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An in depth study of telecommunications can become quickly complicated. Spanning multiple sectors in manufacturing and service within many industries, what was once easily defined has now become a gray area of communications, software, internet and entertainment. What ties together all these facets of telecommunications is the mobile communications device.

The innovation of the smartphone in particular has revolutionized how we perceive information and information technology. With one device we carry with us a music player, video player, camera, and phone. We can play games, read books, store and transmit files, pay bills, etc. Smartphones, much like the computer and the internet have been a game changer in many industries. Firms have had to reevaluate how they do business in a World of ever changing technology. Not only how they operate the business but how they can reach consumers via these little devices.

Despite economic downturn, the market for mobile communications handsets grew by 13 percent in 2012. According to an iSuppli 2012 report, "...the wireless segment as a whole remains one of the few areas in the worldwide electronics value chain expected to keep growing." This strong showing is a testament to how key this market is to overall economic growth and global trade.

This report will cover an in depth market analysis of the major industry players, including: historical information, financial data, products, firm-level strategies, and expansion strategies. We will take a look at major global policies that affect the market, specifically: sanctions and embargoes, patent regulation and concerns regarding mobile security, such as: cyberterrorism and espionage.

The consumer mobile communications equipment market covers mobile telecommunications handsets and tablets. This does not include service related revenue or telecommunications fixed-line equipment which are related but separate markets within the telecommunications industry. This is an important distinction because the top telecommunications equipment vendors are not necessarily the same as the top mobile phone handset vendors. Handsets include smartphones and feature phones.

Table 1 - Worldwide Mobile Phone Sales to End Users by Vendor

Company	2012 Units	Market Share %	2011 Units	Market Share %
Samsung	384,631.2	22	315,052.2	17.7
Nokia	333,938.0	19.1	422,478.3	23.8
Apple	130,133.2	7.5	89,263.2	5
ZTE	67,344.4	3.9	56,881.8	3.2
LG Electronics	58,015.9	3.3	86,370.9	4.9
Huawei Technologies	47,288.3	2.7	40,663.4	2.3
TCL Communication	37,176.6	2.1	34,037.5	1.9
Research In Motion	34,210.3	2.0	51,541.9	2.9
Motorola	33,916.3	1.9	40,269.1	2.3

Company	2012 Units	Market Share %	2011 Units	Market Share %
HTC	32,121.8	1.8	43,266.9	2.4
Others	587,399.6	33.6	595,886.9	33.6

(Gartner, 2013)

Smartphones are the products currently trending the most heavily. According to a Nielsen poll February 2012, half of mobile subscribers own a smartphone, up 38% over the previous year. This shows a significant increase in the demand and supply of smartphones. Mobile communications equipment manufacturers who failed to produce smartphone technology have lost significant market share.

Directly related to mobile communications equipment manufacturers are the operating system developers - which are one in the same. Operating systems tend to be owned by the key players which adds to the complexity of the market. Most revenues for the equipment manufacturers will include profits from software as well. Many companies tend to use a particular OS to differentiate their product in this highly competitive market.

Table 2 - Operating Systems

Operating System	Developing Company	Manufacturer Company
Android	Google	HTC, Motorola, Samsung
iOS	Apple	Apple
BlackBerry	Research In Motion	Research In Motion
Windows	Microsoft	Microsoft, Nokia
Bada	Samsung	Samsung
Symbian	Accenture	Nokia

Table 3 - Worldwide Smartphone Sales by Operating System 4Q12

Operating System	2012 Units	Market Share %	2011 Units	Market Share %
Android	144,730.3	69.7	77054.2	51.3
iOS	43,457.4	20.9	35456.0	23.6
Research In Motion	7333.0	3.5	13184.5	8.8
Microsoft	6185.5	3.0	2759.0	1.8
Bada	2684	1.3	3111.3	2.1
Symbian	2569.1	1.2	17458.4	11.6
Others	713.1	0.3	1166.5	0.8

(Gartner, 2013)

Segments for tablets and handsets refer to the speed of the technology, commonly referred to as 1G (short for 1st generation), 2G, 3G, 3.5G & 4G. The 3G handsets were the first technology that allowed for streaming video and television, video conferencing, GPS and location based application services. 3G remains the prevailing segment in the market. “With 44 percent of the market and revenue of \$149.0 billion, the 3G handset sector remains the largest contributor in 2011 to the mobile communications device industry” (Sideco, 2011). However, there is a major push for adaptation of new technologies as these segments compete with each other for market share. “Spending on 4G LTE is expected to more than double to \$8bn by the end of this year, from \$4bn spent in 2011” (CBR, 2013).

The supply chain of mobile handsets is a truly global endeavor. “Where once large integrated companies such as AT&T built their own infrastructure, made the key compo-

nents, and designed, manufactured and distributed their own products, today these activities are more often carried out by independent companies in a vast global network spanning the semiconductor, computer, communications and consumer electronics markets” (Dedrick, 2010). Based off this report by Jason Dedrick, “The Distribution of Value in the Mobile Phone Supply Chain,” we see that the majority of profits go to the carrier, followed by that of the manufacturer. The suppliers account for very little of the value added to the phone. This is important because it shows that much of the value added is in the country of origin. Suppliers of mobile telecommunications devices are also growing at a substantial rate, even if the majority of the profits are going to the carrier and manufacturer. “The semiconductor market for mobile communications is expected to grow 5% to \$74bn by the end of 2012, up from \$71bn generated in 2011” (CBR, 2013).

Figure 1 - 5 Forces Competitive Analysis

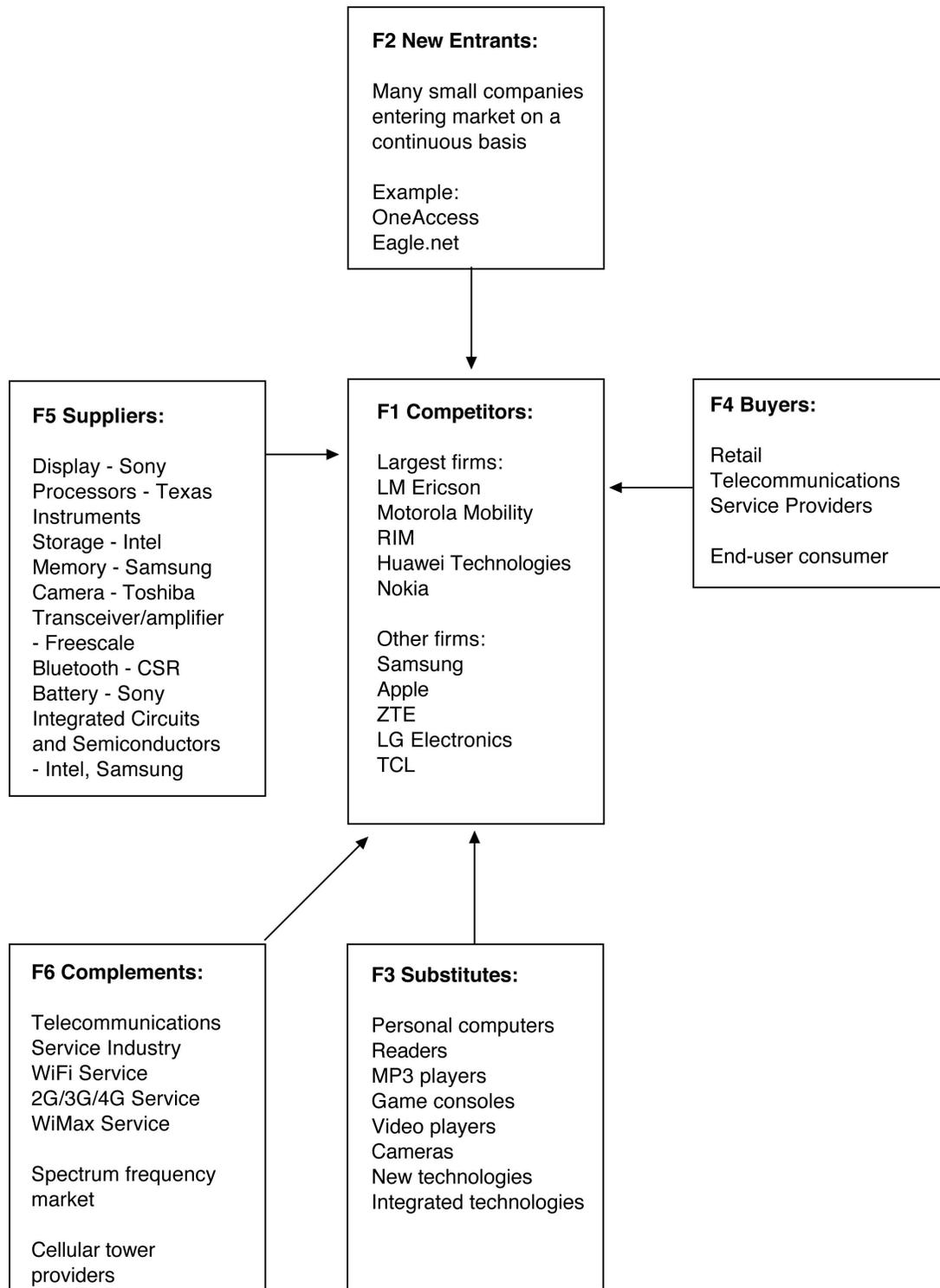


Table 4 - Financial Data of the Major Telecommunication Equipment Manufacturers

Company	Country	Public	Revenue(mil)	Net Income	Employees
Samsung	Korea	KRX, LSE	2012 KRW 201,103,613 21.88%	2012 KRW 23,185,375 73.25%	221,726
Nokia	Finland	OMX, NYSE	2012 USD 39,784 -21.94%	2012 USD -4,995 -62.53	97,798
Apple	U.S.	NASDAQ, S&P 500	2012 USD 156,508 44.58%	2012 USD 41,733 37.89%	72,800
ZTE	China	SZSE, SEHK	2011 HKD 86,254 23.39%	2011 HKD 2,060 -36.62%	89,786
LG Electron- ics	Korea	KRX, LSE	2011 KRW 56,256,585 -2.69%	2011 KRW -432,805 -133.75%	91,045
Huawei Technologies	China	Employee owned	2011 USD 32,396 10.49%	2011 USD 1850 -52.87	140,000
TCL Multi- media, TCL Communica- tion Tech- nolog	China	SZSE, SEHK	2012 HKD 39,685 20.50% 12,031 12.94%	2012 HKD 911 101.26% -208 -126%	50,000

Company	Country	Public	Revenue(mil)	Net Income	Employees
Research In Motion	Canada	NASDAQ, S&P 500, TSX	2012 USD 18,435 -7.39%	2012 USD 1,164 -65.88%	13,400
Motorola/Google	U.S.	NASDAQ, S&P 500	2012 USD 50,175 37.91%	2012 USD 10,737 10.27%	16,317
HTC	Taiwan	TWS	2012 TWD 239,020 -37.95%	2012 TWD 61,976 -91%	16,746
Ericsson	Sweden	NASDAQ, OMX	2012 SEK 227,779 0.36%	2012 SEK 5,775 -52.54%	109,214

Figures obtained from Yahoo Finance & Markets.ft.com 2-26-2013

Expansion is vastly different among competitors in this market. One key similarity with established technology companies is the constant need for innovation and reinvention. Many of the leading companies in the telecommunications equipment market started out in other electronics markets and either transitioned or diversified into the telecommunications market.

Nokia and Ericsson have been around for the longest time, spanning multiple centuries. Ericsson was started by founder Lars Magnus Ericsson in 1876 as a telegraph repair service in Sweden, and later selling his own telephone equipment. In the 1890s he began selling internationally to Britain and Russia (Ericsson.com). Nokia was established in 1865 as a paper mill, in 1912 they branched out into what would become the modern day idea of Nokia, telephones. Nokia was a huge industry player, manufactur-

ing many different products. It's unclear exactly when they expanded internationally, sometime during World War II. Eventually in the 1990s they decided to focus solely on telecommunications (Nokia.com). Both companies had a hefty head start in the telecommunications equipment market, successfully capturing the early market with superior feature phones. Unfortunately, with the emergence of the smartphone, a technology they were slow to adapt, they have lost considerable market share and have shown a steady decrease in revenue.

Motorola Mobility, formerly Motorola Inc, was founded in the U.S. in 1928 also producing radios and televisions. First exports of their products were into Canada in 1958 Motorola Mobility is now owned by Google. (Motorola.com).

Research In Motion a Canadian company founded in 1984 started by making pagers, they had early partnerships with Ericsson and Motorola to manufacture and sell their pagers. In 2000 they released their first smartphone which held considerable market share until the release of Apple's iPhone in 2007 (Blackberry.com).

South East Asia has become a main contributor in the global supply chain for telecommunications equipment. This development made it possible for many Asian company to enter the market. Huawei Technologies, ZTE, TCL were all established as Chinese firms in the 1980s (Econimist). Because of the strong relationship between China and Hong Kong all three firms entered the international market relatively quickly. HTC is a Taiwanese company founded in 1997 (htc.com). Korean firm LG Electronics was well established by the telecommunications boom starting out in 1958 at GoldStar manufacturing radios and televisions. In 1995 they purchased U.S. firm Zenith (LG.com).

The two major players in the smartphone market, and currently getting much attention for their continuous litigation is Samsung and Apple.

Samsung is a conglomerate with over 75 subsidiaries and 20 current joint ventures. According to their history web page they started out as a small export company in Taegu Korea selling dried fish, vegetables and fruit to Manchuria and Beijing. They quickly moved into manufacturing and sales operations. Their first acquisitions were insurance companies, in 1958 they acquired Ankuk Fire & Marine and in 1963 Dong-Bank Life. In 1977 they exported their first electronics product, the television. In 1981 they exported their microwave to Canada and in 1984 their VCR to the U.S. In 1982 they established a subsidiary in Germany. In 1991 they developed their first mobile phone handset and in 1999 their first smartphone. In 1993 they acquired U.S. firm HMS. For such a large company they have very few, less than a dozen acquisitions. During this time Samsung was a major leader in product innovation much of which can be attributed to the Samsung Advanced Institute of Technology which was established in 1987 for the purposed of R&D. In the last decade Samsung has released an exhaustive list of products in numerous industries. Electronics, Machinery, Heavy, Chemical, and Financial.

They are both a component supplier and manufacturer of mobile communications equipment. They could be considered on of the last vertically integrated mobile equipment manufacturers, developing memory chips, LCD's, flash memory, cameras, CPU cores. In 2008 as a response to the Apple iPhone they created their touch screen phone and the Bada operating system. The Samsung website lists 145 cell phone

products and 19 tablets, their most current mobile communication products are the Galaxy SIII (Android), Focus (Windows), Galaxy Tab (Android).

Vice Chairman & CEO Geesung Choi boasts in the Samsung 2011 annual report; 10 million Galaxy SII units sold worldwide, 4894 registered U.S. patents, the top share of televisions sold worldwide, and the number 1 market share of smartphones.

Apple by contrast is a rather small company operating only within the technology sector. Small in size but not market value. In August 2012 they became the most highly valued public company ever (Wingfield, 2012). Apple computer founded in 1976 by Steve Jobs and Steve Wozniak developed personal computers, components, peripherals, servers, application and operating software. In 2001 Apple released the iPod and in 2003 they added the iTunes music store. The iTunes music store was introduced to international markets in 2004 to the United Kingdom, France, Germany, the European Union and Canada. In 2005 to Denmark, Norway, Sweden, Switzerland and Australia. In 2003 they opened their first international retail store in Tokyo's Ginza District. In 2004 they opened a store in London and in 2005 in Canada. When the iPhone was announced in January 2007 units were sold in the U.S., Canada and the E.U. Unlike Samsung, a good deal of Apple's international expansion was done through mergers and acquisitions. Forty mergers and acquisitions in the U.S., U.K., Germany, Canada, Australia, Sweden and Israel. Apple has several subsidiaries in low tax countries; Ireland, Netherlands, Luxembourg, and the British Virgin Islands. "Apple, for instance, was among the first tech companies to designate overseas salespeople in high-tax countries in a manner that allowed them to sell on behalf of low-tax subsidiaries on other continents, sidestepping income taxes, according to former executives" (Duhigg, 2012). In

1980 Apple opened their EMEA headquarters (Europe, Middle East, Africa) in Cork Ireland. This was their first physical presence outside the U.S. Apples current product lines; iPhone, iPad, iPod, and Macintosh. Each running Apple's proprietary OSX.

Many people tend to associate Apple with a higher price point, but if you look at current product prices for both Samsung and Apple you will see they are very comparable.

Table 5 - Current Products and Pricing Apple & Samsung

Manufacturer	Product	Type	Price (USD)
Samsung	Galaxy Note II	Smartphone	299.99
Samsung	Galaxy S II	Smartphone	199.99
Apple	iPhone 5	Smartphone	199.99
Samsung	Galaxy Note	Tablet	549.99
Samsung	Galaxy Tab	Tablet	349.99
Apple	iPad Retina Display	Tablet	499.99
Apple	iPad 2	Tablet	399.99
Apple	iPad Mini	Tablet	199.99
Samsung	13.3" Series 9 Premium Ultrabook	Laptop	1399.99
Apple	13" Macbook Pro Retina Display	Laptop	1499.99

Source Apple.com and Samsung.com

Telecommunications is an integral part of government infrastructure in both developed and developing countries. We see that the industry is heavily monitored by local governments and restricted with respect to national security. "The various principles

and agreements made under the WTO have contributed to the liberalization and privatization of telecom markets around the world” (Magallanes, 2012).

Telecommunications is covered under GATS (General Agreement on Trade Services) and also BTA (Basic Telecom Agreement). The ultimate objective is a universally open market. GATS specifies MFN (Most Favored Nation) treatment for members. “In other words, a WTO member cannot treat telecommunications service suppliers from other members less favorably than it treats its local suppliers; treatment in taxation and regulation must be identical” (Magallanes, 2012).

In the U.S. the general tariff duty is free with a statutory rate or 35%. The WTO website reports three disputes in the industry, the most recent in 2000 between Mexico and the U.S. Before that in 1996 between Korea and the E.U., and in 1995 between Japan and the E.U. All three disputes pertained to violations of the GATS agreement and settled amicably (WTO.org). India anti-dumping against China and Israel and China against Korea. There seems to be an amicable relationship between countries due to the industry’s globalized supply chain.

There are many important topics in the media right now concerning mobile communications equipment. On the forefront are the current patent suits between the key players in the industry. The popular phrase coined by economists and analysts is “Patent Warfare”. These patent suits are somewhat of a new development in the industry, Lea Shaver, Associate Professor of Law at Indiana University, discusses how patents used to be a protection against frivolous lawsuits. Technology companies avoided lawsuits for the fear of “mutually assured destruction.” Patents have gone from being a defensive tool to an offensive weapon; previously technology companies collaborated on

industry standards, voluntarily pooled patents, and established non proprietary protocols (Shaver, 2012). This has led some to question whether patents are disruptive to the market and prevent competition. Obviously, there are multiple sides to the debate, “From the point of view of consumers and society at large, we all lose if companies do not have sufficient incentives to invest in research and development. We also lose when patents prevent advances in a particular technology or make it difficult or expensive for the majority of consumers to adopt the most useful, usable and elegant designs” (Cusumano, 2013).

Whether or not patents actually reward innovation and encourage R&D is outside the scope of this paper. It is however, important to analyze the role of patents in trade. Patent suits are currently being used to create a “hold up” with foreign competition. By filing a patent suit, companies are allowed to request an initial injunction preventing the sales of equipment by their competitors into a particular region where the case is filed. These injunctions are being pursued in many geographic segments, including courts in the U.S., England, Germany, South Korea, Japan, and the Netherlands. When injunctions are denied, companies are taking their case to the International Trade Commission (ITC) as a further attempt to block products from a particular market (Shaver, 2012).

In August 2011 we saw the first patent infringement claim between Apple and Samsung (Ajuria, 2012). Although final verdicts have not been handed down, the majority of suits to ban both Samsung and Apple products have been met with dismissal. Exceptions being in Germany and the U.S. where the Samsung Galaxy tab was banned from the E.U. and U.S. markets (Albanesius, 2012). Samsung responded with the following statement, “Should Apple continue to make legal claims based on generic design

patents, design innovation and progress in the industry could be restricted” (Albanesius, 2012). This however, has not kept Samsung from retaliating with their own patent suits against Apple.

This is not the first time Apple has attacked one of their competitors on the basis of intellectual property patent violation. In 1988 Apple sued Microsoft for copying the graphical user interface of the early Macintosh computer. A suit which they lost. Microsoft, created application software for Apple and had access to Apple’s source code and user interface. Similarly, Samsung as one of the largest suppliers of microprocessors to Apple was privy to design specs and software code (Cusumano, 2013). This puts to the question whether firms really benefit from outsourcing component manufacturing. It may lead to increased specialization, but there is a significant risk of undesired technology spillovers and copycat products.

The U.S. has comprehensive trade and investment embargoes against; Cuba, Iran, Iraq, Sudan, and Syria (Bureau IS). These embargoes prohibit export or re-export of telecommunications equipment. Recent allegations have been made against ZTE for supplying an Iranian firm TCI (Telecommunications Company of Iran) with software, surveillance equipment and U.S. made technology against these sanctions. ZTE is public, but the largest stakeholder is the Chinese government (Poeter, 2012). ZTE has refuted these claims, but tensions between the Chinese and U.S. governments have heightened. The FBI has launched a full investigation.

There have also been other allegations against ZTE and Huawei claiming their telecommunications devices contain malicious hardware and software. A report filed by the U.S. House Intelligence Committee explains that the hardware and software could be

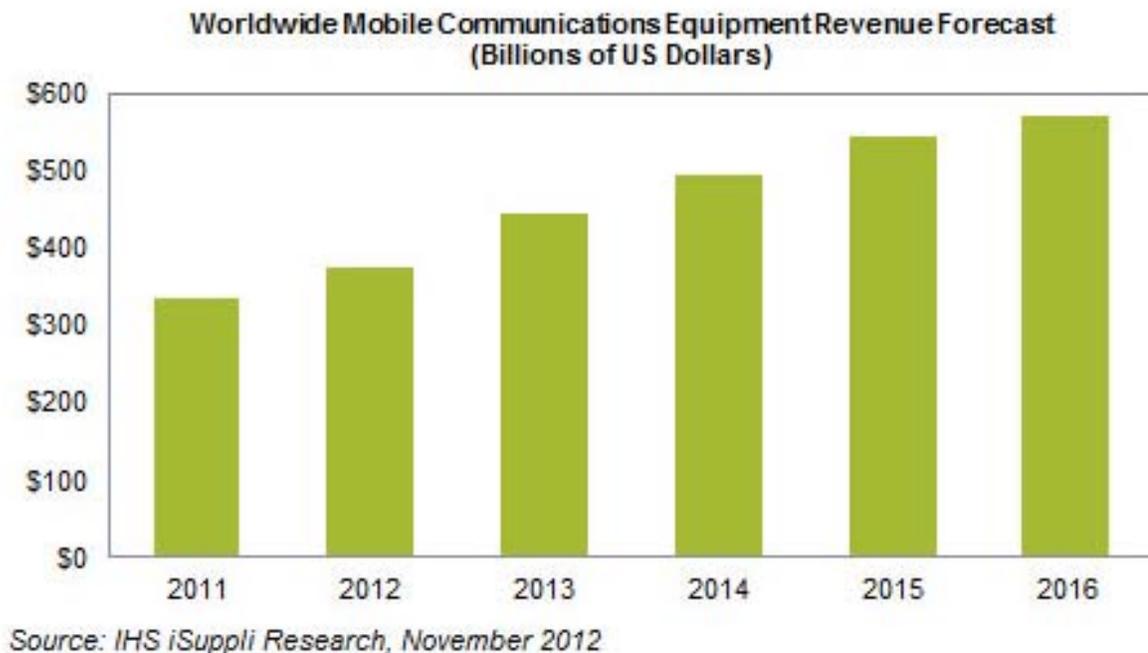
used as a “potent espionage tool”. The committee recommends expanding the role of CFIUS (Committee on Foreign Investment in the United States), a committee responsible for reviewing all foreign business transactions gaining a controlling interest in a U.S. firm (DiMascio, 2012). Cyber security analysts say the threat to national security is very real. However they warn against measures that may be too severe and compromise global trade and economic growth (Magnuson, 2012). Review of purchase agreements (millions every month) would be costly, incite retaliation from other countries, and cause issues within the World Trade Organization.

In 2011 as a response to the perceived security risk coming from China the U.S. blocked Chinese firm Huawei from purchasing U.S. company 3Leaf (DiMascio, 2012). Regardless how the situation plays out with China major consensus is that there needs to be standards and regulation in the telecommunications equipment supply chain.

There are many factors to consider when looking at the future of the telecommunications industry. Security issues and regulation aside, the outlook for the entire industry is positive.

Rising cost of inputs are to blame for a slow down in telecommunication equipment manufacturers net income over the last year. But many firms saw positive revenue growth and are projected to grow steadily over the next several years. According to CBR, mobile communications equipment revenue is expected to grow at a compound annual growth rate of 11% over the next five years until 2016. Figure 2 details expected revenue growth.

Figure 2



Telecommunications equipment and services play a critical role in global economic growth. “Global telecommunications services generate \$1.5 trillion per year” (Magallanes, 2012). Mobile devices are becoming increasingly important and crucial to daily operations on a business and personal level. Telecommunications technology effects multiple industries, for better or for worse. Not only will mobile manufacturers need to adjust to newer technologies but so will firms in a broad spectrum of industries such as retail, media, banking, advertising, social networking, books, newspapers - just to name a few. It will be interesting to watch how everything plays out over the next several years.

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