	
Dep3. I would feel worse if I lose my cell phone than if I lose my wallet.	
Dep4. I can express my feelings better on phone than face to face.	
Dep5. I use my phone whenever I am free. (e.g. on bus, waiting in queue, etc.)	
Dep6. I use my phone while having meal or watching TV.	

Dep7. I use my cell phone just before bed and right after I wake up.	
Dep8. I usually lose track of my time when using my cell phone.	
Dep9. Using the cell phone is taking a lot of my time.	
Dep10. I am obsessed with my cell phone.	
Dep11. When I do not have my cell phone I feel disconnected.	
Dep12. I feel uneasy in places where cell phone usage is prohibited.	

Table 1: Survey items used for the study

The model was tested based on a survey administrated to a convenience sample of both undergraduate and graduate students at a major public university in the southern United States. The survey method was chosen to provide a quantitative explanation about individual behavior. College students were chosen at the sample group for this survey since they are the majority of Smartphone users in US regarding the age. Based on statistics more than 65% of Smartphone owners in US are between the ages of 18 to 44 (comScore Data Mine, 2011).

DATA ANALYSIS AND RESULTS

211 questionnaires were given to students, out of which 203 were complete and valid, yielding a response rate of 96%. About 34% of the respondents were male and 66% were female. Figure 2 shows the percentage of the participants based on their age groups. As it is shown more than 85% of the respondents are between 18 and 30 years of age.

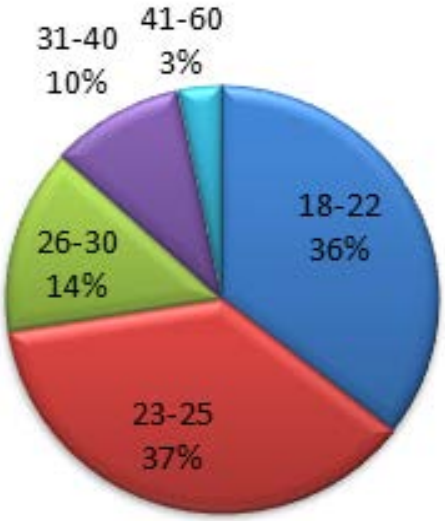

Figure 2: Survey respondents' age distribution

To test the construct validity including convergent and discriminant validities, exploratory factor analysis on the data was performed. The result of test for measures of fit by exploratory factor analysis using Varimax extraction method for independent variables (overall attitude toward using Smartphone, exposure to Smartphone, enjoyment associated with using the cell phone, dependence on cell phone) indicated some items were cross loading and some were loaded under another factor. Those items (Joy4, SlfAtt1, SlfAtt2, SlfAtt3, FrdAtt2, FrdAtt3, Dep1, Dep2, Dep5, Dep7) were dropped. Table 2 shows the final result of factor analysis after dropping cross-loaded items.

The 'Overall Attitude toward using Smartphone' construct was initially broken down into two separate constructs, named as 'Individual's attitude toward using the Smartphone' and 'Friends' attitude toward using the Smartphone'. However most of the items pertaining to those constructs loaded under a single factor. Thus the two constructs were merged into one, named 'Overall attitude toward using the Smartphone'.

The result of test for measures of fit by exploratory factor analysis among *Use1, Use2, Use3, Use4* items related to the mediator construct (intention to use a Smartphone) with items loading from 0.72 to 0.87. The item loadings for *Pur1, Pur2, Pur3* related to the dependent variable (*Intention to purchase Smartphone*) were between 0.91 to 0.94. The percentage of

cumulative rotation sums of squared loadings on the four independent variables, one mediator and one dependent variable indicates the values of 65%, 65%, 85% respectively.

	Component			
	1	2	3	4
Joy1	.045	.224	**.905**	.049
Joy2	.071	.178	**.923**	.082
Joy3	.344	.167	**.743**	.286
SlfAtt4	.185	.135	.126	**.820**
FrdAtt1	.219	.391	.239	**.510**
FrdAtt4	.137	.139	.051	**.886**
Exp1	.122	**.624**	.087	.124
Exp2	-.045	**.839**	.107	.113
Exp3	-.002	**.868**	.189	.086
Exp4	-.102	**.865**	.136	.097
Dep3	**.602**	.062	.129	.092
Dep4	**.641**	-.095	-.089	-.014
Dep6	**.644**	.108	.319	.014
Dep8	**.664**	-.030	.021	.127
Dep9	**.717**	.038	.188	.118
Dep10	**.841**	.046	.070	.134
Dep11	**.763**	.033	.113	.209
Dep12	**.811**	-.020	-.027	.074

Table 2: Factor Analysis

In terms of reliability, Cronbach's alpha was computed for each construct. The result of the reliability analysis indicates Cronbach's alpha values for the constructs ranging from 0.74 to 0.91, indicating high reliability of the items related associated with their constructs (Nunnally, 1978). The Cronbach's alpha for each construct is also shown as α inside each construct.

Ordinary least square regression was used on the average score of associated items for each construct in order to test the hypotheses. Figure 3 illustrates the research model with insignificant relationships as dotted line, and the standardized coefficients of the relationships between the constructs. The asterisks indicate the p-value for the relationship with *** indicating a p-value less than 0.001, ** indicating a p-value less than 0.01 and * indicating a p-value less than 0.05.

The R-square for the first regression (i.e. regressing Overall attitude toward using Smartphone, Exposure to Smartphone, Enjoyment associated with using Smartphone and Cell phone dependence on Intention to use Smartphone) is 0.58 and the R-Square for the second regression (regressing Intention to use Smartphone on Intention to Purchase Smartphone) is 0.30 which indicate that 58% and 30% of the changes in Intention to use Smartphone and Intention to purchase Smartphone respectively can be explained using their associated predictors. A descriptive analysis of respondents' cell phone usage behavior based on gender is provided in the appendix.

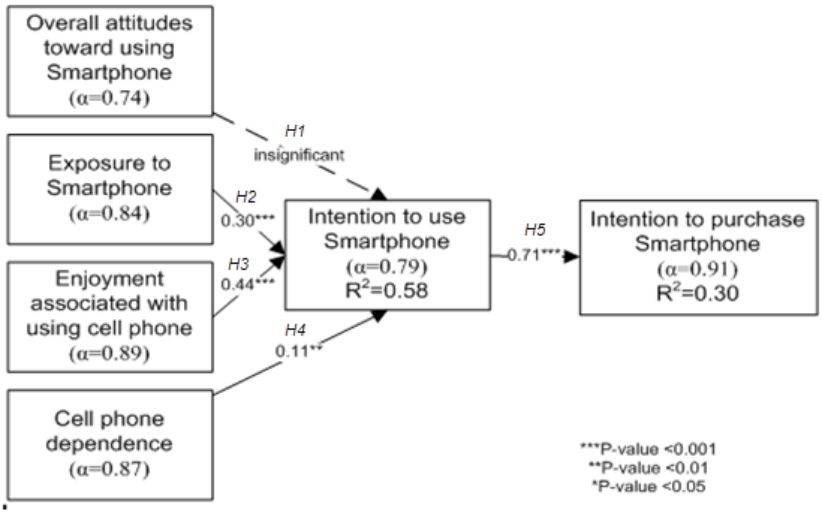

Figure 3: Overview of the results

The independent constructs can be sorted based on the degree they influence Intention to use Smartphone as follows based on their standardized coefficients: Enjoyment associated with using the cell phone (β= 0.44), exposure to Smartphone (β= 0.30) and cell phone dependence (β= 0.11).

The analytical results indicate that 4 out of 5 hypotheses are supported. With the exception of H1 which was not supported, all other Hypotheses (H2, H3, H4, and H5) were supported. Table 3 shows a summary of the hypotheses test result.

Hypotheses	Result
H1: Individual's intention to use a Smartphone is positively affected by overall attitudes toward using Smartphone.	Not Supported
H2: Individual's intention to use a Smartphone is positively affected by his/her exposure to Smartphone.	**Supported**
H3: Individual's intention to use a Smartphone is positively affected by the enjoyment associated with using the cell phone.	**Supported**
H4: Individual's intention to use a Smartphone is positively affected by his/her dependence on cell phone.	**Supported**
H5: Individual's intention to purchase a Smartphone is positively affected by his/her intention to use Smartphone.	**Supported**

Table 3: Hypotheses test result

The results indicate that as the number of Smartphone users grow and people get more exposed to seeing Smartphones being used around them, their intention to use a Smartphone increases. The hedonic aspect of cell phone use and the degree of individual's cell phone dependence are also important the factors that positively influence individual's intention to use a Smartphone which ultimately influences their intention to purchase a Smartphone.

LIMITATIONS AND FUTURE RESEARCH

Although the research findings were significant and despite 4 out of 5 hypotheses were supported, certain limitations must be acknowledged in this study. First, the respondents were college students from the same university which may result in a sampling bias. Second, about 66% of the respondents were female which may also cause sampling bias. Third, the responses were all self-reported which may weaken results accuracy. Further research is required to be conducted to test the moderating effects of education and gender on the Smartphone purchase behavior. Moreover, the availability of various mobile services

such as mobile internet can have a moderating effect on intention to purchase Smartphones, which is not considered in this research.

CONCLUSION

There have been many studies addressing adoption or purchase intention of cell phones and Smartphones. However, no study has addressed the relation between cell phone dependence and intention to use and purchase Smartphones.

This study has several important implications. First, regarding hedonic aspects of IT, the study demonstrates that enjoyment associated with using a cell phone positively influences individual's decision to purchase a Smartphone. The relative high standardized coefficient for this construct indicates that it is one of the important factors that can be used to explain individual's shift from cell phone to Smartphone. In other words, those who find more pleasure in using cell phone have higher intention to use a Smartphone. Second, exposure to Smartphone positively influences individual's decision to purchase a Smartphone. This suggests that individuals who are more exposed to Smartphones, and those who see Smartphones being used by the people around them more often, are more likely to have higher intention to purchase a Smartphone. Finally, this study demonstrates that those who are more dependent on cell phones are more likely to consider using and purchasing a Smartphone. This is the most important contribution of this paper since no research so far had considered the effect of individual's level cell phone dependence on his/her intention to use Smartphone.

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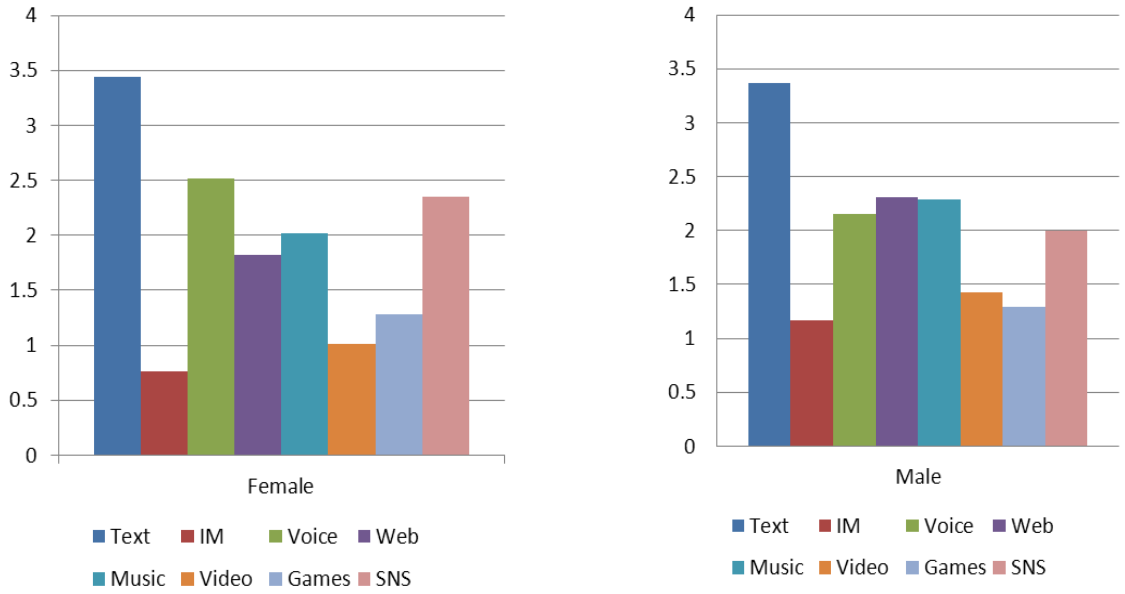
APPENDIX: DESCRIPTIVE ANALYSIS OF RESPONDENTS' USAGE BEHAVIOR BASED ON GENDER.



Female vs. male cell phone usage behavior

The following scale was used to measure participant's usage behavior for voice, web, music, video, games and social networking functionalities:

① More than 3 hours ② 2 - 3 hours ③ 1 - 2 hours ④ 30 – 59 mins ⑤ less than 30 mins

⑥ I do not/ very rarely use this feature.

The following scale was used to measure participant's usage behavior for texting and instant messaging functionalities:

① More than 50 ② 30 – 50 ③ 15 – 29 ④ 5 – 14 ⑤ Less than 5

⑥ I do not/ very rarely use this feature.

The measures were then reversed and their averages were calculated for males and females.

As it is shown females tend to use less instant messaging than males while they use more voice and social networking functionalities than males.

On the other hand, males watch video and listen to music on their cell phones more than females. In terms of use of internet, males spend more time on their cell phone for web browsing than females.