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M.S Dissertation in Engineering

**The Prospective Market for Smartphone
in China Rural Areas**

: A View Based on Technology

August 2013

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Technology Management, Economics and Policy Program

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The Prospective Market for Smartphone in China Rural Areas: A View Based on Technology

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이 논문을 공학석사 학위논문으로 제출함

2013년 8월

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To my dear father and mother,

Thanks for sharing your philosophy of life with me

The Prospective Market for Smartphone in China Rural Areas : A View Based on Technology

Chen Zhao

Abstract

We are moving into a technology age that many of us cannot believe could not have imagined even a couple of years ago. Technology develops at such speed that it extends the boundaries that one feels could not be possible. As one of the most important implied results of interdisciplinary research in recent ten years and a landmark of technology innovation, smartphones play an extremely important role today, since they change our life and make breakthroughs in many ways such as the communication model. The components, both the hardware and software of smartphone and unique computer-featured functions, make smartphones emphasize the user-centered experience, and mobility compared with ordinary telephones and cell phone.

Even though the cost of using a smartphone is expensive, with the need to get information

quickly, handle official and personal tasks, and facilitate multi-tasking, more and more people are finding they cannot live without smartphones. The smartphone market in China has seen a dramatic increase in recent years. In cities when 3G service is widely available, phones introduced with functional and fashionable features have become absolutely necessary. However, we have to face the fact that in rural areas, ordinary cellphones still play a majority role in the communication market and smartphones have not obtained much market share there.

With the fact that the popularity of smartphone is not extended as wide as it is in the cities, one question arises: Is it possible that one day smartphones, with acceptable prices, functional technologies, and practical functions can flourish in rural areas of China?

The goal of this research is to test the possibility of the above-mentioned question. To start with, the author develops basic research about smartphones and the current market in China. This is followed by giving an overview of current Economy situation in rural area and the potential influence on Telecom market. Then the author uses the improved Technology Acceptance Model (TAM) to evaluate potential smart phone user's expectation. To achieve this, a field survey of 299 potential smartphone users from rural areas in China was conducted in order to determine the exact reason they want to purchase a smartphone and what kind of features they require. Based on the result of empirical test, the author finds out that rural

residences want to gain users' experience, status consumption and organization pursuits from smartphone. Besides, although smartphone is an attractive device for rural residences, rural residences have low willingness to purchase. Based on the result, the author hopes that this research can help to answer the question why the current smartphone market in rural area is not established.

Key words: Technology Acceptance Model, smartphone, rural area, China

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Chapter 1. Introduction

1.1 Overall Introduction

Driven by the personal needs and companies' willingness to obtain more market share and generate more profits, the smartphone, as it can be literally interpreted as a multi-function telephone device with artificial intelligence features, was first designed with the idea to combine a mobile phone and a personal data assistant (PDA) together. Since the first prototype device of smartphone under the name of Simon Personal Communicator was launched by IBM on 16 August 1994, many smartphones with computer-like features (such as the Nokia 9000 in 1996 and Kyocera's phone in 2001) were produced. This included the creation of 7,093 patents into 16 technological clusters by citrating linkage to 298 patents that had been involved in the smartphone industry (Sage, 2012; Lloyd, Spielthenner & Mokdsi, 2011). The Internet and Communication Technology (ICT) highlights the interdisciplinary research among various fields such as computer science and communication sciences makes smartphone more computerized, versatile, and substitutable for the personal computer, which can be reflected not only in various communication standards for

smartphones such as GSM, UMTS, WIFI and Bluetooth but also on its software system (such as the operating system) and hardware (such as the CPU, camera, and display). The smartphone market took off after the landmark smartphone iPhone was sold by Apple Inc. in 2007. In response to the breakthrough multi-touch interface, user interface (UI) design, apps, and other functions, people pushed unprecedented fashion in purchasing a smartphone and making the smartphone ubiquitous.

Carayannis, et al., say the smartphone mobile can bring a positive influence with the CEO decision-making process both in business and personal tasks (Garayannis, et al., 2012). Also, as a data-transforming device, smartphones can become a good helper to meet the needs of people from different careers (Theoharido et al., 2012) [Appendix 1]. Scholars try to inspire the charm of smartphone and feature the reason why smartphone is so successful in the public. The smartphone end product is installed with high-tech components such as the display, processor, battery, and memory-chip can properly meet consumers' need of finding an electronic product substitutable for a powerful computer. By being assembled with components, the smartphone was attractive to people with the aspiration of fully utilizing the product. For instance, the internet and wireless technology feature plays a very important position since it enables people to get access to various data services such as communication

service and information content services via smartphone anytime and anywhere (Hong et al, 2008).

More importantly, the checking behaviors emerged from dynamic worldwide information sent to the smartphone promote common people to use smartphone more pervasively (Oulasvirta et al., 2011). Under the study of consumer behavior, the usage of the smartphone can be treated as an extension of people's usage experience of convergent devices and can positively influence the choice collecting behavior (Yoo et al., 2010; Katagiri & Etoh, 2011).

Another reason why the smartphone is attractive to users in different age groups is that they emphasize the user-centered design to reduce frustration and increase user satisfaction (Huang, 2009). Many smartphone manufactures, such as Samsung, conduct research in the dynamic adaptation of touch interfaces that utilize human-machine interaction by equipping smartphones with touch-based emotion recognition sensors. (Kim et al., 2013).

1.2 Research Question and Objectives

As one of the biggest markets in the world, the China smartphone market has substantially increased in the past recent five years. Based on the research from iResearch China Smartphone Market Research, annual smartphone shipments increased to 72 million units (iResearch Inc, 2012). Considering the reality that more than 1 billion mobile potential phone customers exist, the market is still developing. Also many multinational companies locate their advanced R&D centers in China and as the world's most famous manufacturing country, many smartphone devices were assembled there (Jyrki et al., 2011; Chen, 2008), there is an imbalance in the development of the smartphone consumer market between economically developed areas and undeveloped areas within the country: the mobile phone market penetration rate has reached 70% and 45%, respectively (Movable Termination White Paper, 2013)¹.

Do people in rural areas refuse to use smartphones? Until the year 2011, about 1% of the total amount of 729,000 3G base stations and 118.7 million 3G subscribers were deployed in rural areas in China, most of them located in villages next to big cities². Even though the

¹ China Academy of telecommunication Research of MIIT Movable Termination White Paper, China Academy of telecommunication Research of MIIT, 2013

² Data is estimated from China Mobile, China Union, and China Telecom rural area 3G construction

number is quite small, customer needs exist; the smartphone market can be extended beyond its geographic boundaries into rural areas of China. In China, the ownership of TV sets, computer, and telephones per 100 rural households at year's end in China was 114,975, 70.55, and 44.58, respectively.³ Surveys from Chappuis and others among more than 100,000 respondents found that network construction is one of the main factors that promote smartphone use. People who have access to multi-media such as PCs, the internet, and video are more likely to purchase smartphone devices (Chappuis et al., 2011). So the answer to above-mentioned question is “no”. In a previous study about smartphone development in China, Chen (2006) compared the foreign mobile phone brands and local mobile phone brands and concluded that local brands have advantages in appearance, installed apps, advertisement, promotion, and distribution channels (Chen, 2006). By analyzing 2,648 samples, Ma and Lv (2012) found that lifestyle and price have a significant influence on east China, western China, and central China consumer smartphone purchases. However, more the study was more focused on smartphone hardware and software design and specific app design and usage. However, the scientific research on the study of prospective smartphone

rates.

³ Resources are from China Statistical Yearbook 2012 by National Bureau of Statistics of China

users from rural area in China is still no there.

The goal of this thesis is to identify and empirically assess the key factors that drive customer's acceptance of smartphones in rural areas and measure the potential market.

To achieve this goal, the Technology Acceptance Model was used. Established by F. Davis in 1995, this question should be answered step-by-step. To achieve this goal, the first objective is to get a thorough understanding of smartphones ranging from their hardware to their software. The second objective was to consider the extent of development in rural areas of China and then to take into consideration the different consumer behavior between people from urban and rural areas and what kind of mobile phone purchase that behavior lead to. The third object, the most important one, is to analysis the potential consumer behavior of smartphone usage for people in rural areas. In this step, I focus on investigating the use and acceptance of smartphones by using the Technology Acceptance Model (TAM) to check the human motivations affecting the decision to buy a smartphone among potential users in rural areas of China.

Chapter 2. The overview of smartphone

In this section, we present a deep study about smartphones in three aspects ranging from the definition to major technological improvements to the character of smartphones. The purpose of this chapter is to analyze why consumers would like to switch their telephone consumer behavior.

2.1 The Definition of a Smartphone

The term “smartphone” commonly used by academic research communities and industry refers to the ubiquitous mobile phone device with multi-purpose functions. The regular mobile phone, referred to as “feature phone”, is operated in embedded systems and has limited computational facilities (low throughput, no floating support, and limited processing and network capabilities) with small size black and white or color screens and limited memory and bandwidth.

Comparatively, although there is no agreed definition, a “smartphone” is defined as a mobile phone that is able to perform many of the functions of a computer. It typically has a

relatively large screen and an operating system capable of running general-purpose applications.⁴ In academic research, Becker et al. (2011) defines the smartphone with the following characteristics:

- a) A device that contains a mobile network operator smartcard with a connection to a mobile network.
- b) A device that has an operating system that can be extended with third party software (such as applications from Apple store or Google Play Store).

Theoharidou et al (2012) pointed out an alternative definition: “A cell phone with advanced capabilities, which executes an identifiable operating system allowing users to extend its functionality with third party applications that are available from an application repository.” This is because compared with feature phone, the processing ability and connectivity capability and three sizes are considered as the most notable design of smartphones. However, both of the definitions above ignore the important role that users play in the smartphone. In fact, innovative designs in smartphones, such as sensors, WIFI, operating system, and apps, are all ultimately aimed to improve the user’s experience. Based

⁴ The definition is from online Oxford dictionaries: <http://oxforddictionaries.com/>

on this understanding, I propose defining the smartphone in the following way:

A smartphone is a mini PC-functioned and user-centered mobile device with advanced computing capability to handle business and personal affairs.

2.2 From Feature Phone to Smartphone: Major Technology Improvements

We usually consider that a phone is “smart” rather than a regular feature phone based on the innovation features that the device has. Usually, a smartphone contains thousands of patents ranging from design to network system. Here, I list some of the main improvements in a smartphone device.

Battery: The charging test conducted by Ferreira and others reflected that improper charging can reduce the lifetime of the battery (Ferreira et al., 2011). By solving the technology barrier, such as battery technology and display technology, engineers engineered mobile phones with the requirement of portability, maneuverability, and practicability and reliability. They successfully developed mobile phones changing the Ni-MH-Nickel metal hydride-battery to a nickel-lithium-based battery as well as added multi-function capabilities (Agar, 2013).

Network System: Integrated voice and data networks the key to the mobile phone: in the Second-generation Mobile System (2G), higher spectrum efficiency, better data service, and more advanced roaming were offered (Kumar et al., 2010). GSM (Global System for Mobile Communication) data services enabled the text message function and GSM short message service (SMS) allows the exchange of short alphanumeric message (Garg, 2001). The International Telecommunication Union (ITU) defined the requirements for operating with 3G mobile networks in the IMT-2000 standard within which 3rd Generation Partnership Project (3GPP) and 3GPP2 was constructed. 3GPP has been concentrating on Wideband Code-division Multiple Access (W-CDMA) and Global System for Mobile Communications (GSM) systems while 3GPP2 has been focusing on cdma2000 and cdmaOne systems (Zhao, 2002).

Table 2-1 and Table 2-1 show the network improvement from the First-generation to the Fourth-generation and the standard that some countries adopted.

Table 2-1 Key Features of Mobile Wireless Network: from 1G to 4G

Gener- ation	Access Protocols	Occurrece Time	Service Type		Key Features
			Multi- media	Voice	
1G	FDMA	1980s	~2.4kbp s	AMPS TACS NIMT	1. Analog technology 2. Primarily on voice service 3. Low security level 4. Support for low bit rate data
2G	GSM CDMA	1990s	~64kbp s	IS-95A IS-95B GSM TDMA CDMAOne	1. First digital systems 2. New services such as SMS and low-rate data provided 3. Middle security level 4. Provide voice and data service
3G	CDMA2000 WCDMA HSDPA TD-SCDMA	2000s	~2Mbps	W-CDMA CDMA 2000 1xEV- DO	1. Global roaming across a simple wireless network 2. Limited IP interoperability
4G	FDD-LTE	2010s	~1Gbps	Broadband wireless	1. Global roaming across multiple wireless network 2. IP interoperability for seamless mobile Internet

Resource: Kumar et al. (2010)
Dekleva (2007)

**Table 2-2 Evolutions of Smartphone Communication Standards in Major Countries
and Years in Which Service Began**

Country	1G	2G	3G
USA	AMPS (1983)	DAMPS (1992) GSM (1995) CDMAOne (1996)	Various standards
Japan	NTT (1979) TACS (1989)	PDC (1993) CDMAOne (1993)	Wide-band CDMA(2001)
UK	TACS (1984)	GSM (1992)	Wide-band CDMA
Germany	CNETZ (1985)	GSM (1992)	Wide-band CDMA
China	AMPS (1995)	GSM (1996) CDMA (1997)	CDMA2000 (2009) WCDMA (2009) TD-SCDMA (2009)

Resource: Funk & Methe (2001)
Ministry of Industry and Information Technology of People's Republic of China

Platform: The design of the smartphone is based on the platform. In the history of smartphone development, many leading companies in this industry develop their own operating system to guarantee their market share. In the current market, there are various smartphone operating systems: iOS from Apple, Android from Google, Windows Mobile from Microsoft, RIM from Blackberry Apple's iOS, Google's Android, Microsoft's Windows Mobile, Nokia's Symbian OS, RIM's BlackBerry, Symbian from Nokia, and Bada from Samsung.⁵ From the 1st Quarter of 2013, iOS and Android hold the largest market share with 17.3% and 75.0% respectively.⁶ Goadrich and Pogers (2011) compared iOS and Android platforms and concluded that the hardware requirements from iOS is more rigorous than Android. That makes the bar for operating system design higher from iPhone than Android phones.

Screen: As the most visible and most widely-used feature of the phone, screen quality and screen size will definitely influence the consumer's purchasing decision. This is shown in the smartphones that have been introduced into the market in recent years. Companies

⁵ In the year 2013, Nokia and Samsung announced that they will stop developing Symbian and Bada platform based according to the developments in the market.

⁶ Resources: IDC worldwide Quarterly Mobile Phone Tracker, may 2013, <http://ww4.sinaimg.cn/bmiddle/b8ba19b7jw1e5b46ig0x8j20dw06wwf1.jpg>

such as Samsung and Apple have updated their Galaxy and iPhone models with larger screens with higher screen resolution. For instance, the display size has increased from 3.5 inches to recent 5.5 inches and the number of pixels on the screen has been raised to 1080x1920 and above. In a survey conducted by Sweeney and Crestani in 2006, PDA and laptop users said that screen size should be considered as an important factor in design (Sweeney & Crestani, 2006).

Another innovative characteristic of the smartphone screen is the development of the touch screen and the virtual button. Since the launch of iPhone by Apple, the touch screen becomes a required feature for smartphones. The reason why the touch screen interface is better than physical buttons is their flexibility and ease of use (Kane et al, 2008). The criteria considered in evaluating the touch screen are: 1) website experience and convenience, 2) touch validity, 3) screen size, and 4) one-handed interaction.

Apps: According to Apple, customers have downloaded over 50 billion Apps from the App Store at a rate of 800 apps per second. Together with the iTunes Store and iBook store, the App store, which offers more than 850,000 apps in 23 categories (such as education,

games, and business), contributed \$5.4 billion to the company's income in 2011.⁷

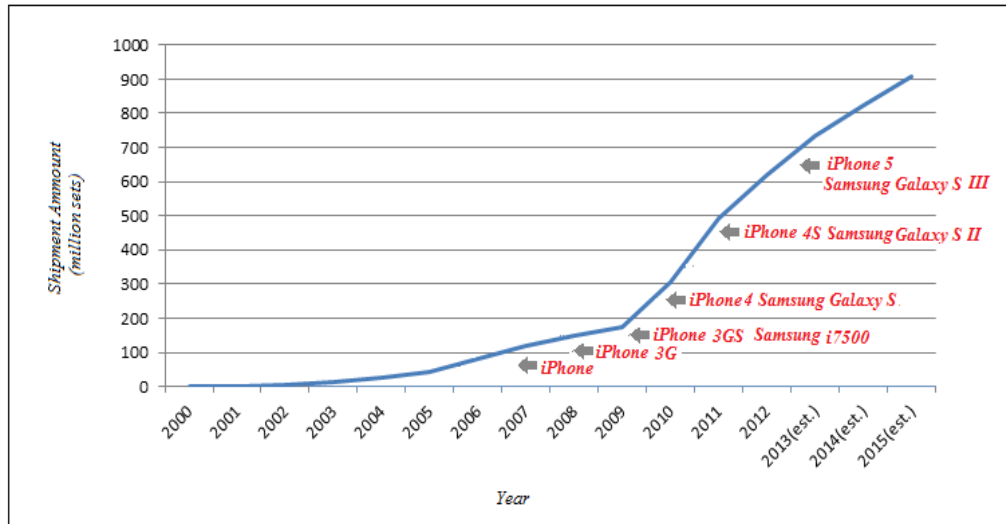
The smartphone device is no longer considered as a simple device since the apps extends the openness of information connecting to international networks, especially in the areas covered with LTE and WIFI networks (Higgins et al., 2010; Xu et al., 2011). Since the web-based Social Networking Sites (SNS) was translated into an app version, mobility become the main reason for smartphone users to download Social Networking Software (SNS) since they can check or change their "status," talk with their friends and family members, and upload their photos at any time.

Recently, the market outlook and huge profits enticed many companies and individuals to get involved into apps development. Because people tend to download certain kind of apps which have much in common, app designers try to find apps that are totally different from others in order to survive in this highly-competitive market. Based on the economic view, this competition delivers the optimal app to the consumer.

⁷ Resource: Apple Inc. website and 2012 10-K Annual Report

2.3 Why people choose Smartphones

With the public stimulating demand for smartphones, world smartphone purchases have mushroomed in recent years. According to the research from IDC, in the year 2011, the annual shipment amount of smartphones has reached 491 million units and for the first time in history surpassed that personal computers at 353 million units. Although not all manufactures choose the strategy of releasing limited models each year, in the past five years, smartphone manufactures choose to cover the market vacancy by selling the same product with slightly different features to meet specific customer needs. The annual global smartphone shipments for some iPhone and Samsung Galaxy smartphone is show in Figure 2-1.



Resource: Coda research Consultancy, 2010
 Topology Research Institute, 2006
 IDC Inc, 2012
 iResearch Inc, 2012

Figure 2-1 2000-2015 Annual Global Smartphone Shipment Amount and some iPhone and Samsung Galaxy smartphone Release Time

According to the Product Life Cycle theory, product life is divided into 4 stages: introduction, growth, maturity, and decline. The figure clearly shows that smartphones met strong demand in the market since 2007 and that the smartphone industry switched to a fast period of growth in the following years.

As an innovative product, smartphones created a totally new demand rather than filling the needs of existing customers. Namely, at the consumer-experience level, the innovative

characters of smartphone can be summarized into three aspects:

User-centered: According to the research conducted by Norman in 1986, “the user-centered design emphasized that the purpose of the system for the user...the needs of the users should dominate the design of the interface, and the interface should be the focus of the design for the rest of the system (Norman, 1986).” From the beginning, the product manufacturer’s decided that the users’ needs are the most important item to address.

With the wide usage of computer technology, human-computer interaction was widely adopted in the design of electronic products. This tendency is more popular innovators of the iPhone with which moved the user-centered concept a large step forward. From a smartphone device, we can experience the “superior consciousness” as the benefit of technology development. One example is use of the touch screen in the smartphone. It is no wonder to learn the truth that the touch screen is a must-have feature for smartphones. No matter the smartphone market leader, the manufacturers choose the large touch screen as one means for them to win market share. Smartphone users can easily fulfill any tasks they want to do in the mobile just by touching the screen. Another example is the NFC function in smart devices. This technology, which allows cash-free transactions, was new a couple of years ago, but today, many smartphones are installed with the NFC service to meet the needs of electronic

payment.

Apps were considered one of the meaningful symbols of user-centered character since the choices is totally determined by the users themselves. Xu et al. (2011) concluded that diurnal patterns can dramatically affect the choice of apps, that is, the app usage behavior is different for a person depending on the time of day: News apps are preferable in the morning while at night game and entertainment apps are more popular. Especially in recent years, apps designed for the professional apps became available in a large numbers.

Mobility: The Third-Generation Mobile System (3G) is expected to provide worldwide access and global roaming for a wide range of services. In the design of the smartphone, compared with 2G feature phones, which are used mainly for speaking and text messaging, the mobility characteristic in smartphones was strengthened. The fast speed and high-quality network system guaranteed people to meet the eager need of sending and receiving short messages, voice call, and email and place calls with high connection quality. This allows people to meet the need to checking information at anytime and anywhere that is covered with a cellular signal.

Functional: “Functional” here refers to the ability of the smartphone to do multiple tasks at the same time. For example, a smartphone can is a television, a radio, a voice

recorder, and more. The smartphone designers always want to add more function on the device rather than took some function off. Before the smartphone was innovated, Personal Computer was recognized as functional. According to the study, the top three functions that people like to spend time on smartphone are browsing the internet, checking social networking sites, and playing games.⁸

⁸ R. Waugh, Making calls is now the fifth most-used function on smartphones - after the web, Facebook, games and music, Mail Online, June 2012, <http://www.dailymail.co.uk/sciencetech/article-2166603/Making-calls-fifth-used-function-smartphones--web-Facebook-games-music.html>

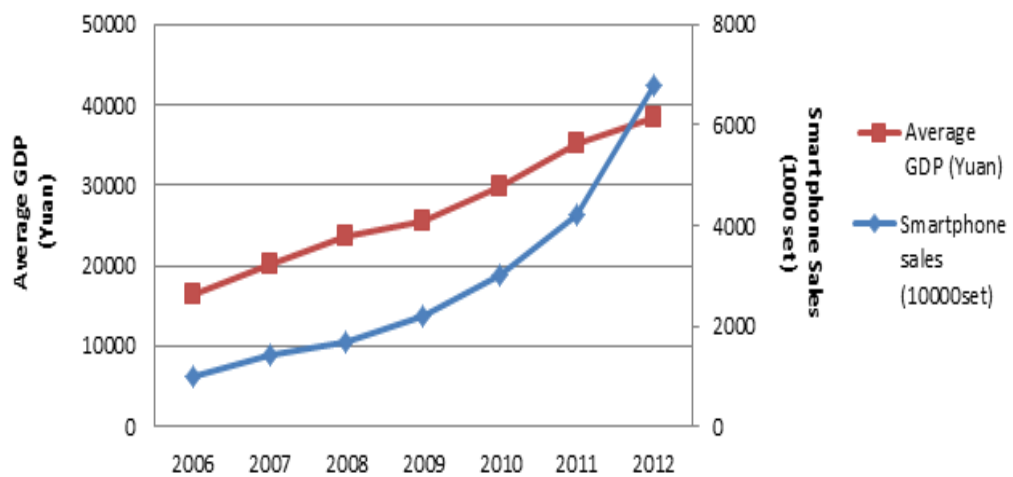
Chapter 3 Smartphone market in China

3.1 The Overview of China Smartphone Market

Traditionally, Chinese consumers had to wait one year or even longer to enjoy the same products and services as their foreign counterparts. This situation, on one hand, is caused by low internationalization level, government rules and approval procedures and international trade barriers, since foreign products could not enter the market right after they were released. On the other hand, the lack of technology forced local enterprises to follow the foreign technology standard and rules rather than innovative products by themselves.

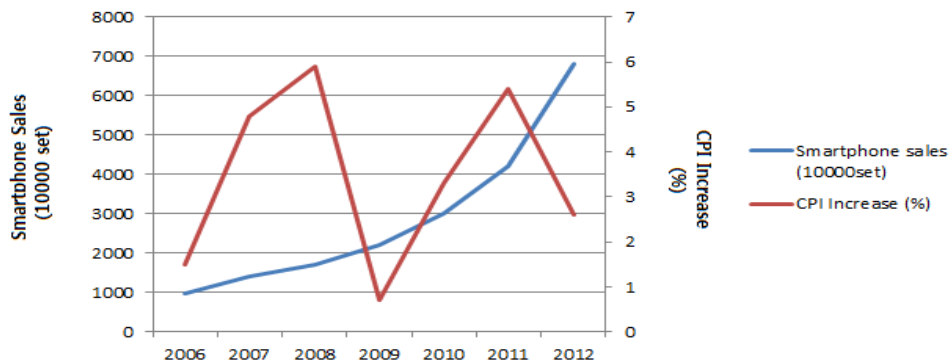
Nevertheless, since China joined the WTO and paid more attention to globalization, the waiting period for latest mobile phone models has been reduced. First, customers are highly developed and cultivated and understand high-tech products, because the Internet allows consumers to get the latest industry and consumer news. Second, at the governmental level, Ministry of Industry and Information Technology was established in 2008 to take in charge of mobile industry regulation. Its establishment reduced the approval time for new high-tech products. Third, many mobile devices are assembled in China

which allows customers to purchase soon after release. Fourth, local companies and international enterprises have created partnerships to develop the Chinese market together. Obviously, both smartphone users and companies benefit from the globalization of the Chinese economy. To analysis the relationship between economy and smartphone sales, see Figure 3-1 and Figure 3-2.



Resource: iimedia.com smartphone research (<http://www.iimedia.cn/13252.html>)
Annual Statistics Book (2005-2012), National Bureau of Statistics of China

Figure 3-1 The Relationship Between Smartphone Sales and Average GDP (2006-2012)

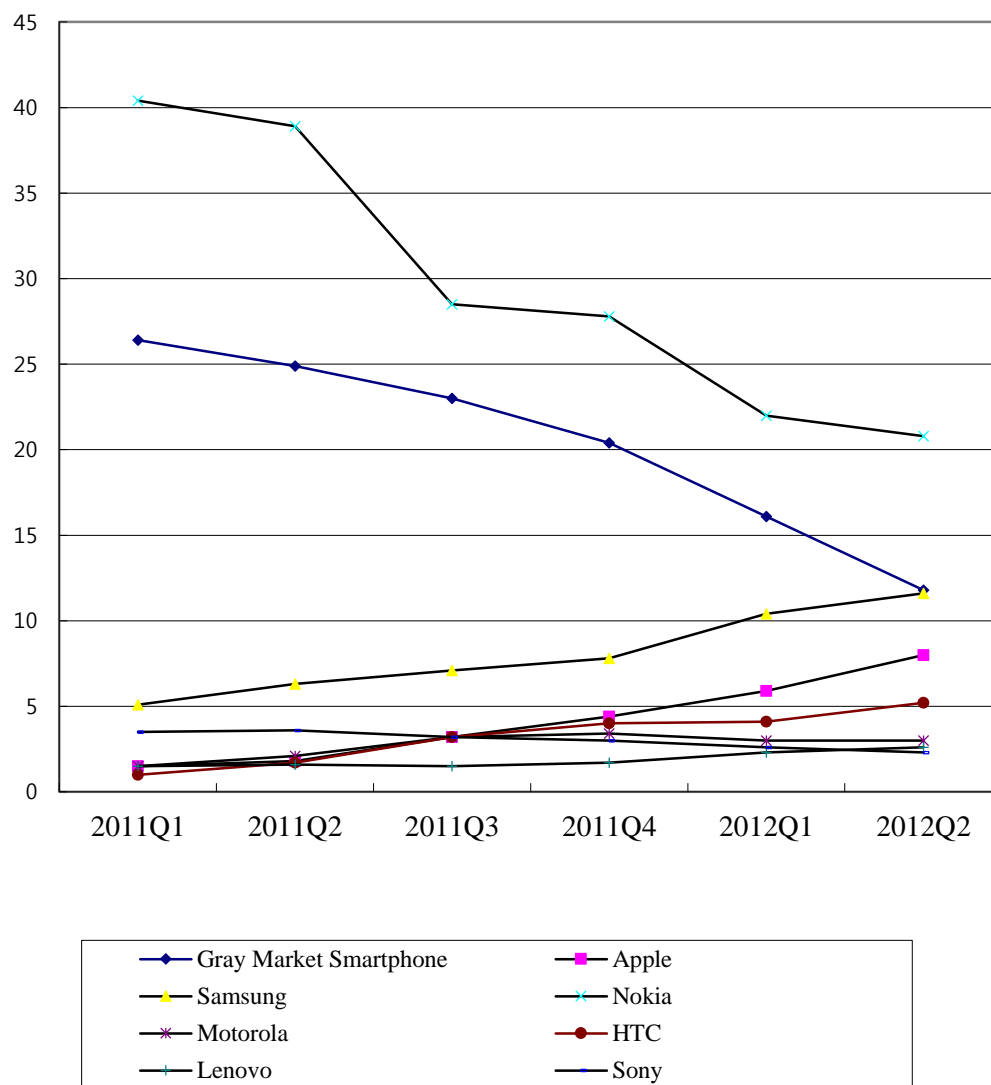


Resource: iimedia.com smartphone research (<http://www.iimedia.cn/13252.html>)
Annual Statistics Book (2005-2012), National Bureau of Statistics of China

Figure 3-2 The Relationship Between Smartphone Sales and CPI Increase (2006-2012)

In China, there is another smartphone market called the “grey-market” (also called “Shan-Zhai”). Usually these kind of smartphones are manufactured by small smartphone manufacturers who do not have governmental smartphone manufacturing license, quality certifications, and network-use permits (Liao and Hsieh, 2012). After the large chip designer Media Tek in 2005 developed a smaller mobile phone chip at a low price, many Chinese small electronics manufacturers have turned into mobile phone manufactures. They make smartphones instead of ordinary cell phones seeking higher profits. Since these firms can order components from local producers and use the MTK solution to assemble mobile phones in a comparatively easy manner. Grey-market producers copy brand-name mobile phones as well develop as add extra functions (such as dual SIM cards, projectors, and heavy-duty

batteries) to attract customers. Compared with brand-name phones, the grey-market mobile device manufacturing cost is quite low. The producers do not have to pay the quality control and certification application fees. Given this economic advantage, the gray-market have taken 35% market share (Liao and Hsieh, 2009) However, the grey-market devices also have negative aspects. First, since the grey-markets manufacturers do have licenses to produce phones, these phones lack quality control. So the consumer may have potential problems charging the phone and with daily usage including body damage. Second, the grey-market producers may install poor quality software with security issues into the devices. The gray-market device could then be overwhelmed with unwelcome ads and send or receive spam or pornographic images. Third, the grey-market smartphone makers and users could be liable to legal sanctions, since many devices are copied from brand models thus run afoul of intellectual property rights. Because of all this, the grey-market smartphone market share began to decrease in the past two years. Figure 3-3 reflects the market share of brands smartphone and gray-market smartphone between the first quarter of 2011 and the second quarter of 2012.



Resource Baidu.com Mobile Internet Development Report (2012Q2)

Figure 3-3 Market Share of Brands and Gray-market mobile phones (2011Q1-2012Q2)

3.2 China Smartphone Industry Supply Chain Analysis

Derived from feature phones, the smartphone industry adopted the similar system from traditional mobile phone industry. However, since the smartphone has PC features, the manufacturing process required advanced technologies and cooperation between different suppliers and operators, some new partners (such as operating system suppliers and service Providers) are engaged in the industry.

The most important factor for Chinese smartphone manufacturers is they currently can only design phones using operating systems based on Android (such as MiUi). In China, at the end of 2011, the Android OS became the most popular operating system because it is open software plus is supported by Google. Android phones then took 65% of market share. Almost all smartphone manufacturers, including the domestic companies such as Huawei, Lenovo, ZTE and OPPO, adopted the Android operating system. On the other hand, other operating systems have become popular compared with Android, such as Apple's iOS because of lack of openness and the Windows OS phones which lack market recognition in China.

In the smartphone market, telecom operators play an important role. In China, with

years of development, there were three telecom operators in the current market: China Mobile, China Unicom, and China Telecom. These three companies entered the smartphone market by investing in national 3G networks and cooperating with smartphone manufactures. The market strategy of telecom operators can be seen from Table 3-1.

Table 3-1 The Smartphone Market Strategy of China Telecom Operators

Company	3G services	Advantages	3G brand	3G Market Share (2011)
China Unicom	TD-SCDMA	Largest user base Low services fee	M-Zone Easyown GoTone	31%
China Telecom	CDMA 2000	Advantage in Business 3G services Cooperation with smartphone manufactures Established market channel	Wo 3G	40%
China Unicom	WCDMA	Advantage in High-end market	E surfing	29%

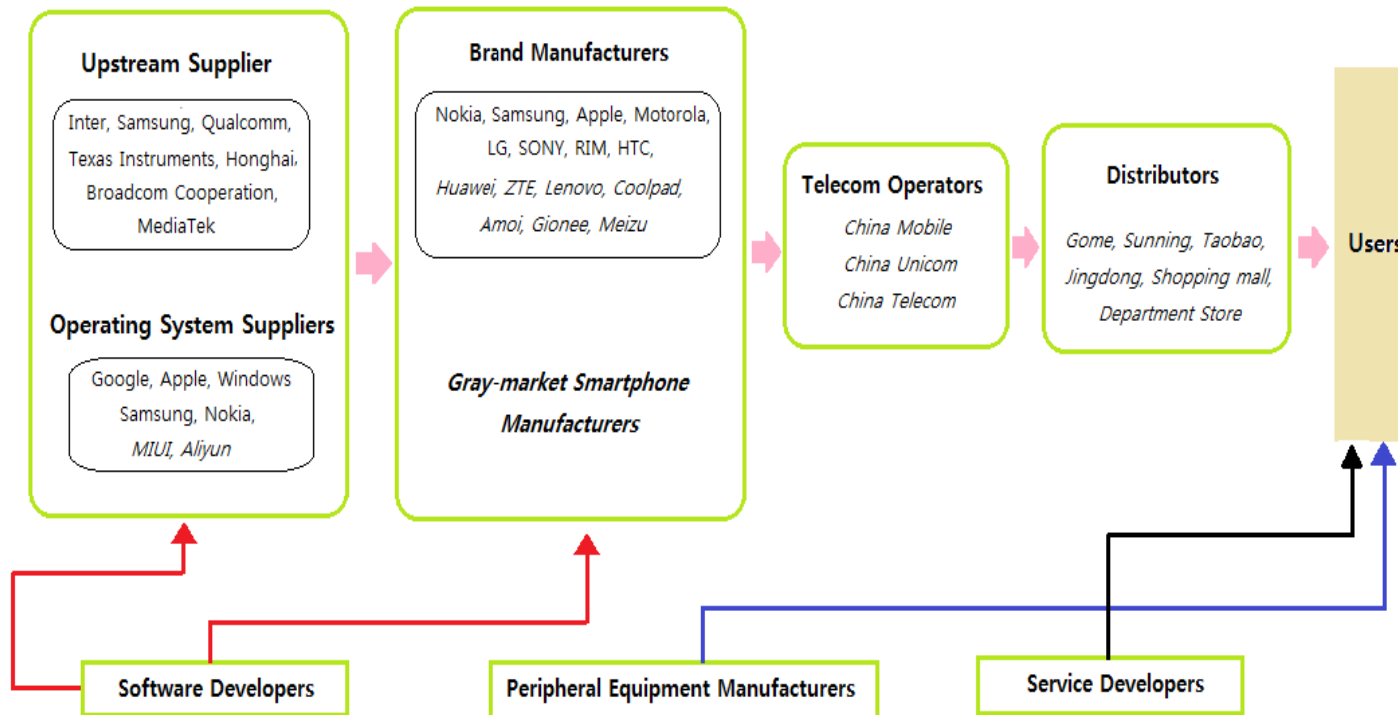
Resources: Ministry of Industry and Information technology of the People's Republic of China

One important player in Smartphone Supply Chain is the app software developer. Since the dawn of the Internet Age, the Internet companies adopted the strategy to give away things free and use advertisement to generate revenue and attract large numbers of Netizens. Free and open become the most significant feature of the internet. In the smartphone age, the most popular and successful apps are the ones that are free of charge. Among all the available apps

that people use and install, IM, search engine, music, and SNS users' preferences are 81.3%, 69.4%, 50.9% and 48.2% respectively.⁹

The key smartphone manufactures keep their profits high by establishing their ecosystems (Kenney and Pon, 2011). This is reflected in some representative companies that extend their business into many sections of the smartphone-manufacturing business. For example, Apple produces and design chips, operating systems, and other devices. Figure 3-4 is the China Smartphone Supply Chain

⁹ Resource: China Mobile Internet Development Report (China Internet Network Information Center, 2013)



Remark: Manufacturers written in italic type are China mainland corporations.

Resource: iResearch China Smartphone Market Research (2011-2012)

Figure 3-4 China Smartphone Market Supply Chain Analysis

Chapter 4 The Study of China Rural Area Economy, Residence and the Impact of Telecom Industry

4.1 An overview of China Rural Economy Development

After the Reform and Open-up Policy, which was launched in 1978, the Chinese economy swiftly changed from a socialist market economy to market-oriented one, providing more work opportunities and higher salaries for workers.

The Chinese Government published a series of regulations on family farming and the agriculture market to help farmers improve farming practices. The price of agricultural products is higher with burdensome government regulations. Farmers were allowed to cultivate private plots and sell the surplus products on the open market. The change from the community-based agriculture to the family-based agriculture system improved the living conditions of farmers.

Another development for rural areas was that the application of "township and village enterprises." This meant that villages could establish their own factory regulations and proposals (Fan et al., 2002; Chen 1998). The current regulation of SMEs in China is based

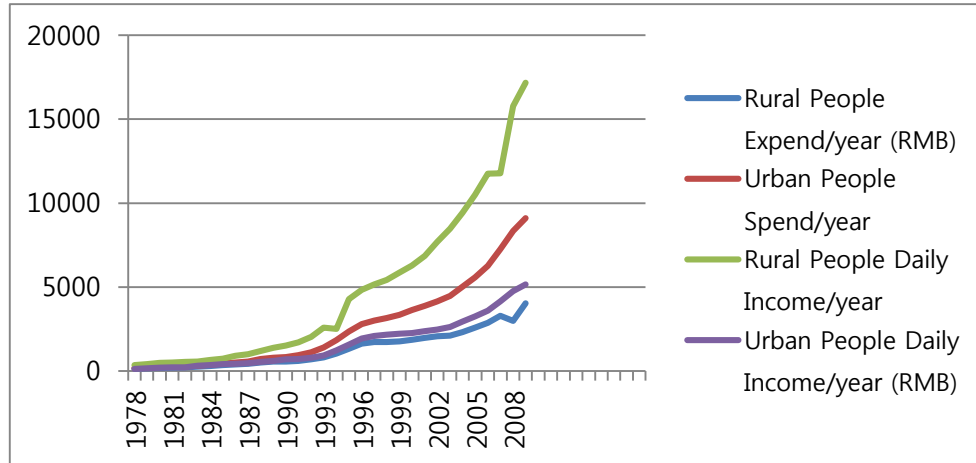
on and even uses funds from foreign countries to build a factory.

Since 1990, the Chinese home agriculture market allows more liberal policies. In 1993, more than 90% of all agricultural products were sold at a market-determined price. This was a clear indication that “China's agriculture had been transformed from a command-and-control system to a largely free-market one.” (Fan, 2002).

Since China joined the WTO in 2002, Chinese agriculture industry, like other industries, has experienced huge opportunities to develop. However, because of the rapid economic growth in China, industrialization and modernized lifestyles in the cities draw Chinese farmers away from their farms and hometowns to find work in the cities. This migration people is increasing rapidly.

In the year 2006, the Chinese central government announced a new policy for farmers by which they can for the first time in history can receive tax exemptions including the agriculture production tax to the education tax. In addition, farmers will receive financial support for their children education and subsidies to purchase of agriculture building, machines, and computers. With the announcement of these policies and the development of IT technology, farmers’ lifestyle is improved. With this tax exemption and the financial support, they can spend on the money on what they could not afford before to improve their

IT technologies so as to improve the productivity of agriculture.



Resource: Annual Statistics Book (1978-2011), National Bureau of Statistics of China

Figure 4-1 The Compare of Urban and Rural People Expend and Income

4.2 Influence Factors on Rural Resident's Purchasing Behavior

Eight hundred million Chinese rural residencies with 210 million families was considered a large consumer consume comprising 40% of all retail sales nationally. However, compared with 500 million urban residences, this number was not high enough. However, based on geographic differences, the eastern and coastal rural residencies developed comparatively better than other rural regions because of township and village enterprises. Also, farmers were exempt from paying tax. The reason why rural residencies is still serious

rational is that low agriculture industrialization level, high health care cost and education costs, and lower income.

The low level of literacy level and resistance from the community effects consumer behavior in the following manner: first, rural area residences have strong group, second, they prefer to choose products with function advantages rather than appearance; third, price is one of the most crucial factors that influence rural residence's purchase behavior. In the case of mobile phones, they were more sensitive to recommendation from relatives and neighbors and purchase durable products at a good price.

4.3 Influence Factors on Rural Residence Incomes and potential mobile phone usage behavior

Factor 1: Out-migration workforce. Even many urban workers can only find simple, low-technology jobs. They are still willing to do this, because it is an opportunity earn a higher salary than they can earn in their hometown. Since China joined the WTO, thus increasing access to export markets, factories in the cities need more workers to fill international orders, so out-migration is very common in rural areas. The serious drawback

with this is that middle-age farmers go to the city to find a job and leave the children and old people alone in the villages. These middle-age farmers spend almost all the year away from home and only return during the Spring Festival short vacation. This means that all the farming—including planting, fertilizing, and harvesting—are done by the young and old people. This is not helping China's agriculture development. At this point, Factor 1 has a positive influence on income and the case of long distance separation, smartphone could be used for face-to-face talk, messages sending, photo taking and website viewing.

Factor 2: Environmental problems. Since the village-owned enterprises help many people in rural places find jobs, enterprises—many of them are textile and electronic companies—are focused on the goal of selling their goods worldwide. With extremely low labor costs and well-trained workers from the villages; these village-owned companies are more competitive in the global export market. However, these private companies do not always follow environment standards and could damage the local environment. In many provinces, the costs due to rural environment pollution exceeds the sales revenues. Medical studies shows that cancer mortality is sharply increasing in rural areas. The low rate of insurance coverage and high health costs is a huge problem for people from rural areas. The low coverage of insurance and high health check fee will be a big problem for people from

rural areas. Under this consideration, the environmental issue will bring a negative effect on rural area residences' income and the residences' willingness of using a smartphone may come from right-safeguarding process, SNS service, photography and camera services functions can be used.

Factor 3: International competition. Even when Chinese farmers began to export their products, in general, they are not as competitive as farmers in western countries who developed mechanized agriculture industry and established their international business market already in the past 60 years. This situation is more serious after China joined the WTO, which allows foreign capital direct invest in the agriculture industry. China has to import soybeans and peanuts because of problems in this area. It is a concern for agriculture. Factor 3 brings a negative influence on income, however, in the future, the smartphones which install the Agriculture information Apps will receive wide welcome for rural residences since they can update the agriculture information in a short time.

Factor 4: The inflation. Rapid economic growth in China, modernization, and the industrial lifestyle carries many negative effects for the Chinese economy. Farmers could face serious problem with inflation and find that the earning gap between rural and urban residents grows larger. The inflation problem will directly influence rural residences' income.

For the rural residents who are sensitive to price, they will purchase smartphone device until the prices reach to acceptable ranges.

Chapter 5 Methodology

5.1 Literal Review of Technology Acceptance Model

5.1.1 Original Technology Acceptance Model and its derivation

Against the background of a wide-ranging changing technical developments in the 1970s to 1980s, the study of how to predict the acceptance of technology among the public is an interesting topic for many researchers. From the Fishbein Model as a theoretical foundation, Technology Acceptance Model (TAM) was designed by Davis in the Management Information System (MIS) to forecast a potential user's overall acceptance as well as the new system itself by demonstrating system prototypes and measuring the potential user's motivation (Davis, 1985; Fishbein, 1967).

David proposed that the characteristics of the system and users can be motivated in both way, that is, the system's features and capability can affect the user's motivation to use the system. His or her behavior can then stimulate the actual system usage or non-usage. The conceptual framework of the TAM model is shown in figure 5-1.

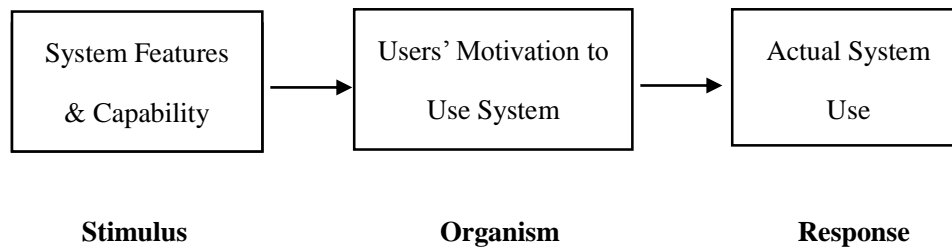


Figure5-1 Conceptual Framework of Technology Acceptance Model (Davis, 1985)

Derived from this framework, in Davis's model, potential users' attitude was divided into two types based on different beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The definition of these two terms can be seen as follows:

Perceived Usefulness: The degree to which an individual believes that using a particular system would enhance his or her job performance.

Perceived Ease of Use: The degree to which an individual believes that using a particular system would not require too much physical or mental effort.

In the original TAM model, User Motivation is composed of three factors: Perceived Usefulness, Perceived Ease of Use, and Attitude Toward Using. The Attitude Toward Using, which determines the user's actual decision as to whether or not use the system, is driving by two major factors: Perceived Usefulness and Perceived Ease of Use. The nature of the model says that Perceived Usefulness can have an effect on Perceived Ease of Use, since

physical effort and how one feels can influence job performance, while both Perceived Usefulness and Perceived Ease of Use can result in Attitude Toward Using, which can be treated as a behavioral response to the new system. Meanwhile, both Perceived Usefulness and Perceived Ease of Use was hypothesized to be directly influenced by the design features (such as X1, X2 and X3), which can be reflected in Figure 5-2.

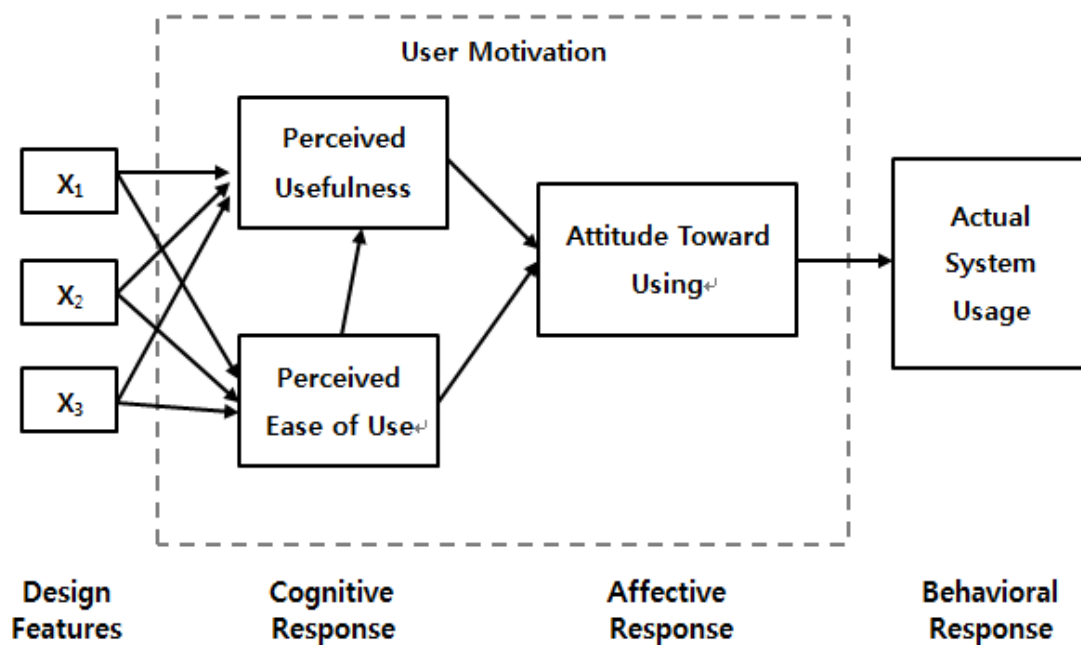


Figure 5-2 The original Technology Acceptance Model (Davis, 1985, p.24)

Mathematically, this model can be explained by using the following four equations:

$$1) \text{ Perceived Ease of Use} = \sum_{i=1,n} \beta_i X_i + \varepsilon \quad \textcircled{1}$$

$$2) \text{ Perceived Usefulness} = \sum_{i=1,n} \beta_i X_i + \beta_{n+1} \textcircled{1} + \varepsilon \quad \textcircled{2}$$

$$3) \text{ Attitude Toward Using} = \beta_1 \textcircled{1} + \beta_2 \textcircled{2} + \varepsilon \quad \textcircled{3}$$

$$4) \text{ Actual Use of the System} = \beta_1 \textcircled{3} + \varepsilon \quad \textcircled{4}$$

where,

X_i = designed feature $i, i = 1, n$

β_1 = standard partial regression coefficient

ε = random error term

In the study of Design Features on Perceived Usefulness and Perceived Ease of Use, according to Davis's research, the anticipated scale length required to achieve a Cronbach alpha reliability of 0.80 was used. Besides, the cluster was used in David's research. Similar item with one aim was chosen to list into one cluster. In PU, there were three clusters related with job performance: job effectiveness, productivity, and the importance of the system to the job. On the other side, in PEOU, 10 items were listed under the cluster of physical effort, mental effort, perceptions. However, 3 items did not belong to any clusters above, so they were separated from other clusters (Figure 5.3).

Table 5-1 The PU and PEOU Items in Davis' TAM model (Davis, 1985)

Perceived Usefulness		Perceived Ease of Use	
Cluster	Item	Cluster	Item
Job Effectiveness	Effectiveness Job Performance Quality of Work	Physical Effort	Controllable Cumbersome Rigid & Inflexible
Productivity	Increase Productivity Accomplish More work Reduces Unproductive Time Saves Me Time	Mental Effort	Frustrating Understandable Mental Effort
The Importance of the System to the Job	Critical to My Job Makes Job Easier Addresses My Needs Job Difficult Without	Perceptions	Ease of Remembering Dependence on Manual Provides Guidance
		No Cluster	Error Recovery
		No Cluster	Unexpected Behavior
		No Cluster	Control Over Work

5.1.2 Study on Smartphone by Using TAM Model

The significance of Smartphone usage is supported by mobile data services. The mobile data services are considered into 4 categories: mobility, wide scope of usage, personal, and usage cost (Hong et al, 2008). In the study of grey-market smartphones, Liao and Hsieh discussed the willingness to purchase grey-market smartphones by separating the intention into factors such as seeking novelty, integrity, and status.

One of the important reasons for consumers to purchase the smartphone is their social needs and social influence. The customers purchase the device, on one hand, based on his or her personal beliefs and desire to join a group of people on the other hand, from other

people's recommendation or comments. Ding and others concluded that there is a significant and positive relationship between social influence and dependency on smartphone among university students (Ding et al., 2011).

Besides, the TAM model is used to analyze smartphone usage in a specific industry. Park and Chen (2007) discuss the situation of smartphone usage motivation in the health care industry and concluded that the users (doctors and nurses) pay much more attention on organizational factors, since they would affect mostly user's attitude toward innovative technology in the medical system.

As a new innovations come about, the society pays increased attention to the need for using a smartphone. Since a smartphone contains various functions and allows multi-tasking, consumer-usage behavior could be totally different from using other products and correspondently, user's attitude of acceptance may be affected by new factors. Kim (2013) found the perceived cost savings and the company's willingness to spend money as new factors in mobile wireless technology study and emphasized that these two factors have positive influence on actual use of smartphones.

Since this model is related to people's emotional state, this uncertainty makes the variables and research models capable of changing, even the developer himself published his

revised work with his colleagues after the year 1985 (Davis 1989; Davis 1993). Table 5-2 is about some TAM studies on smartphones with different variables. From the study of these papers, even though researches adopted some similar key factors, variables which reflect the specific background in each research may result in different result. Besides, for specific purpose, various factors are selected. For example, in a smartphone bank service and security study, perceived security can be used as a variable while in other cases it is hard to be used.

Table 5-2 Some Smartphone Analysis Conducted by Technology Acceptance Model

Author	Study Intention	Variables	Test Results
Ting et al. (2011)	Convenience, Social needs and social influence on university students' dependency towards smartphones	Convenience→ Dependency Social needs→ Dependency Social influence →Dependency Dependency→Purchase behavior	○ ○ ○ ○
Kim (2012)	Mobile wireless technology usage intention in smartphone	PU→BI PEOU→ BI PEOU→ PU BI→ AU PEOU→BI Job Relevance→BI Perceived Cost Savings→BI Company's willingness to fund→BI Experience → BI	○ ○ ○ ○ ○ ○ ○ ○ ○ ○

Author	Study Intention	Variables	Test Results
Park & Chen (2007)	Human motivations affecting an adoption decision for smartphone among medical doctors and nurses	AU→BI PU→BI PU→AU PEOU→AU PEOU→PU Self efficacy→PEOU Self efficacy→BI Compatibility→AU Observability→AU Trialability→AU Task→AU Individual→AU Organizational→AU Environmental→AU	○ ○ ○ ○ ○ ○ ○ ○ Not tested ○ X Not tested X ○ Not tested
Hong et al. (2008)	The behavior of mobile data services consumers	PU→AU PEOU→AU Perceived Enjoyment→AU AU-Intention Social influence→Intention Media influence→Intention Perceived mobility→Intention Perceived monetary Value→Intention	○ ○ ○ ○ ○ ○ ○ ○
Liao & Hsieh (2012)	Consumers' willingness to purchase Gray-market smartphones	Novelty seeking→AU Integrity→AU Status→AU AU→Willingness to purchase Perceived risk→Willingness to purchase	○ ○ ○ ○ ○
Verkasalo et al. (2009)	Users and non-users to use of smartphone Apps*	Technical barrier→Behavioral control Behavioral control→Perceived enjoyment Behavioral control→PU Social norm→Perceived enjoyment Social norm→PU Perceived enjoyment→Intention PU→Intention	○ ○ ○ ○ ○ ○ ○

1) *: Test result for internet service users (N=313) and non-users (N=182)

2) ○ represents the result is supported; X represents the result is not supported

3) AU: Attitude toward Using; PU: Perceived Usefulness; PEOU: Perceived Ease of Use; BI: Behavior Intention

Meanwhile, although the common human recognition of an event or a thing have some similarities and can be attracted or touched by the same thing, but the reason and the result are different. It means the models in TAM also should be analyzed case by case.

5.2 Model Variables

In the design of TAM, Attitude towards the original thinking was considered the one connected with willingness in all the studies. And so we mentioned above, as something will help him/her to perform in the job, PU can have an influence with have an influence with attitude toward to using. Similarly, PEOU is considered have an influence with attitude toward using a smartphone in the physical and mental way. From David's model, we leant that PEOU can affect PU since the mental happiness or sadness affects the job performance.

Hypothesis 1: *A potential rural area smartphone user's attitude toward using a smartphone has a positive influence on his or her willingness to purchase smartphone*

Hypothesis 2: *A potential rural area smartphone user's Perceived Usefulness of a smartphone positively affects his or her attitude toward using a smartphone.*

Hypothesis 3: *A potential rural area smartphone user's Perceived Ease of Use of a*

smartphone positively affects his or her attitude toward using a smartphone.

Hypothesis 4: *A potential rural area smartphone user's Perceived Ease of Use of a smartphone positively affects his or her Perceived Usefulness of a smartphone.*

Discussed in Park and Chen's paper, trialability is considered as "Before deciding"...I would like to..... Use the chance of test, people will evaluate the experience and think whether he or she like or need this product and if they happily accept it. (Park & Chen, 2007). This factor is directly related with PEOU.

Novelty is the feeling of something new and unique. According to the study of China's grey-market smartphones, novelty was used to represent people's taste to try new things. For the people in rural areas, it is a motivation for them to purchase (Liao & Hsieh, 2012).

Eastman et al. (1999) defined "status consumption" as the motivational process by which individuals strive to improve their social standing through consuming products that symbolize status both to themselves and to others. This vanity-pursuing psychology can affect PEOU.

Separated from individuals, the organizational here representing the society. Organizational behavior can be considered as one's desire to join a group and thus becoming happier.

Hypothesis 5: *A potential rural area smartphone user's Triability of a smartphone positively affects his or her Perceived Ease of Use of a smartphone.*

Hypothesis 6: *A potential rural area smartphone user's Novelty Seeking of a smartphone positively affects his or her Perceived Ease of Use of a smartphone.*

Hypothesis 7: *A potential rural area smartphone user's Status Consumption of a smartphone positively affects his or her Perceived Ease of Use of a smartphone.*

Hypothesis 8: *A potential rural area smartphone user's Organizational Pursuit of a smartphone positively affects his or her Perceived Ease of Use of a smartphone.*

Turban et al. (2006) summarized the three characters of mobile e-business that promote users' benefits: portability, real-time effectiveness and geographic limitless. In rural mobile market, the rural consumers also seek for the mobile service benefit from the device: rural residences are want to gain more advantages such as functional benefits (e.g. screen quality, GPS), mobile needs (e.g. network connection and download speed) to guarantee the using experience during experience the mobile service (such as download software, listen to music) for themselves. Separated with the previous Triability, Novelty Seeking, Status Consumption and Organizational Pursuit variables, which can be classified as external influence variables, the idea of use User-centered Need, Functional Need, and Mobility Need as internal

influence variables are considered in the analysis of the character of smartphone usage in Chapter 2.

Hypothesis 9: *A user's User-centered Need of smartphone positively affects his or her Perceived Usefulness of a smartphone.*

Hypothesis 10: *A potential rural area smartphone user's Functional Need of smartphone positively affects his or her Perceived Usefulness of a smartphone.*

Hypothesis 11: *A potential rural area smartphone user's Mobility Need of smartphone positively affects his or her Perceived Usefulness of a smartphone.*

Table 5-3 and Figure 5-3 shows the definition of variables and the Model design.

Table 5-3 Definition of the Variables and Samples of Questionnaire Questions

Construct	Definition	Sources	Sample Survey Questions
Willingness to Purchase A smartphone (WL)	The desire of potential rural consumers to make a purchase of a smartphone in the market	Liao & Hsieh (2012)	1. It is likely I will purchase smartphones within the next 6 month; 2. I recommend my family and friends to purchase Smartphones.
Attitude Toward Using A Smartphone (AU)	Potential rural consumers' psychological tendency to behave in a consistently favorable or unfavorable manner toward using a smartphone.	Liao & Hsieh (2012)	1. It would be desirable for me to buy smartphone.
Perceived Ease of Use (PEOU)	The degree to which a potential rural consumer believes that using a smartphone would enhance his or her job performance	Davis(1985)	1. It would be easy for me to become skillful at using the Smartphone; 2. I would find the smartphone easy to use.
Perceived Usefulness (PU)	The degree to which a potential rural consumer believes that using a smartphone will bring physical and mental efforts	Davis (1985)	1. Using the smartphone in my job would enable me to accomplish tasks more quickly; 2. Using the smartphone would improve my job performance.
Trilability (TL)	Potential rural consumers' motivating force to explore new experience through using a smartphone	Park &Chen (2007)	1.Before deciding on whether or not to adopt the smartphone, I would need to use it on a trial basis; 2. Before deciding on whether or not to adopt the smartphone, I would need to properly try it out.
Novelty Seeking (NS)	Potential rural consumers' motivating force to explore novel through using a smartphone	Liao & Hsieh (2012)	1. I want to experience new and different things in my life; 2. I like innovative products because it gives me some of new Experience.
Status Consumption (CS)	Potential rural consumers' motivating force to gain strong feeling about their social status through using a smartphone	Liao & Hsieh (2012)	1. I would pay more for a product if it has status; 2. I would buy a product just because it has status.

Construct	Definition	Sources	Sample Survey Questions
Organizational Pursuit (OP)	Potential rural consumers' motivating force to gain acceptance or welcome in a group	Wu & Wu (2005) Park & Chen (2007)	1. Using the smartphone affects the quality of the organizational operation; 2. The greater the support from top management, the more likely the smartphone will be adopted.
User-central Need (UC)	Potential rural consumers' motivating force to gain superb user experience through using smartphone	-	
Functional Need (FC)	Potential rural consumers' motivating force to gain high quality hardware of smartphone	-	
Mobility Need (MN)	Potential rural consumers' motivating force to gain mobility service through using a smartphone	-	

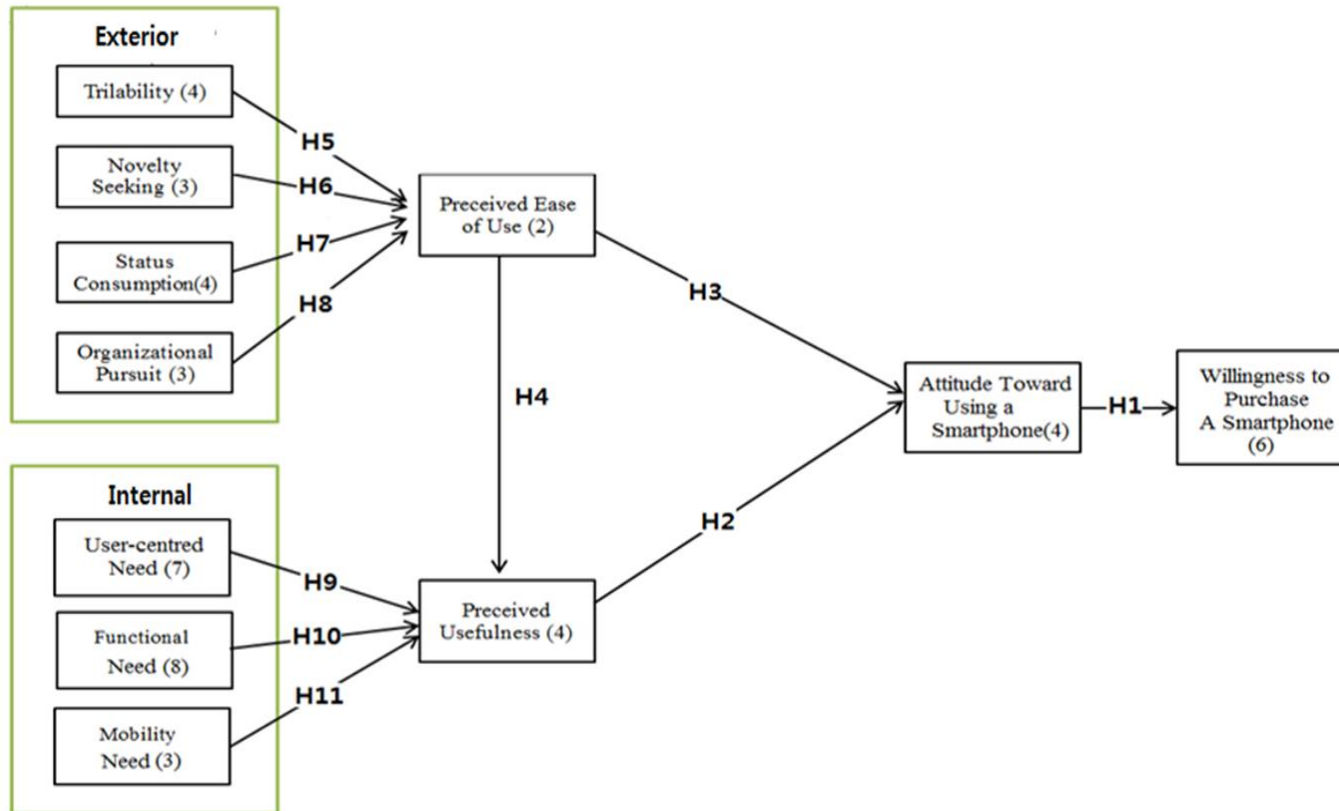


Fig. 5-3 TAM model of Potential Smartphone Users in China Rural Areas

Mathematically, the relationships between variables are:

$$1) PEOU = \beta_i TL_i + \beta_i NS_i + \beta_i SC_i + \beta_i OP_i + \varepsilon \quad \textcircled{1}$$

$$2) PU = \beta_i UC_i + \beta_i FN_i + \beta_i MN_i + \beta_1 \textcircled{1} + \varepsilon \quad \textcircled{2}$$

$$3) AU = \beta_1 \textcircled{1} + \beta_2 \textcircled{2} + \varepsilon \quad \textcircled{3}$$

$$4) WL = \beta_1 \textcircled{3} + \varepsilon \quad \textcircled{4}$$

where,

$$i = 1, n$$

β_i = standand partial regression coeffient

ε = radom error term

Chapter 6 Empirical Analysis

6.1 Data Collection Method

In the survey, two test formats were introduced by adopting a five-level scale in both formats. The first format is named “Attitude 5-item Measurement Format.” This five-item measurement method is a way to test the respondent’s willingness to agree with the description. The survey can be seen in Appendix II.

Attitude-test format:

		Waste a lot	Waste	Nither	Save time	Save a lot
		②	②	③ ⁺	④	⑤
21	I think using smartphone () (of time					

Measurement-test format

7. How often to you use phone?

- ①every 30 minutes ②every hour ③every half day ④every day
⑤every 2 days ⑥every week ⑦occasionally use

The survey is anonymous. The responders are required to answer some questions about their background in the first section. In the second section, questions are divided for the use of TAM analysis with each questions containing 5 attitude choices (strongly disagree to strongly agree). In question No. 20 to No. 24, however, the attitude choice was designed based on the question criteria. In this section questions are used to answer H2-8

In the Section 3, it was for the technology-based survey focus on the job improvement. The last section was designed for the H1 (willingness to purchase)

The responders to the survey are 299 people. The demographical analysis can be seen in Appendix IV. From the background research, we find that the majority of respondents are youngsters from the north and east of China. Although the family annual income was quite low (70% with 40000RMB and less) and almost 50 percent are first industry worker, almost 80% are currently using 2G mobile phones. Almost 70% purchased their phone from stores. According to the mobile phone usage frequency, the percentage of people check every 60 minutes and every day are almost equal.

For the data collection part, special attention in data gathering resources and how the samples are collected are crucial and meaningful for this research. Since the research is focus on prospective smartphone users in rural areas of China, it means there are several limitations of the research respondents: rural area background, knowledge of smartphone, and potential smartphone consumer. Based on these requirements, the target questionnaire participants must meet the following requirement:

- 1) Respondent must originally come from the rural areas (the definition of rural areas is mentioned in previous chapters);

- 2) Respondent must have some knowledge of smartphone from various methods, including, but not limited to, TV advertisement, experience of products in shops and temporary use experience from their relatives and friends;
- 3) Respondent have never purchase a smartphone at the time they participated in the survey.

There are several ways for distributing this survey. Although by analyzing a sample of 1602 students, M.P. Couper, M.W.Traugott and M.J Lamias (2001) concluded that major advantage of Internet survey is the speed with which completed questionnaires are returned, R.D.Fricker and M. Schonlau (2002) summarized from literature and pointed out that, by considering the factors such as response rate, timeliness, data quality and cost, coverage error is the most widely recognized shortcoming of Internet-based surveys. During the survey collection period of this research, the peak reply period with respondents all national wide was the first five days after the survey published. In other ways, in the process of face-to-face interview, the validity of data obtained methods can be controlled and pay a leading role of the success of survey but local control over the interview is a key problem. (Suchman and Jordan, 1990). To control the quality of survey and make the most effective effect on all the answers can reflect the reality, most questionnaires is in the survey were collected by face-to-face

interview. Meanwhile, to solve the limitation of local barrier of face-to-face interview, indirect face-to-face survey was adopted. The survey collection time period was conducted between January and March 2013 in China. I specially adopt this time period because during which China Lunar Year Festival was provide the opportunity for participators bring the survey back to the remotest parts of China to collect information that any other method does not work.

So basically in the survey research of smartphone prospective users, three methods of data collecting methods are adopted: online survey, direct face-to-face interview, and indirect face-to-face interview. Besides, to guarantee the accuracy of survey and make sure the participants can understand about the smartphone device technology terminology that appears in Section three and Section 4, in both direct and indirect face-to-face section, 15 minutes direct technology explanation was conducted before the interview. However, in the web survey part, we suppose the participant understand the terminology via internet.

6.2 Factor Analysis

6.2.1 Reliability Analysis

The test was conducted under the software SPSS.19. First, basic Mean and Standard Division was checked with each sub-item. Then a reliability test using Cronbach's alpha coefficient test was carried out in order to move any cross-loading of items (Ting 2011). Usually, a higher number (less than 1) of Cronbach's alpha was considered as trustworthy. In common test, the result between 0.7 and 0.8 is acceptable but in some cases, numbers more than 0.6 can also be acceptable.

The survey result can be seen in Appendix IV. All items passed the test with Cronbach's alpha α test. (Result>0.7). It means that the factors can be trusted.

6.2.2 Factor Analysis

This paper adopts the factor analysis methods. First, we did Kaiser-Meyer-Olkin (KMO) test and Bartlett's test. The result is shown in Table 6-1.

Table 6-1 The KMO Test and Barlett Test for Variables

	KMO	Barlett Test of Sphericity		
		Chi-square	df	Sig.
Trialability	0.613	41.070	6	0.000
Novelty seeking	0.658	122.307	3	0.000
Status consumption	0.646	259.631	6	0.000
Perceived Usefulness	0.500	33.349	1	0.000
Organizational Pursuit	0.564	11.625	1	0.001
Perceived Ease of Use	0.620	73.214	6	0.000
Attitude Toward Using a Smartphone	0.731	293.263	6	0.000
Mobility Need	0.589	55.420	3	0.000
Functional Need	0.733	326.108	21	0.000
User-centred Need	0.798	598.688	21	0.000
Willingness to Purchase	0.603	88.236	15	0.000

The results show that the KMO results is larger than 0.500 and Sig=0.000, so the study can be conducted by factor analysis. A correlation matrix was generated for the instrument items (Park & Chen, 2007). All the factors loading greater than 0.5 are hypothesized to load. In the first factors analysis, FC7, UC1, UC7, WL2 and WL6 are less than the requirement, so these factors was took out from the second factor analysis. The following Table 6-2 shows the result of factor analysis. Except Factors FC, UC, WL conduct the second factor analysis, the other factors conduct first factor analysis. The results from the factor analysis lend support to the

validity of the measurement instrument.

Table 6-2 Correlation Matrix of Components

	Component										
	1	2	3	4	5	6	7	8	9	10	11
TL	.684										
TL2	.625										
TL3	.570										
TL4	.539										
NS1		.760									
NS2		.770									
NS3		.781									
SC1			.612								
SC2			.641								
SC3			.795								
SC4			.837								
PU1				.814							
PU2				.814							
OP1					.535						
OP2					.801						
OP3					.790						
PEOU1						.743					
PEOU2						.553					

	Component										
	1	2	3	4	5	6	7	8	9	10	11
PEOU3						.710					
PEOU4						.511					
AT1							.785				
AT2							.828				
AT3							.688				
AT4							.645				
MB1								.705			
MB2								.771			
MB3								.646			
FC1									.573		
FC2									.685		
FC3									.602		
FC4									.766		
FC5									.628		
FC6									.569		
FC7									-		
UC1										-	
UC2										.621	
UC3										.802	
UC4										.806	
UC5										.757	

	Component										
	1	2	3	4	5	6	7	8	9	10	11
<i>UC6</i>										.612	
<i>UC7</i>										-	
<i>WL1</i>											.585
<i>WL2</i>											-
<i>WL3</i>											.519
<i>WL4</i>											.728
<i>WL5</i>											.661
<i>WL6</i>											-
Total: 48 items											

6.3 Hypothesis Test

Regression analysis method is adopted to conduct the hypothesis test. In the test of hypothesis testing, R^2 , standard coefficient and significance are checked. The result can be seen in Table 6-3.

Table 6-3 The Result of Tested Hypotheses

Hypo-thesis	Relationship	R^2	Standard Coefficient β	ρ -Value
H1	Attitude toward Using→Willingness to Purchase	0.237	0.308	Supported ($\rho < 0.05$)

Hypothesis	Relationship	R ²	Standard Coefficient β	ρ -Value
H2	Perceived Usefulness → Attitude toward Using	0.259	0.247	Supported ($\rho < 0.001$)
H3	Perceived Ease of Use → Attitude Toward Using	0.412	0.302	Supported ($\rho < 0.001$)
H4	Perceived Ease of Use → Perceived Usefulness	0.711	0.445	Supported ($\rho < 0.001$)
H5	Triability → Perceived Ease of use	0.591	0.397	Supported ($\rho < 0.001$)
H6	Novelty Seeking → Perceived Ease of Use	0.116	0.230	Supported ($\rho < 0.001$)
H7	Status Consumption → Perceived Ease of Use	0.689	0.540	Supported ($\rho < 0.001$)
H8	Organizational Pursuit → Perceived Ease of Use	0.724	0.689	Supported ($\rho < 0.001$)
H9	User-centered Need → Perceived Usefulness	0.859	0.826	Supported ($\rho < 0.001$)
H10	Functional Need → Perceived Usefulness	0.468	0.538	Supported ($\rho < 0.01$)
H11	Mobility Need → Perceived Usefulness	0.471	0.629	Supported ($\rho < 0.001$)

Although Attitude toward Using has a positive influence on Willingness to Purchase smartphone ($\beta_1 = 0.308$, $\rho_1 < 0.05$), but the low ρ -value reflects that the influence is not strong. It reflect the fact that, as an innovative mobile phone, smartphone is quite expensive for rural residences and makes them feel hard to purchase: they want to purchase but the reality (such as high price, the low network speed) doesn't support them to purchase a smartphone device.

According to the results of Standardized Coefficient, R^2 and p-Value, H_2 , H_3 , and H_4 has weak β value ($\beta_2=0.308$, $\beta_3=0.247$, $\beta_4=0.302$) with the p -value less than 0.001. This result reflects the previous study on the TAM in Perceived Usefulness, Perceived Ease of Use and Attitude Toward Using are correct: Perceived Usefulness and Perceived Ease of Use will positively influence Attitude Toward Using; Perceived Ease of Use will positively influence Perceived Usefulness.

Compared with H_7 - H_{11} ($\beta_7=0.540$, $\beta_8=0.689$, $\beta_9=0.826$, $\beta_{10}=0.538$ and $\beta_{11}=0.629$), H_5 - H_6 ($\beta_5=0.397$ and $\beta_6=0.230$) are not seen the significant effect, which means the rural residence are lack of interests in discover new things: they would like to keep the ordinary living style. Also, from the result, we can discover that rural residences expect that purchasing a smartphone will bring them status and origination recognition.

Some other variables in the research are the newly used factors: User-centered Needs with $\beta_9>0.8$, Functional Needs with $\beta_{10}>0.5$ and Mobility Needs with $\beta_{11}>0.6$ reflected that the characters of smartphone can attract rural residence's interesting on purchasing a smartphone. It reflects that rural residences do care about what benefits the smartphone can bring to them. The huge difference between user-centered needs and other two needs could may explain the situation in previous chapters that a large number of rural residences have mobile phones rather

than smartphone is because they believe that mobile phone can meet their functional needs and mobility needs. It seems that until smartphone manufacturers can pay enough attention on users' experience for rural residence (such as agriculture Apps), smartphone market in rural areas can be dramatically increased.

6.4 Conclusion

Smartphones are a technological breakthrough that permeates the personal lives of individual consumers. The benefit of technology should be received by all people. This study has investigated how to entice potential rural area consumers' usage of smartphone. We have empirically validated a TAM research model based on the characters of smartphone.

The innovative study of this research can be summarized in the follows: first, this paper analysis an newly research areas: the prospective smartphone market in rural China; second, the author describe smartphone character as user-centered, functional need and mobility need and used them in the TAM model design.

This study is focus on the question of prospective market analysis in China rural areas. First, the study of smartphone characters is used to understand the question of why we need a smartphone. Then the study of China smartphone market is necessary since it develops the study

about smartphone market development tendency in China. After the connection research of China rural residence's purchasing behavior and economic situation, the author uses empirical studies from 299 survey results to analysis what do rural residences want from smartphone devices. The data shows that rural residences have positive attitudes on smartphones but they have weak willingness to purchase them. Also, the results supports to the finding that rural residences want to purchase a smartphone not only because of status and organization recognition but also want to experience the user-centered functions.

The findings of this study can provide a foundation for further smartphone rural market research: the device with comparative low price and can fulfill the user-centered needs may be popular in the future.

Chapter 7 Limitation

The limitation of this study is the accuracy of the measurement in data collection. Rural area smartphone consumption survey is one kind of questionnaire need a large sample by interview. Cordell et al. (1996) pointed out that the purchase of smartphone goods falls in the class of non-normative consumers' behaviors and it can be seen as the behavior supporting transactions.

There are two suggestions for the future research. First, the status results in this study different than found in earlier studies with fashion are due to it is much easier to detect a smartphone than to detect fashion item. But versatile selections of smartphones are offered at different levels of quality. Secondly, the effect of cultural difference among the purchase behavior of urban smartphones purchasers and rural smartphone purchases would be an interesting issue. Third, the data collection method of this study could be improved to figure out more rural-area reflections.

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Appendix A

Appendix 1

The Usage of Different Information Type

Information Type Source	Personal	Business	Gove- rnment	Financial	Authen- tication	Connection Service
Messaging	○	○	○	○	○	
Device	○	○	○	○	○	○
USIM Card	some	some	some	some	○	○
Application	○	○	○	○	○	○
Usage History and Caching	○	some	some	some		○
Sensor	○	○	○			
Input	○	○	○			
Methods	○	○	○	○	○	

○: the service is used; X: the service is not used

Resource: Theoharido et al. (2012)

Appendix II

China Smartphone Potential User Survey: To People from Rural Areas*

Jan 2013-Feb2013

Thanks for taking your valuable time to answer the survey. This survey is only for academic purpose and all materials will be carefully kept to avoid any abusive behavior. It will take you about 5 minutes to answer all the questions.

Section I: Personal Information/Current Mobile Phone Usage Information

1. Your age : ①20-30 ②30-40 ③40-50

2. Your original living place is :

①North China (Beijing, Tianjin, Hebe, Shanxi, Neimenggu)

②Northeast China (Liaoning, Jilin, Heilongjiang)

③Eastern China (Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Shandong)

④Mid South China (Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan)

⑤Southwest China (Chongqing, Sichuan, Guizhou, Yunnan, Xizang)

⑥Northwest China (Shanxi, Gansu, Qinghai, Ningxia, Xinjiang)

3. Your family annual income is (RMB) :

①less than 20000 ② 20000-40000 ③ more than 40000

4. The Industry of your family main labor force work in is:

- ① first industry ② second industry ③ third industry

5. Your current phone is:

- ① do not use mobile/telephone ② fixed-line telephones

- ③ mobile phone (black/white screen) ④ mobile phone (with color screen)

6. Where do you purchase your current phone?

- ① mobile phone counter of department store

- ② mobile phone counter of electronic product store

- ③ online shopping ④ TV shopping ⑤ other resources

7. How often to you use phone?

- ① every 30 minutes ② every hour ③ every half day ④ every day

- ⑤ every 2 days ⑥ every week ⑦ occasionally use

Section II: Do you agree with the following statements?

		① Strongly Agree	② Agree	③ Neither	④ Disagree	⑤ Strongly Disagree
Trialability						
1	I try to see if the price is affordable before I purchase a smartphone					
2	Before I purchase a smartphone, I will try to see if the investment is doable					
3	I am trying to learn how to use smartphone skillful before I purchase a smartphone					
4	Before I purchase a smartphone, I would like try to understand if some services are free					
Novelty seeking						
5	I prefer to buy the newest smartphone model					
6	I want to purchase smartphone as soon as possible.					
7	Smartphone is a kind of fashion					
Status consumption						
8	I pay more attention to the brand of smartphone rather than its quality					
9	Brand smartphone can always provide unique hardware than others					
10	Using smartphone will provide me a sense of superiority					
11	Smartphone is a kind of luxury product					
Perceived Usefulness						
12	Using Smartphone will help me to finish work quickly					
13	I will use smartphone to help my career development					

Organizational Pursuit						
		① Strongly Agree	② Agree	③ Neither	④ Disagree	⑤ Strongly Disagree
14	The main reason I want to buy smart-phone is I can get involved into groups					
15	I will teach others especially my family and friends to use smartphone					
16	I will give my family and friends smartphone as gifts					
Perceived Ease of Use						
17	I think smartphone is easy learn					
18	I would find it easy to get the smartphone to do what I want it to do					
19	Smartphone can provide unique designs that easy to use					
20	Smartphone inner function are easy to use					
Attitude Toward Using a Smartphone						
		① Waste a lot	② Waste	③ Neither	④ Save time	⑤ Save a lot
21	I think using smartphone () (of) time					
		① Strongly Dislike	② Dislike	③ Neither	④ Like	⑤ Strongly like
22	I think I () smartphone					
		① Very hard	② Hard	③ Neither	④ Easy	⑤ Very easy
23	Smartphones are () to use					
		① Very Expensive	② Expe-nsive	③ Neither	④ Cheap	⑤ Very Cheap
24	The smartphone ()					

Section III: If you have a smartphone, do you agree/disagree that the following of the following function would help you to perform in job

		① Strongly Agree	② Agree	③ Neither	④ Disagree	⑤ Strongly Disagree
Mobility Need						
1	Wifi					
2	Connection quality					
3	Email					
Functional Need						
4	Standby time					
5	Touch screen					
6	Screen Size					
7	Memory Size					
8	Camera/video function					
9	Three proofings function					
10	Swiftable Two sim card					
User-centered Need						
11	Installed Software					
12	Entertainment					
13	Apps download Need					
14	SNS Need					
15	Smartphone hopping function					
16	Document editor					
17	Smart phone wallet function					

Section IV: The willingness to purchase a smartphone

		① Strongly Agree	② Agree	③ Neither	④ Disagree	⑤ Strongly Disagree
1	I will to purchase a smartphone if from any resource (such as advertisement, product trail experience, ect) the smartphone drives my interest					
2	I will to purchase a smartphone and do not care the brand					
3	I will to purchase it to take with friends as soon as possible					
4	I will to purchase smartphone with maximum budget that I can afford					
5	I will to purchase smartphone with limit monthly mobile phone bill cost					
6	I will to purchase smartphone for using various Apps					

* The original survey was did in Chinese Language

Appendix III

Demographic Analysis of Survey Participators

Item	Group	Frequency	Percentage (%)
Age	20-30	188	62.88
	30-40	69	23.08
	40-50	69	23.08
Original Living Place	North China	90	30.10
	Northeast China	111	37.12
	Eastern China	27	9.03
	Mid-South China	31	10.36
	Southwest China	23	7.69
	Northwest China	17	5.70
Family Annual Income (RMB)	Less than 20000RMB	118	39.46
	20000-40000RMB	92	30.77
	40000RMB above	89	29.77
Family Main Labor Force's Career Type	First Industry worker	129	43.14
	Second Industry worker	80	26.76
	Third industry worker	90	30.10
Current Phone	Do not use mobile/telephone	11	3.67
	Fixed-line telephones	28	9.36
	Mobile phone (black/white screen)	44	14.72
	Mobile phone (color screen)	193	64.55
Purchase Place of Current Phone	Department store	101	33.78
	Electronic product store	107	35.79
	Online shopping	58	19.40
	TV shopping	1	0.33
	Other resources	32	10.70
Phone Usage Frequency	Every 30 minutes	107	35.79
	Every 60 minutes	109	36.46
	Every 12 hours	54	18.07
	Every day	3	1.00
	Every 2 days	1	0.33
	Every week	1	0.33
	Occasionally Use	24	8.02

Appendix IV

Reliability Analysis of the Questionnaire

	Mean	S.D	Cronbach's Alpha
<i>Trialability</i>			<i>0.720</i>
TL1: I try to see if the price is affordable before I purchase a smartphone	2.12	0.71	
TL2: Before I purchase a smartphone, I will try to see if the investment is doable	2.51	0.84	
TL3: I am trying to learn how to use smartphone skillful before I purchase a smartphone	2.60	0.71	
TL4: Before I purchase a smartphone, I would like try to understand if some service are free	2.51	0.88	
<i>Novelty seeking</i>			<i>0.756</i>
NS 1: I prefer to buy the newest smartphone model	2.93	0.81	
NS 2: I want to purchase smartphone as soon as possible	2.87	0.89	
NS3: Smartphone is a kind of fashion	3.19	0.37	
<i>Status consumption</i>			<i>0.796</i>
SC1: I pay more attention to the brand of smartphone rather than its quality	2.86	0.46	
SC2: Brand smartphone can always provide unique hardware than others	2.37	0.81	
SC3: Using smartphone will provide me a sense of superiority	2.89	0.89	
SC4: Smartphone is a kind of luxury product	2.87	0.92	
<i>Perceived Usefulness</i>			<i>0.890</i>
PU1: The main reason I want to buy smartphone is I can get involved into groups	2.92	0.93	

	Mean	S.D	Cronbach's Alpha
PU2: I will use smartphone to help my career development	2.42	0.83	
Organizational Pursuit			0.714
OP1: The main reason I want to buy smartphone is I can get involved into groups	2.59	0.82	
OP2: I will teach others especially my family and friends to use smartphone	2.38	0.62	
OP3: I will give my family and friends smartphone as gifts	2.75	0.92	
Perceived Ease of Use			0.893
PEOU1: I think smartphone is easy learn	2.35	0.85	
PEOU2: I would find it easy to get the smartphone to do what I want it to do	2.86	0.23	
PEOU3: Smartphone can provide unique designs that easy to use	2.37	0.15	
PEOU4: Smartphone inner function are easy to use	3.18	0.15	
Attitude Toward Using a Smartphone			0.819
AT1: I think using smartphone () (of) time [waste a lot of time—save a lot of time]	2.97	0.87	
AT2: I think I () smartphone [strongly dislike—strongly like]	3.10	0.03	
AT3: Smartphones are () to use [very hard—very easy]	2.71	0.10	
AT4: The smartphone () [very expensive—very cheap]	2.92	0.94	
Mobility Need			0.892
MB1: WiFi	1.51	0.61	
MB2: Connection quality	1.61	0.57	
MB3: Email	2.23	0.89	

	Mean	S.D	Cronbach's Alpha
<i>Functional Need</i>			<i>0.754</i>
FC1: Standby time	1.84	0.96	
FC2: Touch screen	1.70	0.64	
FC3: Screen Size	2.36	0.87	
FC4: Memory Size	1.97	0.76	
FC5: Camera/video function	1.67	0.53	
FC6: Three proofings function	2.01	0.85	
FC7: Two sim card	3.05	0.97	
<i>User-centred Need</i>			<i>0.951</i>
UC1: Installed Apps	3.07	0.65	
UC2: Entertainment function	2.23	0.86	
UC3: Apps downloadable	1.89	0.72	
UC4: SNS function	2.00	0.76	
UC5: Smartphone Shopping functional	2.55	0.05	
UC6: Document editor function	1.95	0.82	
UC7: Smart phone wallet function	2.44	0.91	
<i>Willingness to Purchase</i>			<i>0.706</i>
WL1: I will to purchase a smartphone if from any resource (such as advertisement, product trail experience, etc.) the smartphone drives my interest	2.53	0.02	
WL2: I will to purchase a smartphone and do not care the brand	2.58	0.87	
WL3: I will to purchase it to take with friends as soon as possible	2.55	0.60	
WL4: I will to purchase smartphone with maximum budget that I can afford	2.76	0.20	
WL5: I will to purchase smartphone with limit monthly mobile phone bill cost	2.40	0.63	
WL6: I will to purchase smartphone for using various Apps	3.62	0.71	
Total: 48 items			

Acknowledgement

At the end of my master study I really feel that this wonderful journey give me too many amazing surprises and unforgettable memories.

First of all, I would give my deepest gratitude and respect to my dear supervisor Professor Junseok Hwang, who generously offer me not only knowledge but also the philosophy of life in these three years. With his encouragement and guide, I can feel that how huge improvement I got in the three years.

Also I would like to express my sincere thanks to Professor Jeongdong Lee, Professor John Altmann, Professor Jongsu Lee Professor Yeonbae Kim, Professor Youngjun Kim and Professor Paik Myunghee Cho. Their great knowledge will benefit me all my life time. Especially, I also would like to give my sincere thanks to Professor John Altmann, and Professor Jongsu Lee for the instructions on my thesis.

I would like to acknowledge my gratitude to all TEMEP staffs and classmates. Special thanks to Professor Junseok Hwang's research team and funding from Smart Media Research Center, without your kindles help I cannot improve my academic ability in quite a short time. Also I would like to give my special thanks to Dr. Shirshi, Song and Youcai Yang, for their amazing help on the inspiration of the original and the direction on my thesis.

Here I also would like to say thanks to my dear friends: Emmanouil Zografakis, Sodan Baek, Xinpeng Xu, Jiangtian Xu, Jin Li, Wenqing Wang, Shuang Wang and Sungmin Kang, for their sincere helped during in my study in Seoul National University.

Finally, I would like to use this opportunity to express my love from my deepest heart to my beloved father Likuan Zhao, mother Suhui Yang and my relatives. Special thanks to my dearest grandma Yuelan Jia. Thank you so much for your supports all the time! Your love is my energy to move ahead!

초록

빠르게 발전하는 과학기술은 학문간의 장벽을 없애 융합을 촉진하였고, 이러한 융합으로 인해 스마트 시대가 시작되었다. 기술 혁신의 성과인 스마트폰은 사람들의 생활 방식을 완전히 바꾸어 놓았다. 하드웨어와 소프트웨어로 이루어진 스마트폰은 유저 중심의 경험을 제공하고 높은 이동성을 가지고 있다. 스마트폰의 높은 가격에도 불구하고 실시간으로 정보를 교류하고 공적, 사적인 업무의 빠른 처리가 가능하며 다양한 기능을 가지고 있기 때문에 사람들은 스마트폰을 선택한다.

중국의 3G 서비스가 시작된 이래 최근 몇 년간, 중국의 스마트폰 시장은 급성장하였다. 그러나, 중국의 스마트폰 시장에는 불평등이 존재한다. 도시 지역에서는 스마트폰 이용율이 높지만, 농촌 지역에서는 피쳐폰과 유선전화의 시장을 지배하고 있으며 스마트폰의 입지가 매우 작다. 본 연구에서는 스마트폰이 합리적인 가격과 기능으로 농촌시장에 진입할 수 있는 여부에 대하여 연구한다. 우선 스마트폰과 중국 스마트폰 시장에 대해 조사한 후, 중국 농촌의 경제발전 특징에 대한 연구를 진행하여 중국 도시 지역과 농촌 지역 소비자들의 소비 패턴의 차이를 연구한다. 299명의 스마트폰 잠재 소비자에게 설문조사를 시행하고, 설문 데이터를 이용해 개정된 Technology Acceptance Model을 세워, 농촌 지역 소비자가 원하는 스마트폰의 기능과 특징 등에 대해 연구한다. 또한 이를 통해 스마트폰이 중국 농촌

지역에 확산되지 않은 원인을 알아낸다. 본 연구를 통해 스마트폰 업체와 통신사의 전략 수립과 정부의 정책 수립에 도움이 되어 농촌 지역의 스마트폰 확산에 기여할 수 있다.

주요어: Technology Acceptance Model, 스마트폰, 중국, 농촌

학 번: 2010-24111

