**Engineering Management
Field Project**

Changing Trends in Telecommunications Industry

By

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Executive Summary

The mobile telecommunication industry is one of the fastest growing and continually changing markets in the world today. The greatest achievement of wireless technology is that it has made communications possible in the most remote of places at a much lower cost and at a much lesser time to deploy. The US market is largely considered an early adopter market in the wireless technology domain. A wide variety of products are designed in US and the service providers have the opportunity of bringing these devices first to customers locally. On the voice side the US market is seen as a fairly stable and saturated market. With the sudden proliferation of data services and aligned equipment, new markets in the same geography have opened up and have created a huge opportunity to restructure the way wireless services are sold to customers. The US model has traditionally been a model where the service provider sells the equipments needed for the service on a contract basis. There are some obvious advantages and some disadvantages with this model. Businesses may assume they are using the right method to deliver services to attract and retain their customers, but in reality they may miss the part of understanding the user needs. The industries involved in this study include the wireless service provider industry, the equipment manufacture industry and the wireless chipset industry. Through this study it was found that customers are happy to stay with the current model of buying services on a monthly plan from their service provider but are not happy with the contract they need to sign during activation. It was also found that there is a need to look more closely at the current wireless service provider and handset manufacturer relationship and in some cases decouple the closed structure it is in place today. The consumers want more freedom in terms of the devices and services they want

to buy. The wireless chipset manufacturers have not much of a change in role they play today. They would work almost the same way they function today to deliver the state-of-the-art chipsets that go into handsets irrespective of the changes in the relationship between the service provider and equipment manufacturer. That said they need to closely understand the changing dynamics in the product portfolio and create systems with multiple technologies that would work more seamless together. This project has helped understand various aspects of the mobile telecommunications market better from a consumer perspective.

1. Introduction

The use and availability of wireless devices for communication and information exchange has increased dramatically in the past decade. Growth in the wireless telecommunication sector had been fueled by the increasing demand for voice services and the recent demand for broadband services such as web browsing, email, multimedia entertainment, positioning and location based services. The power behind selling wireless services lies on a number of factors, one being the user equipment that is sold to the customers. This could be any mobile computing platforms that come in various form factors and broadly includes cell phones, smart phones and PDAs, eBook readers, tablet PCs etc. The sophistication that comes with these contemporary electronic gadgets has been largely possible due to the advancements in the semiconductor and electronic equipments manufacturing industry. The rapid increase in the processing speed of the chipsets, the amount of integrated circuits that can be packed into a micron sized silicon wafer and the ease with which it can handle complex functions that were once possible only in a machine the size of a room or larger is phenomenal. This study mainly focuses on the wireless semiconductor industry and the wireless service provider industry. The user equipment industry will form a bridge between the two industries. The study has been conducted in two phases namely an interview phase with industry experts to understand their impression on the wireless sector, and a survey phase with a group of audience to gather their opinion on a slew of topics about the industry. The survey participants include consumers who are a directly a part of the wireless industry and those who are not, but have a good understanding of the industry.

The main components of this study include a detailed review of the following sectors:

1. US cellular market: voice and data services

2. Wireless chipset industry

Where ever applicable, a comparative study of the markets has been done and a list of observations of the market has been created. Using this information and the answers from the survey, a final conclusion has been arrived at the trend of the wireless landscape. This helps to see if our result is in accordance with the perception of customers and the reality of the market.

Consider the US mobile business model. Wireless service providers require a solid portfolio of handsets to attract customers. Hence, they work with a number of different handset manufacturers to get the best and most comprehensive line of user equipments. These handsets require a modem or a "baseband" module to connect to the wireless carrier's network. In addition to these mobile phones that provide access to email, media, games and complex computing capabilities also require applications processors, memory elements and a set of network connectivity boards to run the phone's software and services. The connectivity boards may include Bluetooth®, Wi-Fi and GPS chipsets which form an important and integral part of handsets manufactured these days. Hence, the user equipment manufacturer has to maintain a relationship with chipset vendors to get the best components to go into their handsets. The chipset vendors in most cases merely deliver what the equipment manufacturers need and never really have any direct relationship with the wireless service providers. A similar situation exists between the user and the handset manufacturer. The user never really has a direct relationship with the handset manufacturer. In most cases the consumer's relationship with the device he owns is only through the service provider. The service provider controls, sells and in some

cases repairs the end user equipment. This creates a single point of contact for the user and also a roadblock in terms of choice and preference. This could be seen as an advantage or in some cases a disadvantage.

This study tries to address two questions:

1. Is there a need to change the way a wireless service end user buys wireless services and products from the service provider and will increasing his visibility to the handset manufacturer market more directly help address the consumer needs? Is this the future of the US mobile market?

2. Will increasing the visibility and relationship of wireless service providers and chipset manufacturers help collaborate with handset manufacturers more effectively and help develop better devices and give superior products to customers?

The analysis contains two view points, one from the user perspective as to what they want out of a wireless service and the second is from the far end of the spectrum that comprises the chipset manufactures. The handset manufacturers form a bridge between the two industries and in most play the role of an observer and facilitator in the project.
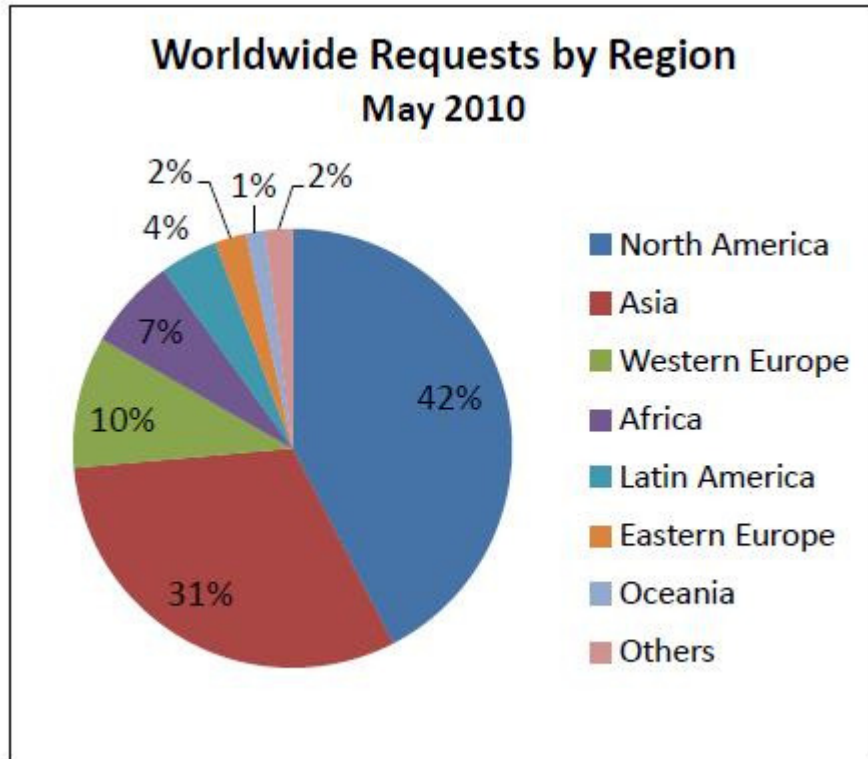
2. Literature Review

According to Wireless Intelligence estimates as of November 2009, the number of worldwide mobile connections is expected to reach approximately 4.6 billion by the end of 2009 and almost 6.3 billion in 2013 reaching a wireless penetration rate of approximately 89%. *(Qualcomm, SEC Filing, 2009)* The primary factor for growth in the mobile sector is the need for voice services whenever and wherever. This is complemented well by the availability of easy to use handsets, lower cost of service, flat rate plans and bundle packages. From the service provider's point of view too, it is easier to build and maintain wireless networks as opposed to the cumbersome wired networks. This is especially true in developing nations where there is a significant cost advantage when deploying wireless networks where there has never been a wired network infrastructure.

In addition to the voice services, there has been a significant increase in the demand for data services. Such services enable easy access to the internet, email, messaging, social networks, multimedia based entertainment content and a number of value added services. The Yankee Group, a global market intelligence and advisory firm in the technology and telecommunications industries, estimated that more than 3.6 billion people will be using mobile data services by 2013, and the revenue produced from these services will account for 25% of total wireless service revenue worldwide. *(Qualcomm, SEC Filing, 2009)* This actually indicates that the market is tending toward a situation where an individual or family would adopt more readily a wireless voice and data service over a traditional wired voice and data service. In future, such a service could become the only form of communication available to customers.

A recent study by Admob shows that the North American market attribute to over 40% of ad request served by over 23,000 sites it serves. Though this does not represent the entire mobile data market on a whole, it sure dies help in understanding the market trend and the importance of understanding the North American market. *(Admob, 2010)*

Worldwide Requests by Region
May 2010

2% 1% 2%
4%
7%
10%
42%
31%

- North America
- Asia
- Western Europe
- Africa
- Latin America
- Eastern Europe
- Oceania
- Others

Figure 1 Mobile Ad requests worldwide statistics

Source: Admob Google Inc., May 2010

Another important fact to note in the mobile data access is the number of requests on Admob from the Smartphone category. With more users preferring data centric devices, the growth in the smart phone market has been steadily increasing. This is evident with the fact from Figure 2 that the number of requests generated by a smart phone over a

period of one year has increased from less than 40% to almost 50%. During the same

period, the request from multimedia phones reduced by the same margin.
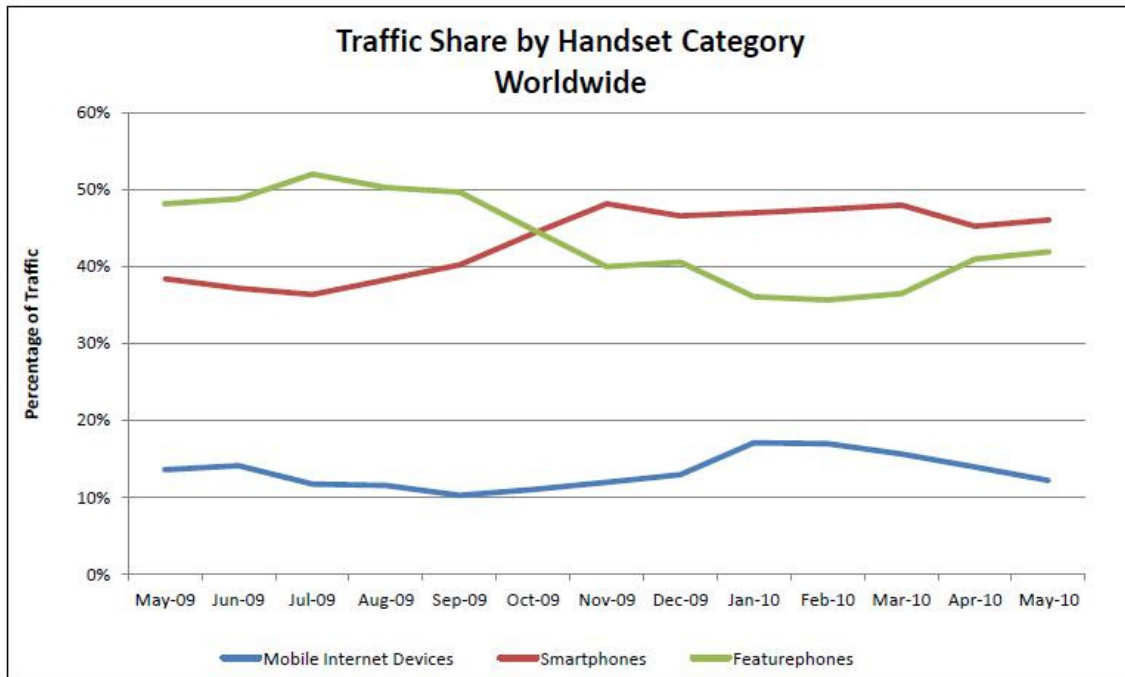
Figure 2 Traffic share in the handset market

Source: Admob Google Inc., May 2010

Before addressing the mobile sector completely, it is important to understand the various

segments of the wireless market. These markets perform as standalone markets but this

study focuses on the areas where they coexist more seamlessly.

2.1   Division of market

The connectivity market comprises of several key technologies that broadly include:

•   Cellular networks: The cellular networks support a variety of devices that

includes: mobile handsets, smart phones, smart books, net books and notebooks, PDAs

eBook readers.

•   Ethernet: This technology provides Internet and device-to-device connections in wired networks in both enterprise and homes, and embedded in devices such as PCs, laptops, routers and similar consumer electronics products. This forms the backbone for internet connectivity. In this study the primary focus is the wireless networks. The Ethernet equivalent of network connectivity wirelessly is commonly referred to as Wireless Local Area Networks (WLAN).

•   WLAN: This supports Internet and device-to-device connections for wireless network infrastructure in homes, businesses and hotspots, and embedded in an increasing number of devices including PCs, smart phones, gaming devices and televisions. This plays an important part while studying the current market trend as devices, apart from the traditional cellular form of connectivity have the option of connecting through a WLAN method popularly known as Wi-Fi for accessing internet based content.

•   Bluetooth technology for personal network connectivity primarily links devices such as PCs to keyboards and handsets to headsets. This is a form of short range communication with limited connectivity to the internet. *(Martin, 2002)* This study does not analyze Bluetooth in detail.

•   GPS providing navigational and location-based information services. This has been traditionally a separate market but with the need for one device to support all features, there has been an increase in the location based services in cellular networks. According to research firm iSuppli, GPS will be increasingly integrated more into cell phones. It is predicted that 79.9% of cell phones will have GPS functionality in it the fourth quarter of 2011. This is up from around 56.1% that were shipped in the first quarter of 2009. *(Shein, 2010)* All the above technologies enable connectivity of some

form or the other to the end user for communication but we focus on the wireless chipset manufacturers of the above technologies. The wireless chipset manufactures that are part of this study include Atheros Communications Inc., Broadcom Inc., Intel Inc., and Qualcomm Inc.

To use some or all of these technologies, there is a need for a service and hence a service provider. The wireless service providers that are a part of this study include AT&T, Sprint and Verizon from the US. Added to this, an overview of the Indian cellular market also forms a part of the study as it helps in providing completeness to the issues addressed.

2.2   Service Provider Review

1. Sprint Nextel Corporation

The two main business segments of Sprint includes: Wireless and Wire line. This review of Sprint is based on its wireless side of business. Sprint owns a third generation (3G) network based on the CDMA technology it licenses from Qualcomm and a national push-to-talk network based on Motorola's proprietary iDEN and Qualcomm's Qchat. Through its mobile virtual network operator (MVNO) relationship with Clearwire, it also offers the first and only nationwide 4G service. Sprint 4G is currently available in 27 markets serving more than 30 million people, and is expected to cover up to 120 million people by the end of 2010. *(Sprint, SEC Filing, 2009)* Sprint sells a broad range of devices that range from basic phone and feature phones to smart phones and mobile broadband hotspot capable devices which in turn work with Wi-Fi enabled devices. Sprint's relationship with a variety of third-party providers enables a market for location-based services, and consumer product providers through open device initiatives. The open

device initiative incorporates selling, marketing, product development, and operations resources to address growing non-traditional data needs, which covers a wide variety of products and services including in-vehicle devices, e-readers, specialized medical devices, and other original equipment manufacturer devices. A huge part of these devices are dependent on a cellular network but in many cases have local area connectivity also possible through the use of Wi-Fi technology. *(Reardon, 2006)*

2. AT&T Inc.

ATT uses a different technology than Sprint and Verizon for it operations, known as UMTS for its 3G networks. Universal Mobile Telecommunications System/ High-Speed Downlink Packet Access third generation (3G) network technology covers most major metropolitan areas of the U.S. This technology provides superior speeds for data and video services, as well as operating efficiencies, using the same spectrum and infrastructure for voice and data on an IP-based platform. *(AT&T, SEC Filing, 2009)* AT&T's wireless network also relies on digital transmission technologies known as Global System for Mobile Communication, General Packet Radio Services and Enhanced Data Rates for GSM Evolution for data communications. AT&T also has announced plans to transition their network to more advanced Long Term Evolution technology in 2011 as network equipment and handsets are expected to become widely available. *(Patrizio, 2010)* Apart from the traditional cellular service, AT&T offers other means of broadband wireless access in a number of locations, including airports and cafes, where customers can access broadband internet connections using wireless fidelity (local radio frequency commonly referred as Wi-Fi) wireless technology.

Like any other wireless service provider in US, the portfolio of users equipments sold plays an important role in sales and growth. AT&T sells a wide variety of handsets, wirelessly enabled computers (i.e., notebooks and net books) and personal computer wireless data cards manufactured by various suppliers for use with their voice and data services. The subscriber base also includes emerging devices (e.g., eReaders and mobile navigation devices) purchased by consumers from third-party suppliers who buy data access supported by AT&T network. *(AT&T, SEC Filing, 2009)*

3. Verizon Communications Inc.

Verizon Wireless provides wireless voice and data services across one of the most extensive wireless networks in the U.S. and has the largest third generation (3G) network of any U.S. wireless service provider. The Verizon network covers a population of approximately 290 million and provides service to a customer base of nearly 91.2 million. *(Verizon, SEC Filing, 2009)*

A key part of Verizon's business strategy is to provide the highest network reliability. Similar to Sprint, Verizon's primary network technology platform is CDMA, based on spread-spectrum digital radio technology. CDMA-1XRTT technology is deployed in virtually all of their cell sites in their CDMA network. In addition, EV-DO, a third-generation packet-based technology intended primarily for high-speed data transmission, has been deployed in approximately 94% of the cell sites in Verizon's CDMA network. Like AT&T, Verizon has chosen and is developing their fourth generation (4G) wireless broadband network using Long Term Evolution (LTE) technology. This new technology follows GSM's evolutionary path but is different from, and is expected to be an improvement upon, the previous generations of both GSM and CDMA-based digital

radio technologies. LTE networks are designed to provide higher throughput performance and improved efficiencies for 4G wireless voice and data services. Verizon plans to launch the LTE network in 25 to 30 markets in 2010, and to cover virtually the entire current 3G network footprint by the end of 2013. *(Verizon, SEC Filing, 2009)*

2.3 Wireless Chipset Manufacturer Review

Competition in the wireless chipset market is affected by various factors, including:

- Comprehensiveness of products and technologies and level of integration of product portfolio;
- Value added features which drive replacement rates and selling prices without any compromise on quality, network throughput, product range, power efficiency, security features, reliability and consistency;
- Manufacturing capability;
- Scalability and the ability of the system technology to meet customers' immediate and future network requirements;
- Design and engineering capabilities;
- Ability to comply with, and influence, industry standards and international regulatory requirements;

One of the issues with the chipset industry is that there is a direct reflection on the increase in developmental costs and hence pressure on lowering the selling price to meet those from competitors. The outcome is that there is a need for increasing the sales volume so as to meet the cost incurred in manufacturing. This results in the pressure to add new features to an existing product line. An example of this is the increase in the

number of combo chipsets. Chipset manufactures tend to mitigate lower demand by increasing their product portfolio. *(Atheros, SEC Filing, 2009)*A Wi-Fi chipset with a particular form factor is redesigned with a Wi-Fi and a Bluetooth combo chip and in some cases a third technology such as FM radio is added. The end product is a chipset of the same size but with increase in features. This is actually a result of a two way pressure. One there is an increasing demand for combo chipsets among vendors who in turn are under pressure to have the most feature enabled handsets, and another reason is the chipset manufacturers need for constant innovation on existing product line so as to differentiate their product from that of their competitors thereby making their buyers more competitive. While pricing pressures from competition may, to a large extent, be mitigated by the introduction of new features and functionality in products as evidenced by the recent success of smart phones and other feature rich, data capable devices, there is always the uncertainty of challenges posed by competing standards. Hence, the chipset manufacturing companies need to be aware of what technologies they adopt and try to combine in their chipsets. The division of the chipset market is done through a portfolio review. *(Trefis, 2010)*

1. **Atheros Communications Inc.**

The main areas of focus includes technologies for wireless and wired communications products that are used by a broad base of customers, including manufacturers of personal computers, or PCs, networking equipments for digital home, small office/home office, or enterprise and carrier deployments, and consumer electronics for home and mobile applications. This added with wireless and wired systems and software expertise, the high-performance radio frequency, or RF, mixed signal and digital semiconductor design

skills, Atheros provides highly integrated chipsets that are manufactured on low-cost, standard complementary metal-oxide semiconductor, or CMOS, processes. The product portfolio includes solutions for Wireless Local Area Network, or WLAN, Mobile WLAN, Ethernet, Bluetooth, Global Positioning System, or GPS, and Power line Communications, or PLC. *(Atheros, SEC Filing, 2009)*

2. Broadcom Corporation

The product portfolio of Broadcom could be categorized as mentioned in their Annual report as the following:

Solutions for the Home (Broadband Communications) - enabling such products as digital cable, satellite and Internet Protocol (IP) set-top boxes and media servers; cable and digital subscriber line (DSL) modems and residential gateways; high definition televisions (HDTVs); high definition Blu-ray Disc® players; and digital video recorders (DVRs).

Solutions for the Hand (Mobile & Wireless) — integrating solutions in applications for wireless and personal area networking; cellular communications; personal navigation and global positioning; processing multimedia content in smart phones; and for managing the power in mobile devices; and

Solutions for Network Infrastructure (Enterprise Networking)— incorporating solutions for the business network requirements of enterprise, data center, small-to-medium-sized businesses (SMBs), and carriers and service providers, featuring high-speed controllers, switches and physical layer (PHY) devices supporting transmission and switching for local, metropolitan, wide area and storage networking and server solutions. *(Broadcom, SEC Filing, 2009)*

Both Atheros and Broadcom have a similar product line and mostly compete head to head on all areas of business.

3. Intel Corporation

As mentioned in their annual report, Intel has 9 significant groups for its operation.

- *PC Client Group.* Delivering a high-quality computing and Internet experience through Intel architecture-based products and platforms, primarily for notebooks, net books, and desktops.

- *Data Center Group.* Delivering server, storage, and workstation platforms for small, medium, and large enterprises.

- *Embedded and Communications Group.* Delivering Intel architecture-based products as solutions for embedded applications through long life-cycle support, software and architectural scalability, and platform integration.

- *Digital Home Group.* Delivering Intel architecture-based products for next-generation consumer electronics devices with interactive Internet content and traditional broadcast programming.

- *Ultra-Mobility Group.* Building a business in the next-generation handheld market segment with low-power Intel architecture-based products.

- *NAND Solutions Group.* Delivering advanced NAND flash memory products for use in a variety of devices.

- *Wind River Software Group.* A wholly owned subsidiary delivering device software optimization products to the embedded and handheld market segments, serving a variety of hardware architectures.

- *Software and Services Group.* Delivering software products and services, in addition to promoting Intel architecture as the platform of choice for software development.

- *Digital Health Group.* Delivering technology-enabled products that are designed to reduce healthcare costs and connect people and information to improve patient care and safety.

Our main focus in the Intel business is the wired and wireless connectivity products that work across the PC client, embedded, home connectivity and mobility groups.

The wireless and wired connectivity products include network adapters and embedded wireless cards, based on industry-standard protocols used to translate and transmit data across networks. Wireless connectivity products based on Wi-Fi technology allowing users to wirelessly connect to high-speed local area networks, typically within a close range. Other wireless connectivity products for both mobile and fixed networks include products based on WiMAX, a standards-based wireless technology providing high-speed broadband connectivity that can link users and networks up to several miles apart. *(Intel, SEC Filing, 2009)*

4. **Qualcomm Inc.**

Qualcomm publicly introduced the concept that a digital communication technique called CDMA could be commercially successful in cellular wireless communication applications. CDMA stands for Code Division Multiple Access and is one of the main technologies currently used in digital wireless communications networks. CDMA and TDMA (Time Division Multiple Access), of which Global System for Mobile Communications (GSM) is the primary commercial form, are the primary digital

technologies currently used to transmit a wireless device user's voice or data over radio waves using a public cellular wireless network. Qualcomm licenses to other companies and implement in their own products CDMA based technology and chipsets.[1] Its product portfolio includes:

- CDMA-based integrated circuits (also known as chips or chipsets) and Radio Frequency (RF) and Power Management (PM) chips and system software used in mobile devices (also known as subscriber units, which include handsets and modem cards) and in wireless networks;

- Software products and services for content enablement across a wide variety of platforms and devices for the wireless industry;

- Services to wireless operators delivering multimedia content, including live television, in the United States;

Qualcomm designs CDMA-based integrated circuits and system software for wireless voice and data communications, multimedia functions and global positioning system products and also creates multimode and multiband integrated circuits incorporating other wireless standards for roaming in global roaming markets. The main consumers are manufacturers of wireless devices, particularly mobile phones, laptops, data modules, handheld wireless computers, data cards and infrastructure equipment. *(Qualcomm, SEC Filing, 2009)*

2.4   Market Cycle

While addressing the semiconductor industry it is important to understand the cyclic nature of its business. The global semiconductor market is characterized by constant,

though generally incremental, advances in product designs and manufacturing processes. Semiconductor prices and manufacturing costs tend to decline over time as manufacturing processes and product life cycles mature. Typically, new chips are produced in limited quantities at first and then ramp to high-volume production over time. The "semiconductor cycle" is an important concept that refers to the ebb and flow of supply. The semiconductor market historically has been characterized by periods of tight supply caused by strengthening demand and/or insufficient manufacturing capacity, followed by periods of surplus inventory caused by weakening demand and/or excess manufacturing capacity. This cycle is affected by the significant time and money required to build and maintain semiconductor manufacturing facilities. *(Texas Instruments, SEC Filing, 2009)*

2.5   Summary

From the data gathered in the literature review, the US cellular market has a mobile penetration of almost 90%. The market is fairly stable and covers most parts of the US. The main portion of revenue for operators is the voice services and there has been a steady growth in revenue from data services. Clearly the future of the mobile growth in US is the mobile data sector. In comparison in the Indian market the mobile penetration is mostly restricted to the big cities and the rural sectors pose a great opportunity for growth. The key aspect from the Indian market is the success of pre paid cellular services and its impact on the sudden boom in the sector. Though US has pre paid options for its customers, the aim of the study here is to find if a much larger scale of the pre paid model with no contracts work in the US. Another key aspect gained from the SEC flings of the three service provider companies is the need to carry the best selection of devices. This

forms an important part of attracting customers. In turn the chipsets and the capabilities of the chipsets are an important factor in building a wide range of phones. From the study of the wireless chipset manufacturers it was found that the more technologies a company can work on and build multiple chips the better chances they have for design wins. Based on the information gained from both the wireless chipset and wireless service provider reviews a survey and two interviews were conducted to understand the user perception. The process and methodology of the survey and interview is covered in Chapter 3 and the results are produced in Chapter 4.

3. Process and Methodology

The primary findings from the secondary market research are summarized in this section. The section is divided into three categories, the factors that are considered as common risk factors to all industries and the factors that are considered a risk to each separate industry.

2.1 Risk Analysis

1. Factors that are considered as common risk factors to all three sectors: wireless service provider, chipset manufacturer and handset manufacturer

Global economic conditions that impact the wireless communications industry could negatively affect the revenue and operating results of all companies.

The industry is subject to rapid technological change, and the players must make substantial investments in new products, services and technologies to compete successfully. If they are unable to develop and introduce new products successfully and in a cost-effective and timely manner, the operating results could be adversely affected.

If the companies are not able to take advantage of technological developments in the telecommunications industry on a timely basis, there will be a decline in the demand for their services or may be unable to implement their business strategy successfully.

Hence it is extremely important that the right product is delivered at the right time in the right form.

2. Factors that are considered a risk to the wireless service provider industry

It is always a challenge to develop attractive and profitable product/service offerings to offset increasing competition. While doing so, it is important to compete successfully for

new subscribers and to retain the existing subscriber base and reduce the rate of churn. The lower the churn rate the higher the bottom line.

There is always the fear that competitors could offer products and services at lower prices due to lower cost structures and in some situation just to regain the lost market, which may pose a challenge for some companies. Also, another issue could be a company could have a lower wireless fee as they could offer a bundle package with TV and internet thereby attracting more customers.

Another factor that is a major challenge to wireless service providers is the availability and cost of additional wireless spectrum, the regulations related to licensing the spectrum, and the technical standards involved in deploying the specifications. Independent of the development of technology and rapid pace at which it could be deployed; there is always the uncertainty of tackling government regulations and successfully bidding wireless spectrum.

3. Factors that are considered a risk to the wireless chipset industry:

The deployment of technology and expansion rate if not as expected could harm the sales. Say for example, if wireless network operators delay or are unsuccessful in the commercial deployment or upgrading the 3G technology or if they deploy other technologies then manufacturers of one technology chipsets get adversely affected.

One of the main issues faced by all chipset manufacturers is that they depend on a few significant customers and/or design wins for a substantial portion of their revenue. So, the loss of a key customer or design win or any significant delay in the customers' product development plans could seriously impact the revenue and harm the business. Hence, customer retention is a huge challenge. Most of the chipset manufactures sell their

products to OEM and ODM vendors. This puts the chipset manufacturers in a spot as they have limited visibility as to the volume of sales of their products by customers and inventory levels of the products held by their customers. Hence, the ability to accurately forecast future demand of their products is limited.

One key aspect of the chipset industry that is common among all manufacturers is that their products typically have lengthy sales cycles. A customer may decide to cancel or change its product plans, which could cause a huge loss from anticipated sales.

The complexity of the products delivered to customers could result in unforeseen delays or expenses from undetected defects, errors or bugs in hardware or software, which could reduce the market acceptance for new products, damage the reputation with current or prospective customers and adversely affect the operating costs.

Another key issue is compliance with standards. Most products designed have to conform to standards set by industry standards bodies and alliances such as the IEEE, the Bluetooth Special Interest Group and Wi-Fi Alliance. Hence there is a dependence on industry groups to certify the products. If customers adopt new or competing industry standards with which these products are not compatible then the existing products would become less desirable to customers.

3.2   Process Definition

The aim of the study was to understand the perception of general customers in the US on the current mobile market. To this end the tools that were used to understand the trend was a survey and a set of two interviews. The focus of the survey was to gather input from current mobile users as to what they think were right in the current model and what they thought could be different. This primary research helped in understanding greatly

the nature of the market. The next phase of collecting data was through a set of two interviews. The first was with an experienced telecommunications professional from the wireless service provider industry and the other was from a global product engineering and software quality assurance professional from the wireless chipset industry. The questions asked to the interviewers were specific to their domain of expertise and comprised of understanding what the future of the market could be. None of the questions asked pertained to a single service provider or a chipset manufacturer. The responses were gathered in the aim of understanding the entire business structure.

3.3   Survey Methodology

The survey was conducted using a third party online tool provided by SurveyGizmo.[12] The survey was conducted among a diverse group of mobile customers that consisted students in the EMGT 835 class, friends, business and academic professionals and acquaintances. The survey consisted of a set of 25 questions mostly multiple choices and tried to understand the user perception of the mobile market. Some of the questions that were asked are listed below. The entire set of survey questions has been added to Appendix A.

The survey was divided into the following groups from a study perspective though the actual survey did not sub divide any of the categories.

1. The kind of mobile hand set the user owned

2. The kind of service the end user was using

3. The opinion on the service the customer was using and the factors that were tied to their liking or disliking their service

4. Their opinion on the current US business model and the feasibility of adopting changes to the existing model.

5. Alternate means of mobile data communication and their usability in the market.

Sample Survey Questions:

1. Under what category does your mobile device fall?

2. What is the aspect of the handset you currently own that you like the most

3. The American cellular model is largely different than, say for example most Asian markets where largely the customer gets to choose the handset of his choice and then the service provider. As a consumer do you think such a model would work in the US?

4. Which selection of devices would you like to see more in your wireless service provider's handset portfolio?

5. What is your opinion on prepaid wireless services?

6. If you own a smart or a multimedia feature phone, do you think you are making good utilization of your phone's internet capabilities and justify the amount you spend every month on wireless bills?

7. As a consumer what are the changes you would like to see in the mobile telecommunication space?

3.4 Interview Methodology

The interview phase was conducted in two phases again using the online tool Survey Gizmo. This was a module where the interviewer was asked specific questions related to the industry they work and their perspective was taken. As the two main industries we are

focusing here include the service provider industry and the chipset industry, the questions were kept specific to their area of expertise.

The interview covered the following topics:

Wireless Service Provider Interview

1. Where do you think the industry is positioned? Do you think the wireless business in general has saturated or is there a scope for growth in the industry?

2. What do you consider to be the Universal Selling Point of the service provider industry?

3. The US wireless business model is largely different than other regions such as in Asia where the user in most cases gets to choose his handset of his choice and go with a service provider of this choice? Do you think such a model would work in the US? Will moving away from the handset portion of support actually streamline the business vision of a service provider?

4. In general what steps do you think service providers could take to improve overall user experience?

Wireless Chipset Industry Interview

1. How do you think the industry is positioned? Where do you think the future of the business is?

2. What do you consider to be the USP (Universal Selling Point) of a chipset company? Which of these do you consider to be the main factors to achieve design wins?

3. Assuming the US mobile market would continue on the service provider and consumer relationship model, do you think chipset manufacturers will have to work more closely with service providers in addition to the relationship with the device manufacturers?

4. Results and Conclusion

The survey was conducted over a period of 3 weeks using the online tool. The data gathered from the survey and the interview was carefully analyzed and the results from the survey are summarized in the sections below.

4.1   Data Gathering and Key Findings from the survey

The total number of responses collected from the survey was 36. All the 36 respondents owed a cellular phone. Of this 27 people or 75% of the people who participated owned a smart phone and the rest owned a multimedia phone or a simple feature phone. So, the demographic of people who have responded mostly are users of much more than the voice service available through a phone. This helps in this study as the main data needed is to understand the changing trends of the industry and this does help understand the evolution of the mobile telecommunication technology. As this study was exclusive to the US, the possibility of most users using a monthly service plan was expected. Rightly, over 90% of the people who participated bought wireless service from a service provider and were tied to a contract. Again, over 90% of the people bought their handset from a wireless service provider. This confirms that the US service provider market still has a tight control on the handset market and the way customers get their devices. Other general information of the participants including their monthly wireless spending and usage is shown in Figure 3 through 6. For example, as shown in Figure 5, one-third of the respondents thought they paid the right price for wireless services, while another on-third felt they could cut about $20 every month on wireless spending.
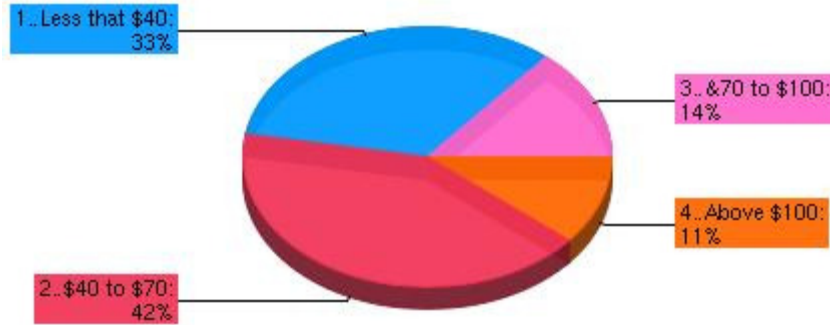
Figure 3 Monthly wireless spending distribution

Value	Count	Percent %
1. My wireless usage on a per month basis is almost the same and does not vary by a margin of 10%	22	61.1%
2. My wirleess usage on a per month basis varies largely and is dependendent on more than one reason.	7	19.4%
3. I do not keep a track of my wireless usage and have no plans of monitoring.	7	19.4%

Figure 4 Wireless usages on a per month basis
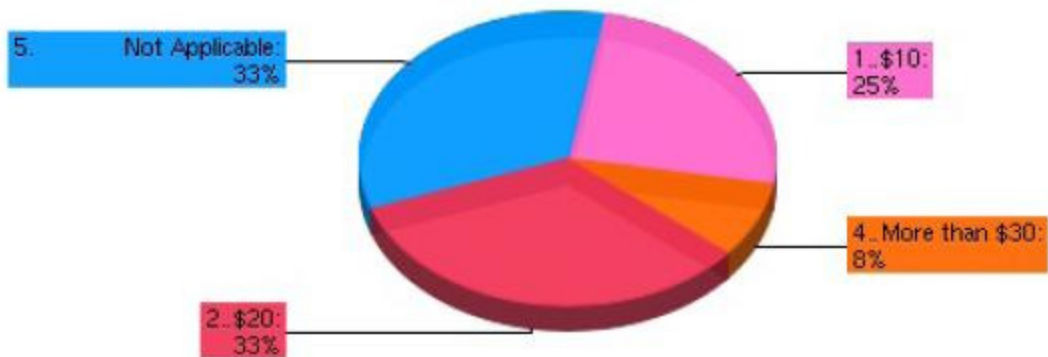
**Figure 5** Average anticipated costs cutting on wireless spending
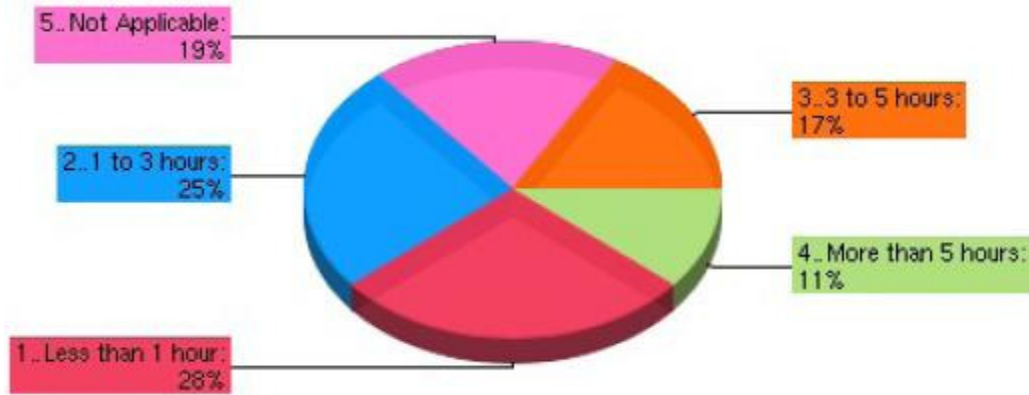
Figure 6 Average time spent per day for data centric activities on the phone

With the general participant demographic defined, the overall experience part is next presented.

Some of the key findings from the survey include:

1. **Customer satisfaction with the current service provider**

The customer satisfaction on the network a customer uses was around 50% both ways. So this study had an even base of customer responses in terms of their satisfaction. This gave a general impression on the kind of responses to expect in the survey.
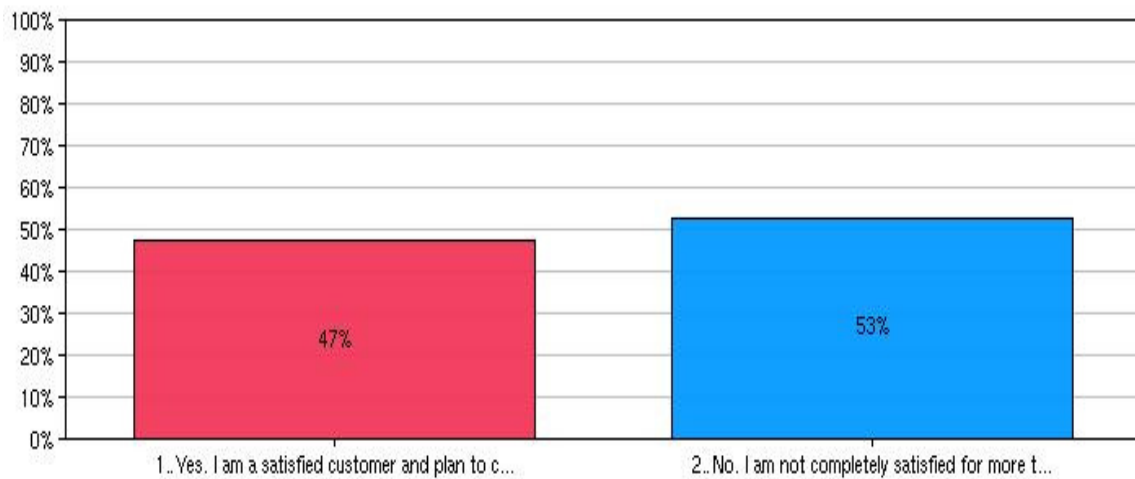
Figure 7 Customer Satisfaction with service provider

2. Customer retention or attrition

To a question to know the reason behind a customer choosing to stay or leave a service provider, the top reasons the respondents choose were the network coverage of service provider and the price/tariff options. 66% of the responses as shown in Figure 8 identified the above stated two reasons. About a third of the respondents chose the selection of handsets available from a service provider to be the reason to stay with a network. This is an important point to note as this addresses the issue of the wide selection of handsets that a service provider tries hard to add to their portfolio so as to attract customers. On the contrary, the customers are more interested in the network quality and price options.
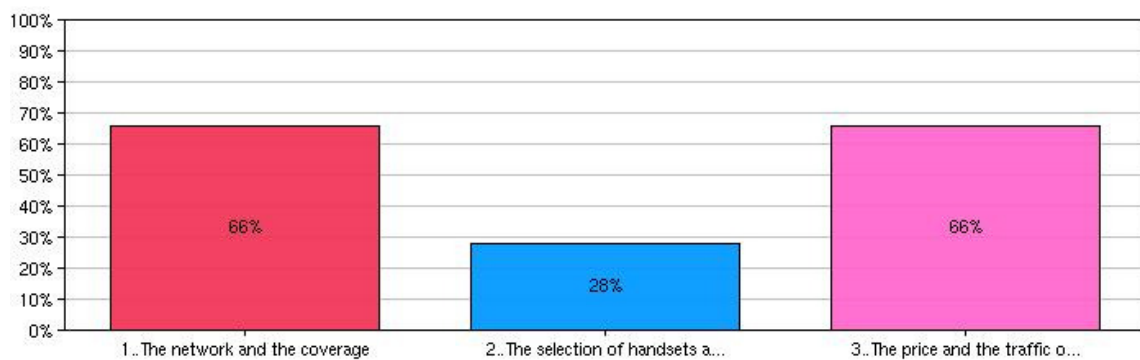

Figure 8 Customer retention or attrition

3. Opinion on the US cellular market model

One of the key aspects that were covered in the survey was the opinion of the participants on the current model used by US service providers. One of the issues that was addressed to the participants was the vast difference in the way cellular service is provided to customers in Asian markets which is mostly contract less and pre paid in most cases and the tight control that service providers have in the US. To this 78% of the participants felt such options if existed in the US cellular market would be beneficial and the rest 22% were unsure as there was lack of clarity as to how that would turn out. The interesting

point to note from the responses is that none from 36 participated chose the option of a model similar to the Asian market not working here in the US. Though there was a sure concern of not have enough clarity, the response was in favor of a more open market.
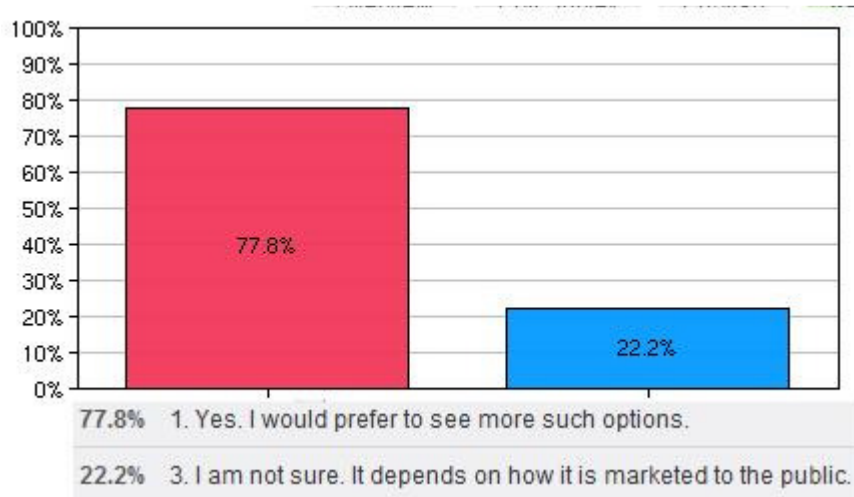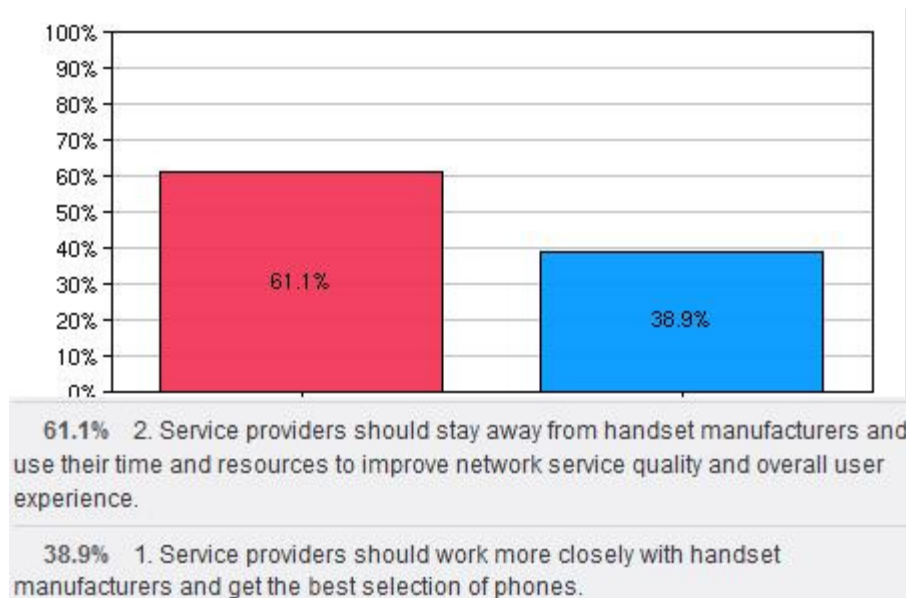

Figure 9 General opinion on US cellular market- Question 1
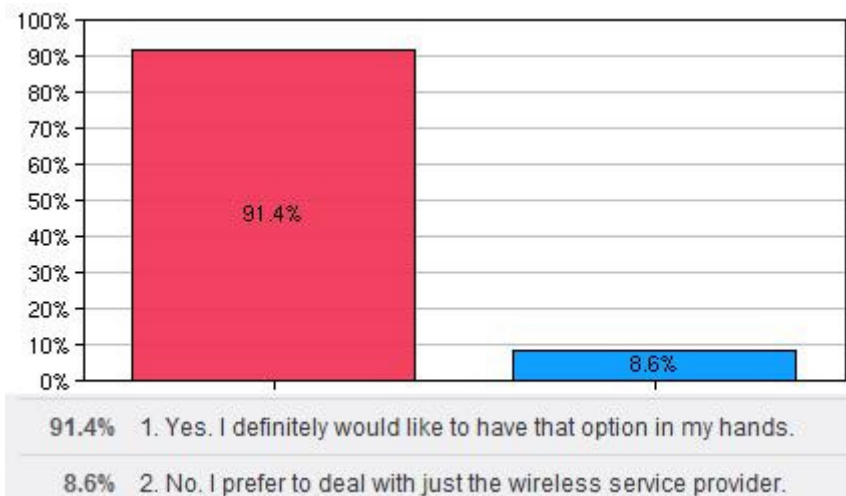
Figure 10 General opinion on US cellular market- Question 2

4. Role of service providers

To a question as to what should be the primary role of wireless service providers, a majority of over 61% of participants felt that service providers should stay away from handset manufacturers and use their expertise in providing a better service in their primary role i.e. network. The rest 39% felt that there was still scope in the US market for service providers to work more closely with the handset manufacturers. At the same time, none of the participants agreed on the fact that service providers perform better due to their tight control over the handset selection.

61.1%   2. Service providers should stay away from handset manufacturers and use their time and resources to improve network service quality and overall user experience.

38.9%   1. Service providers should work more closely with handset manufacturers and get the best selection of phones.

Figure 11 Role of wireless service providers

5. Opinion on prepaid cellular model

Over 55% of the participants had a fair understanding of the pre paid contract less cellular model but would not consider it as a future option to get cellular services. The rest 45% mentioned they would consider it as an option in the future. At the same time, 50% of the participants felt there will be an increase in the prepaid market and more

players would offer such services. The main drawback would be the lack of clarity in the structure. As far as the portfolio of services are concerned, the users would like to see both voice and data services. This data is captured in Figures 12, 13 and 14.
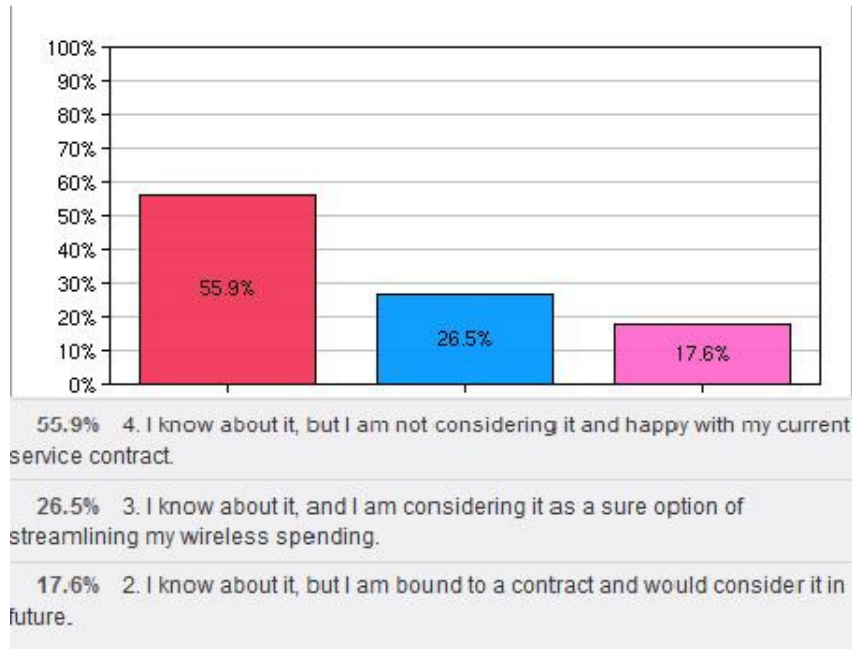
Figure 12 Prepaid cellular model
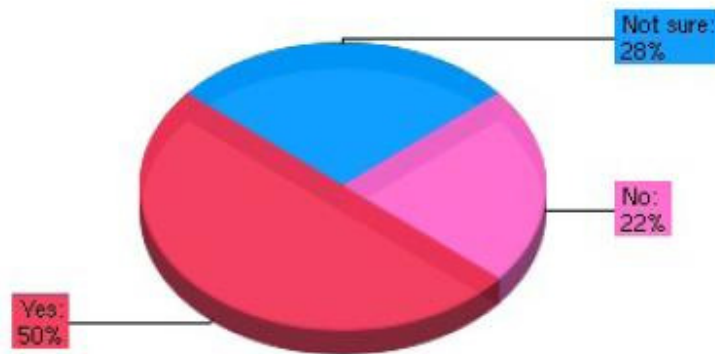
Figure 13 Future of a prepaid tariff structure in US

Figure 14 Portfolio of services in the pre paid model

6. Alternate data access method

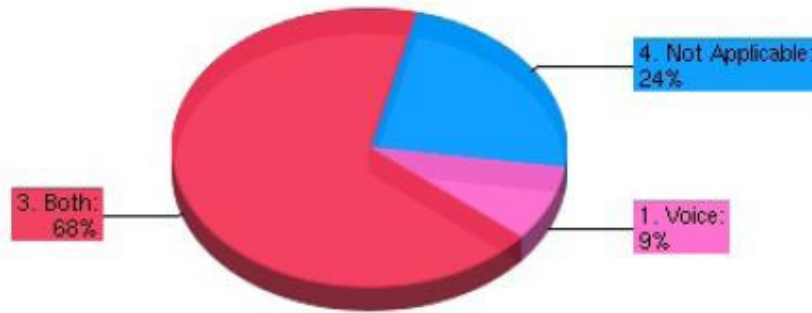Almost two-thirds of the participants had an alternate method of accessing internet content in their phone. The technology that is popular and most used is Wi-Fi. A number of service providers themselves have Wi-Fi hotspots across many commercial spots in cities. Users have the option of switching to such hot spots. Over one-third of the respondents used Wi-Fi to save 3G/4G data usage.
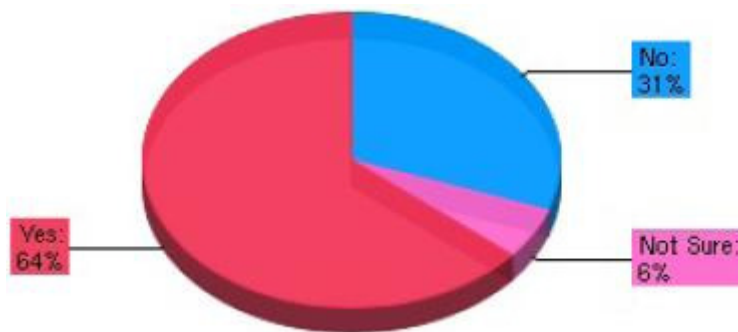
Figure 15 Wi-Fi in phone

On the other hand, around 27% of the respondents owned another gadget in the similar mobile connectivity context and primarily used Wi-Fi. About 80% of the users used Wi-Fi and only 10% chose either 3G/4G or both.
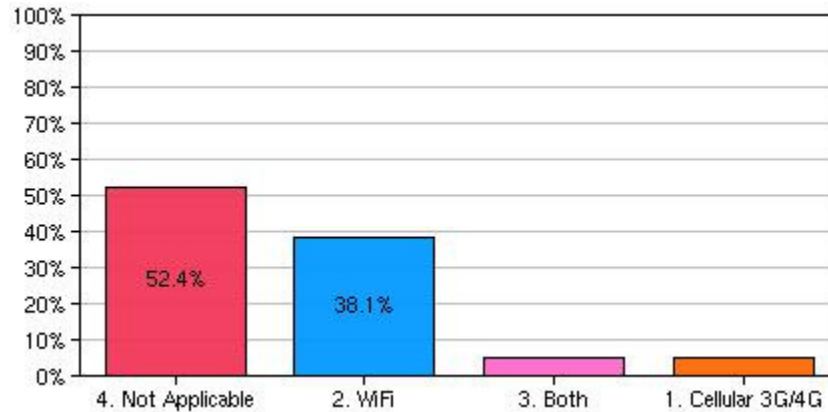
Figure 16 Mode of wireless connectivity

7. General Comments from survey participants

The last question in the survey that was asked to the participants was general comments on the telecommunication market. Excerpts from the response are documented below and the entire set of responses is given in Appendix B.

1. The users should be given the choice of choosing their devices independent of their providers which would increase competitiveness in improving service and network coverage and not just depend on the phone's advertising to attract customers.

Better coverage. I hope I can buy whatever cell phone I want without contracts.

2. I want to be able to get a decent phone that works well and is easy and convenient in conjunction with an inexpensive data plan that does not force me to bundle a messaging or data plan. Right now, the only alternatives are lousy phone and no data or messaging OR quality phone with an expensive monthly plan.

3. I would like to see more prepaid no-contract options with a more competitive pricing scheme.

4. I would like to see the option of having the mobile as a simple telephone. In other words: no texting, no surfing the web, no accidentally connecting to the web and have to

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pay for the mistake, and just have the space available in the phone to have the basic

dialing numbers. Of course, I don't mean let's go back to the past. Just make choices

available for everyone. My personal choice... A simple phone with only access to make

live voice calls.

5. I would like to see more emphasis on developing better longer lasting battery

technology. More environmentally friendly would be good also.

6. I would like to see decoupling between handset manufacturers and service providers. I

would like to see service providers coming up with content services that can lead to

innovative ideas in entrepreneurship.

7. Separation of handset and cellular services: Contract free options - Larger choice of

non-multimedia phones with faster operation (startup time, etc) and much better voice

service/signal.

4.2   Key findings from the wireless service provider interview

The focus of the interview was to get a much deeper understanding on the role of the

wireless service provider. The interview was conducted using the Survey Gizmo online

tool. The interviewee was a highly experienced telecom professional and group manager

from one of the leading wireless service providers in America.

1. With your years of experience in the wireless service provider industry, where do you

think the industry is positioned? Do you think the wireless business in general has

saturated or is there a scope for growth in the industry?

I believe that the growth in not in voice, but in data and how the wireless device is utilized. It has really gone from just a phone to a portable device to check email and do other business related activities.

2. What do you consider to be the USP (Universal Selling Point) of wireless service providers? Which of these do you consider to be the main factors to retain customers with a service provider? You may add others if you have any?

a. Portfolio of devices sold

b. Quality of network built and service provided

c. Marketing and promotions to attract and retain customers.

I think that b is most important (it has to work where you want it to work as a customer) and c is second. Customers like to feel like they are appreciated.

3. The US wireless business model is largely different than other regions such as in Asia where the user in most cases gets to choose his handset of his choice and go with a service provider of this choice? Do you think such a model would work in the US? Are there any learning points from such a model that could be partially adopted to attract or retain customers? Do you think aspects of these could become the future of how business is done?

Well with the predominate carrier being CDMA and the way that the CDMA phones are designed, I really do not see that happening in the near future, but there is more shift to open networks and as the 4G technology starts to converge more you might see more of that. As it is, you can almost find the same phones on each network.

4. Further, do you think if there existed a more open choice for customers to choose a handset directly from the vendor and come to a service provider for just wireless services,

then will it create an opportunity for service providers to concentrate on just the network aspect and not actually have to deal with handset providers? Will moving away from the handset portion of support actually streamline the business vision of a service provider?

Yes, it would and it would also help the network providers from getting bad press if a particular handset did not work well as long as it did not work well across all of the networks. Today you see certain networks getting a lot of bad press because a popular phone does not work (bad reception or does not have a strong signal). It is rare to see the phone vendor getting that bad press. Yes these could be network issues, but if one phone works well in the other does not in the same area, it is the phone.

5. In general what steps do you think service providers could take to improve overall user experience?

They need to look at the problem, so to speak, more from the user perspective. How is it working to the user, not just what new function can be added. The first thing a user wants is for it to work where they are so a better understanding of how the devices are utilized would help.

4.3 Key findings from the wireless chipset industry interview

The two more correlated industries in the market are the service provider and the handset manufacturer industry. The chipset industry in most cases work only with the handset or equipment manufacturer industry. The aim of this interview was to understand the changing dynamic of the chipset industry and how it could influence the mobile market. The interviewee was the director of software testing and QA in one of the fastest growing chipset manufacturers in the semiconductor industry.

1. With your years of experience in the wireless chipset industry, how do you think the industry is positioned? Where do you think the future of the business is?

In the past 5-10 years Wi-Fi has gained significant acceptance resulting in an explosive demand for WI-FI chips across several markets (retail, enterprise, CE, Mobile etc). This continued upward growth of the WI-FI industry coupled with its integration with other technologies such as Bluetooth, GPS, 3G, PLC etc has positioned WI-FI as key technology that's here to stay for a while. The future of the business is in creating seamless integration between all communication technologies (Wi-Fi, 3G, BT, PLC etc).

2. What do you consider to be the USP (Universal Selling Point) of a chipset company? Which of these do you consider to be the main factors to achieve design wins?

1. Portfolio of chipsets sold. (Includes stand alone and combo products sold)

2. Pricing point and aligned marketing to attract and retain customers.

3. Manufacturing, design and engineering capability

4. Software and software quality.

All of the above points are vital in getting design wins with customers. - Chipset portfolio/roadmap allows customers to align with our roadmap and see a variety of options for productization - Pricing point is crucial since it is a competitive market and no one has unlimited budget. - Customers generally review our Manufacturing/Design/Engineering capabilities before big design wins - SW integration and SW quality are important in keeping customers on board and sustaining design wins.

3. Drifting a bit, the US mobile business model is largely different than other regions such as in Asia where the user in most cases gets to choose the handset of his choice and go with a service provider of this choice? Do you think such a model would work in the

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US? If aspects of this model were to become a reality, can the chipset manufacturers do anything different to increase the portfolio of products in which their chipsets go into?

Both plans (pay as you go and monthly) are available in the US already. Most people prefer monthly plan since the total cost of "pay as you go" would probably be the same or exceed the monthly plan. This aspect may not impact chip vendors since chip vendors sell chips to all types of handset manufacturers that can work on any network and are hence not bound to any service provider.

4. Assuming the US mobile market would continue on the service provider and consumer relationship model, do you think chipset manufacturers will have to work more closely with service providers in addition to the relationship with the device manufacturers? Will a three way communication between the service provider the equipment manufacturers and chipset manufacturers help create a wider selection of products with more enhanced features for its customers? If you agree, how do you think this relationship equity can be improved?

I think this relationship between service provider-the equipment manufacturers and chipset manufacturers (for cellular technologies: GSM/CDMA/3G etc) has existed for a while. The cellular industry is about 15-20 years old and has observed these relationship models.

5. With the market moving toward high end devices like smart phones, tablets etc. the demand for more niche chipsets has increased. That being said, a major portion of business for most major chipset manufacturers comes from the volume sales achieved from low end products. In your opinion, what do you think the chipset manufacturers need to do to tackle this problem of plenty?

The overall revenue distribution across chip families (high end/low cost etc) is fairly even. low cost chips usually have a lower margin while the high end ones have lower volume, they sort of even out. In the long run the high end ones eventually become low cost due to the fast pace of the silicon industry.

6. Lastly, in general what steps do you think chipset manufacturers could take to increase its market cap?

Provide a variety of productization options to customers involving multiple technologies with seamless integration.

4.4   SWOT Analysis

Based on the results obtained from the survey and the interview a conclusion was made on the trend in the wireless communication market. This is presented in the form of Strength, Weakness, Opportunities and Threats.

Strength:

1. The size of the market and the potential customer base is huge.

2. The diffusion of innovation is changing as far as the wireless industry is concerned. The general trend we see is that the customer base of early adopters and early majority is widening. An observation in this survey conducted with a varied demographic was that the number of smart phone users was over 75%. This shows that the consumers are open and want more features on their phones than just voice.

3. Wireless chipset manufactures are having a great market to work with more devices needing some sort of wireless technology. As mentioned in the wireless chipset interview, for example, in the past 5-10 years Wi-Fi has gained significant acceptance

resulting in an explosive demand for Wi-Fi chips across several markets (retail, enterprise, CE, Mobile etc).

4. One of the biggest strengths of the chipset manufacturers is the ability to build gadgets at an extremely competitive prize as the design is done in house and manufacturing is done overseas in most cases. This is an advantage for the device manufacturers and enables them to provide high end gadgets at a much lower price across various markets.

Weakness:

1. The contract that customers need to sign for obtaining wireless service. A number of participants felt a contract less service will be the best option.

2. The coupling of handsets and service providers is a model that has been extremely successful for service providers to attract new customers but the same cannot be told on the customer perception on this subject. Over 90% of the survey participants mentioned they would choose a more open market of selling handsets if they had that option in hand. The closed structure of the market is not what the consumers need. Also, over 60% of the participants felt that service providers should stay away from selling devices and work in providing better service to customers.

Opportunities:

1. Improve customer service and experience. From the survey it was clear that the customer satisfaction rate was 50% either ways. From some of the user comments it is clear that all service providers in one way or the other do not satisfy the needs to the user.

2. Service providers can create a more tiered/pre paid data usage centric that is easy to understand as more customers are looking at such options. Only 26% of the participants mentioned they are considering a pre-paid wireless model as a possible way of

streamlining their spending. Over 55% mentioned they would stick to the current model of buying wireless service. At the same time, over 50% of the participants did feel such a structure would be introduced at different level by carriers in the market. Users at the same time, if offered wanted to see both voice and data options in the pre-paid category.

3. Seamless integration of multiple technologies and platforms to build the same. This is a great opportunity for both the chipset manufacturers where they can work with multiple technology pioneers and more seamlessly integrate their technologies. The biggest opportunity would be the integration of Wi-Fi with cellular standard such as 3G and 4G.

4. The market is still open for technologies like Wi-Fi. Over 35% of the smart phone and multimedia phone users mentioned that they used Wi-Fi to access internet content to save on 3G and 4G usage. This is a great opportunity for chipset manufacturers to capitalize. They can add more such components in their portfolio. The biggest of the opportunity seen is the e-book reader and tablet PC market. This is significant as such devices are becoming popular more people will want to access the internet. At the same time not want to pay a lot for 3G services. Integrating Wi-Fi with 3 and in some case selling stand alone Wi-Fi based gadgets has proved profitable for customers. The same sentiment was echoed in the wireless chipset interview. This market is still huge and open as only about 25% of the users actually owned devices in this category.

5. Another important opportunity for chipset manufacturers is to work on the battery technology. As right discussed in the wireless service provider interview, an improvement in battery technology will help get more mileage out of data centric devices. A lot of users complain about the battery life of gadgets. Devices with stronger

battery life and better and more efficient power saving methods will help boost gadget sales.

Threat:

1. Form the survey it was found that over 40% of people spend somewhere in the range of $40 to $70 per month and the wireless usage of over 60% of the people was fairly constant on a month to month basis. On the other hand over 33% of the participants felt they wanted to cut over $20 every month on wireless spending. This shows people are willing to spend for wireless services but are cautious about their usage and constantly look for minimizing expenditure.

2. The unhappy customer base may increase and look for less fancy and cheaper services which may be a threat to the amount spent on building data centric networks and bringing in data heavy products to customers. It is worth to note from the survey that a number of users were unhappy with the phone becoming more than just a voice service device and simple feature phones were slowly fading away.

3. One of the threats that service providers face is the chances of losing customers due to engineering defects and anomalies in the handset they sell. As noted from the wireless service provider interview, one of the major threats to the current US model is the chances of getting bad press and eventually losing customers for selling one bad device or gadget. This added burden of selling handsets by wireless service providers may boomerang against their sales strategy.

4. One of the threats of the chipset industry is merger of the right technologies and the increased capability with which they could be integrated. This is an opportunity to

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achieve more design wins but at the same time any miscalculation in manufacturing the right technologies together may erode off potential equipment manufacturers.

4.5   Summary

In summary, the survey was helpful in understanding the user perception on the following topics:

1. Opinion on the selection of user equipment available

2. Opinion on the service provider market and their satisfaction

3. Opinion on the role of the service provider market and how can they work to improve their service.

4. Opinion on the contract based service and contract less prepaid options

5. Opinion on the current US cellular model and aspects that could be adopted from other growing markets.

The survey was helpful in understanding the relationship between the wireless service provider market and handset manufacturer market.

The interview was more focused on understanding the role of the service provider from the industries perspective and how changes could be adopted. The last aspect covered was the chipset interview and this was able to close the end in the three way relationship between the service provider, handset manufacturer and the chipset manufacturer.

4.6   Conclusion

The survey had a sample size of 36 participants and the interviews were conducted with one professional each from the chipset industry and the service provider industry. This project helps the service provider industry to better understand the customer needs. Based

on the data gathered from the literature review, it was found that that the service

providers work extremely closely with handset manufacturers to get the best selection of

devices. Each service provider uses almost the same model for selling services, a model

where user buys a handset at a subsidized price with a bundle package and a contract

agreement. The general consensus from this study was that the existing service provider

and consumer model of contract based service could continue though there was always

the possibility of creating a more robust pre paid contract less model. Further, the

respondent's opinion was the current model of handset manufacturers and service

providers was not the most preferred form of buying user equipment. A decoupling

between the two would help serve the customers with better service. The service

providers should reconsider selling handset and user equipment. The users felt a need for

more choices and less restriction in this part of the US mobile business model.

Another part of this research was to find if there was an avenue to increase the

relationship equity between the chipset manufacturers with the service providers apart

from the device manufacturers. It was concluded that such a model already existed in

some aspects of the market and was effective over the years. The future would be to

merge more wireless technologies currently disjoint into one seamlessly integrated chip

design so that device manufacturers could increase their device portfolio at a much

reduced cost and with lesser stops to shop for components. This would indirectly drive

the service provider market to choose the best devices assuming the current model of

relationship equity would continue. Finally, as wireless technologies merge and current

complex standards become more open in nature, the closed nature of the US mobile

market would also change and would open more avenues for customers in terms of device choices.

5. Future work and recommendations

The data gathered and analyzed in this project is fleeting in most parts. So a good recommendation for anyone looking at studying this further would be to ask some of the same questions asked in this project at a later time. This will form a good basis of understanding the user perception at that time. A comparison between the two will help to determine if the market has changed and have customer preferences changed. A greater sample size and conducting the survey over a greater period of time will help gather more data.

The project can be extended to get primary research data from Asian markets. In this project our research was based on secondary data from Asian markets. A similar study on such markets will help find the changing dynamics in the world market. Aspects such as the regulatory and legislative restrictions in such market and the way these markets can be more structured in selling services can also be added in the study.

The project conducted a general survey and two interviews, one from the chipset industry and one from the service provider industry. In future, a third dimension from the equipment manufacturer industry could be added. In addition, the other sectors such as people from the sales side, business analysts in the telecom industry and the semiconductor industry could be interviewed for their opinion.

Glossary

PDA- Portable Digital Assistant

Wi-Fi- Wireless Fidelity

GPS- Global

WLAN- Wireless Local Area Network

3G- 3rd Generation. A cellular standard

CDMA- Code Division Multiple Access

PTT- Push-to-Talk

iDEN- Integrated Digital Enhanced Network. A Push-to-Talk standard

Q-Chat- Qualcomm Chat. A Push-to-Talk standard

MVNO- Mobile Virtual Network Operator

4G- 4th Generation. A cellular standard

GSM- Global System for Mobile Communication

GPRS- General Packet Radio Service

UMTS- Universal Mobile Telecommunications System

1xRTT- 1 times Radio Transmission Technology. CDMA variant.

EV-DO- Evolution-Data Optimized. CDMA variant.

LTE- Long Term Evolution

WiMAX- Worldwide Interoperability for Microwave Access

FM- Frequency Modulation

CMOS- Complementary Metal Oxide Semiconductor

SOC- System on Chip

PLC- Power Line Communication

IP- Internet Protocol

HDTV- High Definition Television

DVR- Digital Video Recording

RF- Radio Frequency

OEM- Original Equipment Manufacturer

ODM- Original Design Manufacturer

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Appendix A: Changing Trends in Telecommunications Industry Survey Questions

1. Do you own a mobile phone?

    ☐ Yes

    ☐ No

2. Under what category does your mobile device fall?

    ☐ 1. Simple Feature phone

    ☐ 2. Multimedia Feature phone

    ☐ 3. Smartphone

    ☐ 4. None of the above

3. Which of these statements is most accurate for you?

    ☐ 1. I bought my mobile handset as part of a service contract from my wireless service provider.

    ☐ 2. I bought an unlocked phone from the market and chose the wireless service provider.

4. Under what category does your wireless service fall under?

    ☐ 1. Post paid service. I get a bill every month.

    ☐ 2. Pre paid service. I reload my phone minutes with a predetermined dollar value as and when I need.

5. Are you satisfied with the current service you get from your wireless provider?

○ 1. Yes. I am a satisfied customer and plan to continue my service agreement.

◉ 2. No. I am not completely satisfied for more than one reason.

6. Which of the following statements describe the reason for you to be or not wanting to be with your current service provider? (Check all that apply)

☐ 1. The network and the coverage

☐ 2. The selection of handsets and devices

☐ 3. The price and the traffic options

7. What is the aspect of the handset you currently own that you like the most? (Check all that apply)

☐ 1. The network and access to content I most need.

☐ 2. The features (Camera, Video, Wi-Fi, Bluetooth, Radio, GPS, storage etc)

☐ 3. The physical aspects of the phone. (Ruggedness, Durability, Battery life, Design)

☐ 4. Ease of use and customizable to my needs.

8. The American cellular model is largely different than, say for example most Asian markets where largely the customer gets to choose the handset of his choice and then the service provider. As a consumer do you think such a model would work in the US?

○ 1. Yes. I would prefer to see more such options.

○ 2. No. The current model is more convenient.

○ 3. I am not sure. It depends on how it is marketed to the public.

9. Which selection of devices would you like to see more in your wireless service provider's handset portfolio?

    ☐ 1. Wider selection of smart phone

    ☐ 2. Wider selection of multimedia feature phones

    ☐ 3. Wider selection of simple feature phone. I am not a data person.

    ☐ 4. Nothing new. I am ok with the range of products available

10. If you had a more open market with handset manufacturers selling their products directly to you would you consider adopting it?

    ☐ 1. Yes. I definitely would like to have that option in my hands.

    ☐ 2. No. I prefer to deal with just the wireless service provider.

11. Which of the following statements do you agree with on the role of wireless service providers?

    ☐ 1. Service providers should work more closely with handset manufacturers and get the best selection of phones.

    ☐ 2. Service providers should stay away from handset manufacturers and use their time and resources to improve network service quality and overall user experience.

    ☐ 3. Service provider's tight control of the selection of handsets and portfolio of services helps serve the customer needs better.

12. What is your opinion on prepaid wireless services?

    ☐ 2. I know about it, but I am bound to a contract and would consider it in future.

    ☐ 3. I know about it, and I am considering it as a sure option of streamlining my wireless spending.

☐ 4. I know about it, but I am not considering it and happy with my current service contract.

13. With the big wireless service providers adding prepaid services (sometimes with a different branding) to its portfolio, do you think there will an increase in such service options?

☐ Yes

◉ No

☐ Not sure

14. If you answered No, what do you think the reason would be?

☐ 1. The current model is easy to understand and satisfies most user needs. So adopting a pre-paid structure will complicate things

☐ 2. The prepaid structure is promising and would definitely help me streamline my usage but the lack of clarity stops me from considering it as an option

☐ 3. I do not prefer the prepaid model and will not satisfy my usage and needs

☐ 4. Other

15. If you think a prepaid celluar service structure would be useful then which of these services would you like to see in the prepaid category?

☐ 1. Voice

☐ 2. Data

☐ 3. Both

☐ 4. Not Applicable

16. On an average how much do you spend on wireless bill for yourself every month?

○ 1. Less than $40

○ 2. $40 to $70

○ 3. &70 to $100

○ 4. Above $100

17. Which of these statements best describes your wireless usage every month?

○ 1. My wireless usage on a per month basis is almost the same and does not vary by a margin of 10%

○ 2. My wireless usage on a per month basis varies largely and is dependent on more than one reason.

○ 3. I do not keep a track of my wireless usage and have no plans of monitoring.

18. If you own a smart or a multimedia feature phone, do you think you are making good utilization of your phone's internet capabilities and justify the amount you spend every month on wireless bills?

○ 1. Yes

○ 2. No

○ 3. Not Applicable

19. If No, how much do you think you could cut every month on your wireless fees?

○ 1. $10

☐ 2. $20

☐ 3. $30

☐ 4. More than $30

☐ 5. Not Applicable

20. If you own an internet capable phone, how much time in a day do you spend for activities like email, web browsing, watching videos, listening to music etc?

☐ 1. Less than 1 hour

☐ 2. 1 to 3 hours

☐ 3. 3 to 5 hours

☐ 4. More than 5 hours

☐ 5. Not Applicable

21. Does your phone have Wi-Fi (Wireless Fidelity) capability?

☐ Yes

☐ No

☐ Not Sure

22. If you answered yes, do you use it in places where Wi-Fi is available or remain with the wireless service provider's 3G/4G network?

☐ 1. Yes, I do it all the time to save on 3G/4G data usage.

☐ 2. Yes, only when I am at home or work.

☐ 3. I didn't know I could use such a feature in my phone.

☐ 4. No, I do not use the feature.

23. Do you own another electronic gadget that requires wireless connectivity? (e book reader, tablets etc)

☐ Yes

☐ No

24. If you answered yes, then what kind of wireless connectivity do you use for this device?

☐ 1. Cellular 3G/4G

☐ 2. Wi-Fi

☐ 3. Both

☐ 4. Not Applicable

25. As a consumer, what are the changes would you like to see in the mobile telecommunication space? (Optional. Please feel to add any more comments)

Appendix B: User comments from the survey

1. The users should be given the choice of choosing their devices independent of their providers which would increase competitiveness in improving service and network coverage and not just depend on the phone's advertising to attract customers.

2. Better coverage. I hope I can whatever cell phone I want without contracts.

3. I want to be able to get a decent phone that works well and is easy and convenient in conjunction with an inexpensive data plan that does not force me to bundle a messaging or data plan. Right now, the only alternatives are lousy phone and no data or messaging OR quality phone with an expensive monthly plan.

4. Re: Question 22 - Don't use Wi-Fi at work because work Wi-Fi is proxy controlled (i.e. restrictive on sites I can visit – my phone is my link to blocked sites like facebook while at work). Always use Wi-Fi at home, and other than that only use Wi-Fi when I'm getting a poor 3G signal. Re: Item 24 - another option to me should have been tethering to 3G/4G phone.

5. Unlock all phones........they are too expensive to serve just one wireless provider

6. I would like to see more prepaid no-contract options with a more competitive pricing scheme.

7. Are you sure this survey captures what you want to know...just asking the question. Cheaper rates - similar to landline rates or internet rates. The mobile rates are currently ridiculously overpriced due to lack of good competition.

8. I would like to see the option of having the mobile as a simple telephone. In other words: no texting, no surfing the web, no accidentally connecting to the web and have to pay for the mistake, and just have the space available in the phone to have the basic

dialing numbers. Of course, I don't mean let's go back to the past. Just make choices available for everyone. My personal choice... A simple phone with only access to make live voice calls.

9. I would like to see a wider range of coverage for these devices in the future. Currently there are to many dead areas.

10. The US mobile telecommunication space is not consumer friendly in the sense that a consumer cannot be guaranteed to get the best device and service provider in most cases. The best example is iPhone which is available only to AT&T customers but everyone is aware about the despicable service levels of AT&T. This tight coupling of devices with service providers has to be changed. Similarly the service levels available in bigger market like Asia is significantly better compared to the US service providers.

11. Improved voice/data coverage and reasonable prices

12. Contract less service with the freedom to pick any phone with any service (given they us the same technology).

13. I would like to see more emphasis on developing better longer lasting battery technology. More environmentally friendly would be good also.

14. Looking forward to carriers offering better smart phones/services on a no contract basis.

15. Using the radio on the mobile phone to operate other gadgets i.e. increased interconnectivity. - HD streaming and docking for TV - Virtual GUI, keyboards

16. I would like to see decoupling between handset manufacturers and service providers. I would like to see service providers coming up with content services that can lead to innovative ideas in entrepreneurship.

17. Separation of handset and cellular services - Contract free options - Larger choice of non-multimedia phones with faster operations (startup time, etc) and much better voice service/signal.

18. Currently the data plans for the smart phones are very expensive. Also the customers have limited options and long-term contracts on popular phones like iPhone & Androids. I would like to see the reduced prices and short term contracts which will help the service providers to reach out more consumers. Overall I feel the US cellular market is still way behind in providing the consumer with options for wireless plans unlike Asian service providers where the cell phones are very popular because of the flexibility provided by the service providers.