Technological Innovations and Consumer Needs: An Analysis of Mobile Communications Market

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This study combines insights from market diffusion and consumer research to provide an integrated framework of mobile communications market in Japan. We base our analysis on data from company interview, focus group discussion and industry reports. Our findings indicate that technology push dominates in the early introduction and consumer needs pull in the maturing stage. Three implications for the marketing area are; first, user needs for mobile communications have evolved from basic mobility and functionality to include aesthetic and experiential benefits, second, innovations of product capabilities co-evolve with user needs, and lead to increases in mobile usage and product-user attachments, and third, in a saturated market, mobile consumption is premised on the utilitarian and hedonic values as perceived by the users. As mobile phone is a universal product, analysis of a saturated market such as Japan provides a deeper understanding of the evolution of technology and consumer in other markets.

Keywords: Technology, consumer needs, mobile communication, Japan

Introduction

The growth of mobile phone adoption across the global market is phenomenal. In the mid 1990s, the mobile phone market had about 200 million subscribers worldwide; a decade later, the figure climbed to more than 2 billion subscribers and by mid 2000s the number of mobile phone subscribers has surpassed more than half of the world population (ITU, 2009). In maturing market such as Japan, in which mobile and internet services have converged, mobile communications as a whole and several services thereof are considered indispensable.

One such indispensible feature is the ability to personalize a mobile device so that a user can define the “who, what, when, where and how” of personal communication (Ito et al., 2006). In other words, the mobile phone has been transformed from only a voice communication tool into a multipurpose communication device. The growth and evolution of mobile phone were mostly credited to technological innovations, reduced handset price and monthly service charges, competition and market demand.

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Among those forces, technology push and demand pull are the most apparent forces which have driven worldwide rapid adoption of mobile phone.

Mobile phones are normally defined by product families or generation of technical standards i.e. the first generation (1G), second generation (2G), third generation (3G) and so forth (see among others Ahonen et.al, 2004, page 8-14 and Steinbock, 2005, page 35-38). The world’s first mobile network or 1G was introduced in the early 1980s based on analog signals to transmit voice between mobile phones and base stations. By the early 1990s due to rapid growth of global subscribers, demand began to exceed the available capacity. This led to the introduction of 2G or the digital technology that enabled voice and data transmission. In the early 2000s, 3G, which focused on multimedia technology and faster Internet connectivity, was introduced. These technological standards define the interface between the phone and the base stations; and each standard is accompanied by new or enhanced mobile service features. The shift from 2G to 3G also has extended mobile phone usage; for instance, in order to use 3G mobile services consumer must acquire new mobile devices equipped with internet access and new features such as possibility to receive and send multimedia messages.

The changes in mobile technologies also changed the way people use their mobile phone. Currently, the mobile market is in the situation where basic communication need is broaden to new means of interactions and personal digital assistance. From a user perspective, mobile phone is now regarded as a multipurpose and personal communication device. Thus, thorough analysis of the current development of mobile market requires understanding of consumer behavior such as use motivations and product usage. For example, during the early introduction of mobile phones, users acquire the phone to make voice calls, and then learn to use text messaging and move on to accessing an interactive service on the mobile Internet. The needs for a simple communication service such as mobility and functionality had then shifted to include more aesthetic and emotional ones. Developments of technical standards are associated with mobile phone capabilities, which are constantly offering or improving new product and/or service features. This has resulted in constant changes in the way people perceive, use or experience mobile phone. In this regard, it is crucial to recognize the interplay of technology and marketing throughout different stages of mobile phone development.

Moreover, despite high growth rates of mobile phone market in countries such as China, India, Indonesia and other emerging markets, the growth in maturing markets is now depending on value added services such as messaging and personalized contents. In the latter markets, mobile phone manufacturers and service providers continue their innovative efforts to prolong the saturation stage or push the product back to the growing stage of its product life cycle. These efforts include product and service innovations such as enhancement of product features and content development. At the same time, marketing strategies began to consider usage-benefit segmentation to profile consumers into distinctive group of users who share similar needs and preference. Thus, the challenge for manufacturers and service providers lies in matching technologies with consumer needs and benefits. In other words, technology and understanding of consumer behavior are regarded as complementary elements in steering the growth and further evolution of mobile product and services.

In Japan, broad penetration of information technology accelerate mobile product and service innovations. The Japanese term for mobile phone, keitai (roughly translated as “something you carry with you”), evokes not only technical capabilities but also defining personal necessities that allows constant business and social connection. As of 2008, Japan boasted more than 100 million subscribers in a population of slightly over 127 million (TCA, 2009). Among factors attributed to a robust and rapid development of the mobile market in Japan include the success of i-mode Internet service which was launched in 1999. Since then, Japan has received global attention particularly, on the development of a mobile ecosystem that emphasizes on the relationships among all the players in the wireless communications sector. These relationships revolve around the network
operators and other players such as handset manufacturers, consumers, content and service providers, application developers and so on. Innovations of mobile products and services in Japan are spurred by the successful implementation of the ecosystem and understanding of user behavior.

This study attempts to first, analyze the influence of technological innovations on the development of mobile product and/or service attributes in Japan, and second, to conceptualize the evolution of communication needs reflected from these innovations. The analysis focuses on the Japanese mobile phone market as Japan is a leading and maturing market, and as such may provide insights into the current and future trajectories of mobile product and services in Indonesia and other emerging markets. Three research questions are addressed:
1. How does technology influence the trajectory of mobile product and service innovations?
2. When is mobile adoption more attributed to technology or consumer? Which of them dominates at each stage of market development?
3. How do technological innovations shape the evolution of communication needs for mobile phone in a maturing market? Did these needs exist before the new technology emerges or do they evolve as technology innovation brings new usages of mobile phone?

Our analysis will proceed as follows; section two reviews the concepts of technology and consumption behavior from market diffusion and consumer research. Section three outlines the research approach, context and data collection. The first half of section four discusses our analysis of the development of Japanese mobile phone market and the latter half presents our conceptions on consumer needs resulted from technological innovations in the Japanese mobile market over time. Finally, section five concludes the study, and provides theoretical and managerial implications for the marketing area.

**Literature Review**

Previous studies on the analysis of technology adoption and consumer related factors is scarce; and most available research focuses on USA, UK and Scandinavia or only emphasized consumer behavior (see among others Babin et al., 1994, Woodruffe et al., 2002, Mazzoni et al., 2007, Chitturi et al., 2007 & 2008). While a large number of studies focus on traditional information and communication technology (ICT) adoption, there are limited available studies on mobile phone adoption. Some studies explored the adoption process from the perspective of technology acceptance e.g. the Technology Acceptance Model (TAM) which focuses on user’s adoption behavior for computer technology (see Davis et al, 1989). Perceived ease of use and perceived usefulness are viewed as the direct determinants of adoption and usage behavior. In the case of mobile sector, the acceptance of mobile phone incorporates both the acceptance of mobile phone and mobile services; initially user’s acceptance of mobile phone is primarily based on its functional capabilities and/or preferred manufacturers/service providers. However, as technologies mature and product features become more similar, consumers are often unable or unwilling to differentiate between brands on rational attributes alone as argued by Temporal and Lee (2001).

From technology perspective, the theory of diffusion of innovation is based on the assumption that an innovation is superior to old products or services (see Rogers 1995), thus will eventually replace them e.g. the transition of typewriters to computers. Bass (1969), Rogers (1995) and Moore (1999) place potential adopters into various categories, such as innovators or imitators (Bass, 1969) or innovators, early adopters, early majority, late majority and laggards (Rogers, 1995; Moore, 1999). Although Rogers (1995) and Moore (1999) consider product characteristics, and therefore technology, as contributing to the adoption decisions of the various potential adopters, we believe the interplay in the mobile phone market is more intricate. This derives not only from the co-evolution of the product and user but because mobile phone services are different. Adoption of new mobile phone services requires a co-evolution between the hardware and software, and between this hardware/software package and the users. Consequently, the introduction of a new mobile phone and service combination does not automatically lead to abandonment of the previous service. Instead, adoption
of mobile phone and service combinations are strongly influenced by the complementarities with previously existing ones, building on previous adoption criteria by adding new criteria and re-interpreting previous criteria.

Literature on technological product has mostly discussed its development in terms of technological advances or competitive situation, e.g. the work of Christensen (1997) and Christensen et al. (2004). Several researchers, such as Yalsinkaya (2008) and Kauffman and Techatassanasoonthorn (2009) and Asai (2010) have explored the impact of demographic characteristics such as socio-economic status and income level, and economic factors such as pricing on the rapid adoption of mobile phone. Only a few researchers e.g. Steinbock (2005) and Sugai et al. (2010) include market related factors such as technology, network externalities, and mobile eco-system and product values in explaining the development of mobile market. Steinbock (2005) provides a global perspective on the revolution in mobile market, and argues that marketing innovation in mobility has proceeded through a sequence of four phases i.e. product, selling, marketing and customer concept. In other words, there exist a shift from selling (focus on the needs of seller) to marketing (focus on the needs of user) as the product moved from the introduction to a maturing stage of its life cycle. Based on the analysis of the Japanese mobile business, Sugai et al. (2010) propose the model of “simplicity” (a merged concept of simplicity and complexity) to reshape the current technology in mobile market that focused not on the device but on the user. They claim that the theory of simplicity combines technology, integrated services, intelligent consumer analysis and an easy to use interface based on and driven by user needs and capabilities. In other words, the success of mobile business will depend on solutions-based technology that make users feel they are in control, not the other way around.

Relentless product and service innovations continue to spur the Japanese mobile market. One unique characteristic shared by the Japanese market and other advanced markets is data usages (Sugai, 2010). Since the successful launch of i-mode in 1999, mobile Internet became an integral part of the personal and business lives of Japanese consumers; and the mobile phone is widely used to access the Internet. Internet-enabled mobile phone captured certain social possibilities that users deemed valuable such as mobility and handy i.e. its smaller size compared to the computer. These elements were not fully delivered by computer-based internet access as discussed in the work of Wareham et al. (2004). The i-mode service was offered at a time when the Japanese market for mobile phone revenue was about to reach a maturity stage, thus, demonstrated a path towards content development to further increase average revenue per user (ARPU). By summer 2004, i-mode users in Japan could access more than 81,000 internet sites with specialized service such as e-mail, online shopping and banking, ticket reservations, restaurant information and so on. With the recent introduction of the smart-phone and increasing use of mobile Internet, the usage of mobile phone is extended to include Internet access device and the role of mobile phone in consumer life is getting stronger than ever before.

More than a decade ago, Strouse (1999) provides a framework for strategic analysis of telecommunications services from a marketing perspective which includes market segmentation, bundling strategy and managing customer churn. However, continuous changes in the mobile phone market such as its convergence with the Internet and the computer industry calls for more timely market analysis as the convergence also resulted in extended boundaries and various consumption motives. Following the introduction of smart phone, mobile phone is being perceived as a mini and portable computer that allows individuals to stay connected at anytime, anywhere and with anyone. At the same time the shift from voice to data communications also extended the usage of mobile phone. In any market, there exist differences among consumers in the demand for products and services. Mazzoni et al., (2007) investigate the characteristics of Italian mobile users and identify three segments of users based on lifestyles, use motivations and product/service attributes. In the case of the mobile phone, the acceptance of mobile product and/or services reflects the acceptance of mobile technologies as new mobile features are made possible by innovation.
of these technologies. As the industry reaches the saturated market, all players in the mobile business need to have thorough understanding of consumer behavior to further enhance usage benefits and match mobile phone capabilities with user requirements and preferences.

Maslow (1970) proposed a classic model of hierarchy of needs that sought to explain why people are driven by particular needs at different times of their lives. These needs are categorized as physiological needs, safety needs; social or belonging needs, esteem needs and self-actualization needs. The model provides a clear basis for understanding consumer motives and behavior; the need for communications is related to social needs that are placed in the third level of the hierarchy. By the turn of new millennium, social interactions through mobile phones became part of individual life. Although accepted as a universal means of communication, mobile phones have different meanings for different users at different places and times because of idiosyncrasies in economic factors and adoption motives. Decisions to adopt a new product or service are considered as innovation behaviors, which vary according to the needs and perceptions of individual adopters (see Gilbert and Han, 2005).

Behavioral decision making research are premised on the argument that consumption decision can be categorized into functional benefits (utilitarian) and emotional values (hedonic) such as among others the work of Hirschman and Holbrook (1982) and Babin et al., (1994). The consumption decision was further studied by other researchers such as Okada (2005) and Chitturi et al., (2007, 2008); and the term “utilitarian benefits” generally refers to the functional, instrumental and practical benefits of consumption offerings and being considered as closer to necessities or needs. The term “hedonic benefits” is referred to aesthetic, experiential and enjoyment benefits as they are perceived as being closer to luxuries or wants. Adoption of mobile product and/or services provides a great example to illustrate the evolution of user motives from functional benefits to include those of emotional ones. Mobile services also differ from traditional interpersonal services due to their convergence with other ICT related services such as internet, broadband and media. Moreover, mobile users are regarded as critical decision makers particularly, in saturated mobile market such as in Japan. This implies the growing importance of integrating consumer’s perspective into the analysis of mobile phone adoption.

The development of the mobile phone market is viewed as a function of technology and marketing. On the one hand, the rapid growth of mobile phone is credited to innovation of technological standards but on the other hand, the role of marketing is becoming more prominent particularly in maturing markets. From user perspective, mobile phone has evolved from merely a voice communication tool in its early years into a daily multipurpose communication device. At the same time, mobile service features also evolved from satisfying deficiency need for wireless voice communication to include more functional and experiential features of data communication. Thus, a clear value proposition of mobile product and services can be developed by thorough understanding of user needs, past and current usage, and social surroundings relevant to a specific market. In this regard, market analysis that focus on the relationships between technology and consumer should begin with maturing markets to illustrate how their interplay shape the evolution of communications needs from consumer perspective. In addition, integrated analysis of technology and consumer would also contribute to mobile market research in which various aspects of mobile innovations and user behavior remain largely unexplored.

Methods

Since the pace of technological innovation varies across markets, it is important to identify a specific context where the interplay of technology and marketing is most apparent. In this regard, the Japanese mobile phone market which is among the leading markets in terms of technology and usage patterns serve as a suitable context for this research. Our data are collected through company interview, focus group discussion with lead users and analysis of available reports on mobile communication in Japan. In particular, the analysis of the Japanese mobile communications market is drawn
from the published data of NTT DoCoMo and industry reports. To ensure the accuracy of these data, we conducted a field study and an interview with NTT DoCoMo’s Mobile Communication History Square in Tokyo to gather the first hand information on mobile phone development in Japan. In addition, a brief focus group discussion with lead users in Japanese market is conducted to identify functional and/or emotional related motives of mobile product/service usage from the users’ perspective. This study employs a holistic approach in which the mobile phone market is analyzed as a whole rather than as individual product or service. We then chronologically summarize the evolution of mobile phone market in Japan based on mobile technical standards i.e. from pre-cellular mobile service to the 4G period. Within each standard, we analyze different aspects of product capabilities resulting from technological innovations, and then conceptualize the evolution of user needs.

Development of Mobile Phone in Japan

Mobile phone services in Japan were introduced by NTT Public Corporation in 1979. NTT was a government agency providing telecommunication services and monopolized the domestic market until the liberalization era in 1993. Due to the growing demand for mobile services, in 1992 NTT DoCoMo was established to take over NTT’s cellular operations. The name DoCoMo is both a play on the Japanese word for “anywhere” and an abbreviation of ‘Do Communications over the Mobile Network’. This section mostly focuses on the evolution of mobile communications with regard to NTT DoCoMo; to some extent, the history of NTT DoCoMo as a market leader also reflects the history of mobile communications market in Japan. Although new entrants such as KDDI and Softbank are gaining stronger position in the market, NTT DoCoMo continues to hold more than half of the total market share as shown in figure 1. In order to secure its leading position in a mature market, NTT DoCoMo renewed its strategic focus: ‘from volume to value’ to capitalize on the current growth of internet use and data transmissions.

Technological advances, market liberalization, and reduction in handset costs and monthly charges led to a gradual increase of Japanese mobile phone subscribers, but with the introduction of 2G digital system in 1993 the numbers began to increase significantly as shown in figure 2. Some researchers such as Sugai (2010)
argued that the rapid adoption of mobile service in Japan is credited to advanced data usage, not the general mobile adoption trend. However, beside data transmission, the 2G digital system had also enabled better quality voice services, thus, created better performance as well as wider usage of mobile phone.

Innovations of mobile technologies improved the technical performance and developed new product and service features and led to rapid adoption of mobile phones throughout Japan from 1995 onwards. As of 2007, the number of subscribers approximately closed to 100 million; about 30% were using 2G system while the other 70% subscribers have migrated to 3G system (TCA, 2009). By the end of 2009, the number of mobile phone subscribers reached 110 millions, double the number of fixed line subscribers (TCA, 2010). Parallel with figure 2, the followings describe four different periods of technological standards from the pre-cellular mobile service to 3G era based on TCA’s database and interview with NTT DoCoMo’s Mobile Communication History Square in Tokyo.

I. Prior to 1987 - Pre-cellular mobile service

The pre-cellular mobile services in Japan consists of paging service or “pocket bell” which were introduced by NTT Corporation in 1968. The pocket bell became popular among business people as they can be reached at anytime and anywhere. In 1979, NTT started automobile telephone service which was installed in the trunk of the car and weighted about 9kg. The service covered only central Tokyo and extended to nationwide in 1984. Since the price of the telephone was expensive, most people could not afford to use the service and the telephone was considered a luxury device at the time. Responding to users’ request, which was “we would like to use the automobile telephone out of the car”, NTT introduced “shoulder phone” in 1985. The phone considered as the first mobile phone in Japan, weighted around 3kg and had a shoulder trap for its usage inside and outside of the car.

II. From 1987 - First Generation (1G) (Analog)

In 1987, NTT started mobile phone service and introduced the first mobile terminal on analog system that weighted 900 gram. The size and weight was still not convenient for most users. Development in smaller and lighter mobile phone went on the following years, and in 1991, NTT launched the smallest mobile phone in the world known as “mova”. The 230 gram mova was well accepted in the market and the number of mobile phone subscribers increased from 132,000 in 1989 to 530,000 in 1992 (TCA 1995). It was considered as the first analog mobile phone service in Japan. Within the same year NTT DoCoMo was established which aimed to focus on mobile communications of “anytime, anywhere, with anyone”. From a
consumer perspective, mobile phone fulfilled the need for mobility and its value for wireless voice communications services began to be recognized.

III. From 1993 - Second Generation (2G) (Digital)

A significant technological innovation spurred the mobile communications market with the introduction of digital communications in 1993. NTT DoCoMo launched “Digital Mova Hyper” or the Personal Digital Cellular (PDC) equipped with high speed data communication capabilities. The PDC was exclusively used in Japan and comparable with the Global System for Mobile (GSM) used in other countries. These mobile phones had better performance in terms of battery standby time and higher voice quality as compared to the phones introduced with analog system. At the time, a mobile phone was still an expensive tool and most people could not afford to subscribe to a mobile phone service. Following the abolishment of the deposit system which has resulted in handset sales liberalization within the same year, the subscriber’s cost started to decrease and the number of subscribers increased drastically from 1993 onwards. The significant role of mobile communications became apparent in Japan especially, during the disaster period e.g. Kobe earthquake in 1995. Mobile phone was recognized as an important tool in Japanese daily life. In 1996, model 201 series was introduced in the market with improved technical performances such as high power lithium battery and longer battery standby time, and only weight a 100 gram. At the same time, NTT DoCoMo continued improvements of the infrastructure as mobile phone was getting more popular and received favorable market acceptance. In 1997, the company released a “pocket board” responded to the demand for email communications for users who do not own or carry a personal computer.

One remarkable feature of the digital system is its ability to also handle non-voice information i.e. data transmission. People began to send and receive e-mails using mobile phone after the introduction of the pocket board. In 1999, NTT DoCoMo introduced i-mode service that enabled people to access the Internet by mobile phone. People were able to access online information at anytime through a mobile phone. This revolutionary service increased the value of the mobile phone as the device to talk and to use, and at the same time it is used to perform personal and business tasks that include voice calls, texting, Internet browsing and so forth. Consequently, the number of i-mode subscribers increased to 10 million in just one year (NTT DoCoMo, 2002). One of the main factors behind the success of i-mode was its main marketing strategy focusing on the ease of accessibility of Internet navigation and it’s far reaching possibilities for improving people’s lifestyles. The marketing campaigns of i-mode intentionally downplayed its technological novelty and excluded the words ‘internet technology’ in any advertisement. While the company was working on the expansion of i-mode service throughout Japan, new mobile phone features such as color displays, ringing melody and so forth were also introduced in the market, and further accelerated the growth of mobile communications.

IV. From 2001- Third Generation (3G) (Multimedia)

The mobile phone continued to play its role as a multipurpose communications device. In 2001, NTT DoCoMo launched the world’s first commercial 3G service known as the “freedom of mobile multimedia access” or FOMA. FOMA’s product line up consists of 3 series compact sized models; the “standard type”, video phone or “visual type” and data only or “data type”. These models are based on an international standard and enabled high speed and large volume of data communications, video phone service, music delivery service and so forth. In addition, applications and visual information such as facial expression, gestures, motions and background scenery enriched warm and exciting communications. In 2002, NTT DoCoMo introduced a mobile phone with a camera function and fingerprint authentication, and later followed by i-mode “Felica” electronic transaction service such as electronic money and credit cards. This further expanded the usage of mobile phones for various lifestyles observable in
many scene of Japanese life. A large variety of handsets were also introduced to meet various categories of users; and more attractive design, colors, and an easy to use interface were developed to meet these aesthetic needs.

Mobile communications in Japan entered another exciting era for consumers when “Mobile Number Portability” system was introduced in 2006. The system enabled the subscribers to use similar mobile phone numbers regardless of their shift in subscriptions to different service providers. New multimedia feature-rich mobile phones were developed to satisfy a wide range of user needs. For example, high speed packet communication support up to 3.6 Mbps, the eco mobile phone for earth friendly users, “one-seg” digital TV mobile phone for terrestrial broadcasting program viewing, and kid’s phone in which safety and reassurance of the children are considered. As the mobile phone became a familiar tool and more people were using the phone for various communication purposes, it was hard to identify a perfect mobile phone for every individual. Thus, NTT DoCoMo further intensified its previous approach on new mobile phone development based on functionality to a series of models that fit individual lifestyles which includes i) “docomo style series”, or highly fashionable mobile phones that matches customer’s style, ii) “docomo prime series”, or new generation entertainment mobile phone that brings enjoyment of entertainment in customer’s hand, iii) “docomo smart series”, or intelligent mobile phones for adults that manage professional and private lives, and iv) “docomo pro series”, or advanced high spec mobile phone that enables unrestricted use of cutting-edge technologies.

The “docomo smartphone series” was added later to the company’s product lines with the introduction of smartphone in the Japanese market. Smartphone is defined as “a mobile phone that incorporates a public general-purpose operating system (OS) such as Android, Apple’s OS etc, to which users can freely add applications, extend functionality or customize” (MCPC, 2009). In this regard, a smartphone can also be viewed as a “mini-computer”. There is a difference in smartphone usage pattern between the Japanese consumers and those in other markets such as Europe and North America. In the West, smartphone is mostly used as a device for e-mail in its early days, but in Japan, mobile phones have been designed with advanced functionality such as i-mode, picture mail, web browsing and so forth; the Japanese consumers adopted data communications services even before the introduction of smartphone. However, with increasing popularity of smartphone especially after the introduction of Apple’s i-phone, some industry observers have predicted that there will be a gradual shift from mobile phone to smartphone. The annual growth rate of smartphone subscription is estimated at an average of about 40% (MCPC, 2009). This will further accelerate the growth in content distribution market such as applications, music, games, and video and so forth; and also extend the usage of mobile phone.

4.2. Technological innovations and user needs

This section highlights key findings based on the previous analysis of Japanese mobile market. These findings are derived from two perspectives; first, technology which has driven the development of mobile product and service features and second, the “why” of adoption which focused on user needs. Our analysis of a matured mobile market in Japan indicates that mobile phone adoption was initially triggered by technology push which was reflected in the functional features, and at a later stage, further adoption was influenced by demand pull factors. As the mobile phone market reached its saturation level, demand-pull related factors such as user behavior play a critical role in mobile market analysis.

Table 1 summarizes our findings; the left side of the table underlines mobile technologies which have enabled innovations of product features to date. Accordingly, the right side presents our conception of user needs. The integration of user needs in this study is premised on the argument that technology and users do evolve. This evolutionary nature can be fully captured as mobile market reached a saturated level. Throughout different stages of mobile phone development, the use of mobile phone also evolved from fulfilling the deficiency needs for wireless voice communication,
integrated service and seamless mobility. The integration of technology and consumer related factors in this analysis also highlight the growing importance of consumer behavior in mobile market research. In a more saturated mobile market such as in Japan, mobile phone offers both the utilitarian and hedonic values to the users.

Figure 3 elucidates the evolution of user needs from the beginning of technology push era to the current period of demand pull. As the results of innovations in mobile technologies, product capabilities also evolved to meet various communication needs as follows:

i) Mobility: Prior to mobile cellular technology era; paging service, automobile telephone set and shoulder phone, fixed line phone are used as a communication tools. With the introduction of analog technology in 1987, mobile phone became the substitute for those communication services. At the same time, the mobile phone fulfilled the deficiency need for mobility or wireless communications at anytime and anywhere.

   ii) Mobility and functionality needs: During the 2G period, increased adoption of mobile phones encouraged new innovations to focus on better performance such as voice quality and functionality or what the phone can do. The digital technology enabled services such as digital voice service, push to talk, Short Message Service (SMS), conference calling, caller ID, voice mail, camera, web browsing and real time location based services. Mobile communications in Japan entered the era of data usage since the introduction of i-mode service in 1999. From a consumer perspective wider usages of mobile phone signal higher product values and benefits. People began to regard mobile phone as a personal necessity and use the phone for various personal and business purposes.
iii) Mobility, functionality and aesthetic needs: As the market reached saturation, which triggers the maturation stage, to reduce the effect of commoditization, which is common to all technology oriented product, both mobile phone manufacturers and service providers emphasized handset appearance and value added services. The multimedia technology enabled high speed data transmission and various services such as Multi-media Message Service (MMS), streaming music, faster web browsing, on demand video, teleconferencing are introduced. At the same time, more handset choices i.e. design and colors that match individual lifestyle are made available in the market.

iv) Mobility, functionality, aesthetic features, experiential and personalized communication services: Gradual diffusion of smartphone and the recent launch of 4G in Japan which focuses on seamless mobility, integrated services, and higher usability has transformed the role of mobile phone from a voice communication device to a ‘mini computer’. It is expected that the era of smartphone and 4G offer new usage experiences and pleasant mobile phone encounters, thus, enhance its personal bonding with the users. Thus, beside mobility and improved performance, users also demand the aesthetic and experiential aspects of mobile phone.

Despite differences in technology adoption period and cultural factors across markets, our analysis on the Japanese mobile market serve as a useful case study for other markets. Over time, the mobile phone market will reach a saturated level, and lessons from a development path of a matured market provide insights into the emerging markets which are currently experiencing rapid growth period. In such cases, the analysis of consumer related factors such as user behavior provides a deeper understanding of mobile phone adoption. The shift from a product focused or functional features to a user focused that include functional and aesthetic features will be more apparent as the market reached a maturity stage. In reality, most technology oriented products are driven by technological capabilities at the outset and subsequently by the consumer related factors such as user needs and behavior.

Conclusion

This study explored the development of mobile phone as a whole, and combined insights from market diffusion and consumer research to provide an integrated framework of mobile communications market in Japan. Previous studies on the analysis of technology adoption and consumer related factor is scarce, and most available research focuses on the US and European markets. Thus, an integrated framework of technology and consumer in a different geographic area such as Japan contribute to limited research of mobile usage behavior and add more understanding of mobile communications market in different settings. While the innovation of new product and services are shaped by mobile technologies during the early stage, it has become increasingly influenced by consumer-related factors such as user needs and behavior as the industry has matured. The move from product focused to user focused indicates future trajectories of mobile innovations. Mobile products and services attributes have found their way to be integrated into people’s lives, and mobile phone that used to be a communication device is now a multipurpose communication device that also has emotional meanings to the users. New usage experience and personalized attributes will further stimulate a personal bonding between mobile phone and the users.

The integrated analysis of mobile technologies, product capabilities and user needs lead to three implications relevant to the marketing area as follows:

As technology and users evolved, the integration of technological innovations and consumer behavior lead to a deeper understanding of mobile phone adoption over time. In other words, combining the research from technology perspective e.g. the work of Rogers (1995), Moore (1999) with behavioral decision theories such as the work of Holbrook and Hirschman (1982) and Babin et al., (1994) and Maslow’s motivation theory (1970), indicate that one must first satisfy basic needs before progressing up the ladder (a starving person is not interested in status symbols or self fulfillment). This implies that consumers seek to fulfill the next higher level of needs only when their current needs are satisfied. Similarly, adoption
of mobile phone and value added services are often considered once the mobility need for a simple communications of ‘anytime and anywhere’ has been fulfilled. Consumers also value different product attributes depending on what is available to them such as functional features during the technology push era. Emergence of mobile technologies enabled new mobile product and service features; throughout 1G to the 4G period, these features meet various communication needs, ranging from basic mobility, functionality, aesthetic and experiential ones. Thus, the evolution of user needs presented in our analysis highlight the growing importance of consumer research in mobile market.

The dominant role of technology on mobile phone adoption is observed during 1G and 2G period, and the interplay of technology and marketing is more apparent from 3G periods onwards. This interplay mitigates the commoditization trap and provides opportunities for value added services. It is observed that from 3G periods, innovations of mobile product and/or service innovations led to increases in mobile usages and enhanced personal bonding between the user and mobile phone. However, not all users will embrace new set of mobile features; thus, it would be interesting to examine the most valued product or service features from a consumer perspective, such as to explore possible relationships between functional capabilities, symbolic or emotional benefits and consumer attitude in a specific market where combinations of hardware, software and service co-evolve with user needs. Further, continuous innovations in mobile market will also lead to a more challenging task of segmentation strategies; and consumer based segmentation methods such as psychographic, behavioral and product benefits will help firms to differentiate their offerings and at the same time guide consumers in their choice.

The mobile phone is becoming a product that satisfies various communication needs; a person can have a sense of safety with a global positioning service (GPS), connected to friends and family for social needs via facebook, twitter and instant messaging services; personal information management system such as calendar, applications to enhance job, contacts and members for productivity, and various applications for entertainment and games thus, enrich user experiences and self fulfillment. On the one hand, this indicates complexities in categorizing mobile phone services which to some extent, has discouraged extensive research in this area. On another hand, it highlights that innovations of mobile product and services can be premised on the utilitarian and hedonic benefits from a consumer perspective. In this regard, examining the influence of varying level of utilitarian versus hedonic values on mobile phone choice is a fruitful avenue for consumer research across different markets.

Our analysis focused on mobile phone development in the Japanese market. Although the mobile phone is a universal product, there exist differences in technology diffusion period and consumer related factors such as cultural values, price sensitivity, attitudes and so on. Further research in this area should consider these differences and regard the proposed framework of this study as groundwork for more timely analysis in other markets. Over time, diffusion of mobile technologies to emerging market will dissolve the gap of mobile adoption between emerging and mature markets. In a matured market, the role of marketing is becoming more crucial in mobile communications research as consumer related factors such as specific user requirements and behavior are integrated into the design of product hardware, software and service innovations. To this end, our analysis offers a balanced perspective of mobile phone adoption research which is often biased towards the dominant role of technology. In reality, most technology oriented products are driven by technological capabilities at the outset and subsequently, consumer related factors. These calls for further studies on mobile market to examine adoption motives across markets, age groups and lifestyles to provide a deeper understanding of mobile choice, and at the same time add more insights to the existing marketing literature. Finally, our analysis on technological innovations and consumer needs is explanatory in nature but would serve as a useful forecasting model for future trajectories of mobile products and/or services.
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