The Rise of MediaTek:
Disruptive Innovation in Mobile Phone Chipset Industry

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English title:
The Rise of MediaTek: Disruptive Innovation in Mobile Phone Chipset Industry

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Publication type:
Master of Science in Business Administration
Strategy and Management in International Organizations
Advanced level, 30 credits
Spring semester 2014
ISRN Number: LIU-IEI-FIL-A--14/01819—SE

Linköping University
Department of Management and Engineering (IEI)
www.liu.se

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Abstract

Title: The Rise of MediaTek: Disruptive Innovation in Mobile Phone Chipset Industry

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Background: In the bestseller "The Innovator’s Dilemma", C. M. Christensen explained why and how outstanding companies can do everything right and still lose their market leadership. The mobile phone chipset industry is a high-tech industry that has a heavy impact on our daily life. In the past ten year, the landscape of this industry has changed drastically. Many entrenched players with their glorious history dated back to the beginning of semiconductor industry’s formation failed while a few new comers rose to dominate the market. Apparantly the entrenched ones had all the resources needed to maintain their competitive advantage as the semiconductor industry is capital and technology intensive which requires continuous innovation. How could the new comers outperform the established ones in such a short time? The author started her investigation bearing the mind of disruptive innovation.

Aim: In this thesis, taking the mobile phone chipset industry as an example, the author studies the rise of MediaTek, a company from Taiwan specialized in providing turn-key chipset solutions to mobile phone vendors. By doing the study, the author tries to reexamine the disruptive innovation theory proposed by Christensen and find out the root causes of the rise and fall of different companies in this industry.

Methodology: The thesis uses deductive approach based on secondary data and qualitative interviews.

Findings and Conclusion: The thesis verifies the five principles of disruptive innovation theory originally proposed by Christensen using the example of MediaTek.
mobile phone chipset industry and MediaTek’s success in riding on the tide of disruptive innovation. The author analyzes MediaTek’s competitive advantage and business model to discover the reason why it succeeded in the fierce competition. Furthermore, the author brings forward three principles for incumbents to handle disruptive innovation based on the study conducted in this thesis.
Acknowledgments

This two-year journey has been adventurous, challenging and exciting. I would like to take this opportunity to record my sincere gratitude to Linköping University for providing me with all the necessary facilities and resources, as well as Department of Management and Engineering for constant support and encouragement.

Life is not easy. It would not have been so fruitful and joyful without many people’s help and kindly support. First and foremost, I would like to show my deep gratitude to my supervisor Associate Professor Andrea Fried, who has guided and encouraged me when I was facing difficulties.

In the beginning of March, I made a big and hard decision to write master thesis on my own, which meant that I would have only two months to finish my thesis. Hence, I am truly grateful for my supervisor’s kindly and generous support.

I would like to thank the international office and the School of Economic Management of Tongji University in Shanghai. During my stay as an exchange student in Tongji University, beside theories I have learnt how to write a business plan in order to capture VC’s eyes and solve practical problems while addressing the challenges of business and society with a global perspective.

The Life as a graduate student comprises hard word and joyful moments with colleges and friends. Thanks to my team members, Daniel, Dorothy, Damir and Nils. I would like to say thank you for your valuable feedback. Thanks for my friends who are working in mobile phone industry, without your constructive and professional suggestions; I will not be able to finish my thesis in time. I especially would like to thank Johan Norberg for reading and commenting parts of the thesis, which was highly appreciated. I also would like to say thank you to my dear and closed friend Wangsun Yangzi, I truly thank you for your kindly
support. I will never forget your incredible patience in helping and supporting me.

I would like to express my gratitude from the deepest point of my heart to my parents. Thanks for your unconditional love, endless support and constant encouragement. "I love you Mom, I love you Dad!" I am also grateful to my parents-in-law for their great support and care.

Last but not the least, to my husband Di. I am so glad and lucky to have you in my life. Thank you for being who you are, for always giving me new perspectives and for inspiring me to new challenges. Your understanding and love has made me what I am today.

Baishi Wang
Linköping, May, 2014
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# Abbreviations

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<tr>
<td>1G</td>
<td>1st Generation mobile telecommunication</td>
</tr>
<tr>
<td>2G</td>
<td>2nd Generation mobile telecommunication</td>
</tr>
<tr>
<td>3G</td>
<td>3rd Generation mobile telecommunication</td>
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<tr>
<td>3GPP</td>
<td>3rd Generation Partnership Project</td>
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<td>4G</td>
<td>4th Generation mobile telecommunications technology</td>
</tr>
<tr>
<td>AWS</td>
<td>Amazon Web Services</td>
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<tr>
<td>CDMA</td>
<td>Code Division Multiple Access</td>
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<tr>
<td>COO</td>
<td>Chief Operating Officer</td>
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<tr>
<td>DBB</td>
<td>Digital BaseBand</td>
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<tr>
<td>DSP</td>
<td>Digital Signal Processor or Processing</td>
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<tr>
<td>EMP</td>
<td>Ericsson Mobile Platforms</td>
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<tr>
<td>FAE</td>
<td>Field application engineer</td>
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<tr>
<td>FDD</td>
<td>Frequency division duplexing</td>
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<tr>
<td>GNSS</td>
<td>Global Navigation Satellite System</td>
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<tr>
<td>GPRS</td>
<td>General packet radio service</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<td>HD</td>
<td>High definition</td>
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<tr>
<td>HSPA</td>
<td>High Speed Packet Access</td>
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<tr>
<td>IPR</td>
<td>Intellectual Property Right</td>
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<td>IP</td>
<td>Intellectual property</td>
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<tr>
<td>IC</td>
<td>Integrated Circuits</td>
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<tr>
<td>KKR</td>
<td>Kolberg Kravis Roberts</td>
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<tr>
<td>LTE</td>
<td>Long Term Evolution</td>
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<tr>
<td>MNCs</td>
<td>Multinational Corporations</td>
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<tr>
<td>MPU</td>
<td>MicroProcessor Unit</td>
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<tr>
<td>Modem</td>
<td>Modulator-demodulator</td>
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<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>NFC</td>
<td>Near Field Communications</td>
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<tr>
<td>iOS</td>
<td>Mobile operating system developed by Apple Inc.</td>
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<tr>
<td>JV</td>
<td>Joint venture</td>
</tr>
<tr>
<td>OIA</td>
<td>Other Intel Architecture</td>
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<tr>
<td>OS</td>
<td>Mobile operating system</td>
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<tr>
<td>OTT</td>
<td>Over The Top</td>
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<tr>
<td>PCB</td>
<td>Printed circuit board</td>
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<td>PA</td>
<td>Power amplifier</td>
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<tr>
<td>QCT</td>
<td>Qualcomm CDMA Technologies</td>
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<td>QRD</td>
<td>Qualcomm Reference Design</td>
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<td>QTL</td>
<td>Qualcomm Technology Licensing Division</td>
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<td>QTI</td>
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<td>R&amp;D</td>
<td>Research and development</td>
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<td>RISC</td>
<td>Reduced instruction set computer</td>
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<td>RF</td>
<td>Radio Frequency</td>
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<tr>
<td>SDR</td>
<td>Software Defined Radio</td>
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<tr>
<td>SoC</td>
<td>System-on-chip</td>
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<tr>
<td>STE</td>
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<tr>
<td>STM</td>
<td>ST Microelectronics</td>
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<tr>
<td>TD-SCDMA</td>
<td>Time-Division Synchronous Code Division Multiple Access</td>
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<tr>
<td>TI</td>
<td>Texas Instrument</td>
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<td>TSMC</td>
<td>Taiwan Semiconductor Manufacturing Corporation</td>
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<tr>
<td>WCDMA</td>
<td>Wideband CDMA</td>
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<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
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<tr>
<td>UI</td>
<td>User interface</td>
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<tr>
<td>UMC</td>
<td>United Microelectronics Corporation</td>
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Chapter 1
Introduction

Tom is a student studying economics at the university. He has a smartphone, with which, he is always connected to the internet so that he can listen to the latest musics and watch online videos, make phone calls, and play games with his friends online. When he is hiking with his friends in the mountains of Alpes, he can use the smartphone to locate his position and figure out the direction. When he is walking around the Gamla Stan (old town) in Stockholm, he can use the smartphone to find the nearest metro station and interesting restaurants. When he returns home, he can share pictures captured by the phone to the 50 inches TV screen with his parents using Wi-Fi connection. A sunny afternoon, he pays for a cup of Coffee at Starbucks using his phone through Google Wallet. The underlying technology that gets him connected anytime and anywhere with an affordable cost (both economically and environmentally), is called a mobile phone chipset which is one of the most important technologies that power our modern life. This thesis aims to examine disruptive innovation taking the mobile phone chipset industry as a case study.

1.1 Background

In today’s fierce competition, the world it is well understood that the success of companies depends not only on the products and services being offered and the overall presentation to target customers. Notably, as Porter (1985) states that customers will keep pursuing lower-price with the same level of quality. Hence companies are working on providing high performance price ratio. Innovation
plays a crucial role when giant companies compete with each other. One type of technological innovation emerging that plays as a strategically important role in business activities is Disruptive Innovation, presented by Christensen (2003). Disruptive innovation is a powerful manner of broadening and developing new markets and providing new functionality, which in turn, may reshape or disruptive existing market networks (Adner, 2006; Charitou and Markides, 2003; Christensen, 2003; Christensen and Raynor, 2003; Day and Gillbert, 2003 and Govindarajan and Kopalle, 2006).

Because of the fierce global competition, pursuing the exploration of new business activities must be included in the organization portfolio. This requirement is already mentioned by Schumpeter (1961), as a process in which the old ways of doing things are endogenously destroyed and replaced by new ways, can be considered as a process of "creative destruction". Hence, we could say innovation is the main competition source when they compete with each other.

Globalization and innovation have been trendy terms for many years in any discussion between scholars, researchers, and entrepreneurs. Because of the substantial influences that those terms bring along have continuously brought the society to new stages. Christensen is one of the leading researchers on disruptive innovation. And according to Christensen (2003, p.xx), there are three bases of disruptive innovation, which are low margins, first entrance, and ignorance by entrenched incumbents. We could understand from Van (2007), a set of activities leading to the introduction of something new that aims to strengthen the defendable competitive advantage of a company. When disruptive products appear in a certain industry, usually the feature is simpler and price is cheaper compared to existing products, which means it could promise lower margins, not greater profits. Meanwhile, the company who owns the disruptive technology is often the first entrance and first commercialized in emerging and insignificant markets. Moreover, the emerging and insignificant markets are usually ignored by entrenched incumbents. More importantly, the disruptive technologies that might underperform today, which means the leading firm’s most profitable customers generally do not want, might be fully performance competitive in the same market tomorrow (Christensen, 2003) . Hence, most companies with a practiced discipline of focusing and listening to their best customers that could bring greater margin, do research on technologies driven
by the best customers, and identifying new products that promise growth, but these entrenched incumbents rarely keep one eye for investing in disruptive technologies until it is too late.

Generally speaking, most companies are seeking to reach their competitive advantage, according to Porter (1985), which could introduce the concept of the value chain, a basic framework for thinking strategically about the activities involved in their business, innovative activities, and assessing their relative cost and role in the differentiation. In this dynamic world, disruptive innovations are becoming and are expected as a main way of achieving competitive advantage (Christensen and Raynor, 2003). Hence, disruptive innovation can be considered as an opportunity for new organizations and whereas leads entrenched incumbents disappear.

1.2 Research Area

Beginning in the late 1940s, the technology that would later be used in today’s cell phones was created and the idea of a mobile phone was introduced (Farley, 2005). From Clarke’s vision “the time will come when we will be able to call a person anywhere on Earth merely by dialing a number”. We could say that mobile phone facilitates communication and benefit the society. The past decade has witnessed the progress of mobile telephony through several generations of technology. The first generation (1G) used analog communication, and the second generation (2G) represented the morning of digital communication. The third generation (3G) opened up a huge market of content-rich multimedia era with the smartphone becoming the center of our daily life. Today, the fourth generation (4G) is quickly penetrating populations in the developed countries to provide high definition (HD) video streaming services. Talking about the mobile phone industry, the change of landscape has just been surprisingly quick. It is well known that recently innovative smart terminals such as the iPhone and iPad have changed the world of mobile communications and reshaped the landscape of the mobile phone industry. The rise and fall of tier-one companies like Ericsson, Nokia and Motorola in the feature phone era, and new players such as Apple and Samsung, which dominated the early stage of the smart phone era
shows us how quickly an apparently well-managed and entrenched company can fail.

Meanwhile, few have noticed that during the exact same period of time, big changes have taken place in the mobile phone chipset industry that most incumbent ones such as ST-Ericsson, Texas Instrument and Infineon came under attack from newcomers such as MediaTek and Spreadtrum.

A chipset is a set of electronic components in an integrated circuit that manages the data flow between the processor, memory and peripherals. A mobile phone chipset usually consists of the following parts: an application processor that handles multimedia processing such as video gaming, 3D graphics and graphic user interface, a digital baseband chip that handles the signal processing of radio receiver and transmitter, a radio frequency (RF) chip that converts digital signal to analog RF signal, and a power amplifier chip that magnifies the transmitted RF signal from RF chip. Mobile phone chipsets play a crucial role in determining mobile phone system performance (Carsten, 2012).

The research conducted in the thesis is focusing on disruptive innovation in the mobile phone chipset industry. As Christensen pointed out, “Those who study genetics avoid studying humans” (Christensen, 2003, p.3), instead, they choose to study fruit flies which have much shorter life. Therefore, to study disruptive innovation, we shall pick an industry that changes quickly and globally so that it is easy to obtain large quantity of data for analysis. From the author’s point of view, the mobile phone chipset business is a perfect match thanks to its rapidly changing technology and business models. In this thesis, the author tries to connect the disruptive innovation theory to the change of this industry.

MediaTek is a Taiwanese company that introduced a series of low-price products with high-quality and a special business model namely turn-key (Shih et al, 2010) to satisfy the need of smaller mobile phone vendors while significantly lowering the entrance requirement to the smart phone market. By allowing a large number of new players into the mobile phone market, MediaTek reshaped the landscape of the mobile phone industry globally.

As elaborated later in the empirical part Chapter. 4, the financial reports of those listed companies show that many entrenched players such as Infineon, STMicroelectronics, NXP Semiconductors, and Texas Instruments have failed in this market. Meanwhile, Qualcomm has been an exception that achieved
fast growth riding on the tide of disruptive innovation. New comers such as MediaTek have risen to compete in this industry.

1.3 Research Aim and Question

In the book "Innovator’s Dilemma" (Christensen, 2003), the author showed that, in the cases of well-managed firms such as those cited above, good management was the most powerful reason they have failed to lead their industries. They lost the leadership in their industry precisely because these firms listened to their customers, invested aggressively in new technologies that would provide their customers more and better products of the type they wanted, and because they carefully studied market trends and systematically allocated investment capital to innovations that promised the best returns, they lost their position of leadership in their industries. He also believes that those who misunderstand the innovative trend are inevitable to suffer the consequence.

The aim of this thesis is to verify the disruptive innovation theory to explain MediaTek’s success in the mobile industry. The author uses collected financial data and interviews to compose a graph to understand the reason behind the rise and fall of the competitors in the mobile phone chipset industry. More specifically, this research is focus on disruptive innovation strategy and how MediaTek took the market share against those entrenched incumbents. With a deep look at MediaTek’s operation, R&D and marketing strategy, the author tries to explain the characteristics that MediaTek possessed which allowed it to enjoy the great advantage of disruptive innovation. Meanwhile the author tries to point out how those apparently well-managed companies failed.

Why did the entrenched ones fail while MediaTek succeeded? What can we learn from a management point of view? The question arose when the author for the first time heard the story on MediaTek. The curiosity was so compelling that the author started gathering materials related to this topic. Thanks to many professionals working in the mobile industry, the author had a chance to collect firsthand information through interviews which lights up the path to understanding of the great change of landscape of this industry.

Research questions in this thesis are listed below:
- How is the rise of MediaTek related to disruptive innovation?
- How shall incumbents prepare themselves better for disruptive innovation?

1.4 Research Scope and Limitation

The research scope is limited to the use of disruptive innovation theory to explain the success of MediaTek and the fail of its entrenched competitors.

Even though the author has been dedicated to collect valid and reliable data to carry out the thesis, in terms of theory and empirical material, certain limitations to this research could not be avoided. This research acknowledges limitations in several aspects, which could be summarized as follows:

Due to time constrains, the data collected through interviews has a limitation in terms of sample dimension and subjective opinions.

In order to make a deep study in disruptive innovation, it is better to refer to the financial aspect in terms of quantitative data. However, due to limited access to the financial data of the business organizations studied, only a limited exposure is used to understand the problem from financial perspectives.

This research focuses on mobile chipset industry, hence it has constrains in reflecting and be generalized for other industries.
Chapter 2
Research Methodology

This chapter will present the methods used to conduct this research. In details, this part presents the philosophy and approaches this research adopted, the reason of choosing the study object, the source and general information of empirical data, the chosen research methods of which kind of data will be collected and analyzed, and how they are collected and analyzed. The validity and reliability of the empirical data run through the entire research.

As explained before, this thesis aims to study disruptive innovation that occurs in the mobile phone chipset industry which is an industry that changes quickly enough to be a good study object. This research mainly focuses on the fall of several entrenched chipset suppliers and the rise of MediaTek, a new comer from Taiwan which emerged quickly to be the tier-1 player in this industry. Deductive approach is adopted here to start from Christensen’s theory of disruptive innovation. The author applies several methods to verify the theory and uses quantitative data together with interviews to collect data.

2.1 Research Strategy

Every research should start from an action plan or an interest angle to follow during the entire process. Case study has been viewed as a tool that aims to do research for deep and rich understanding of a particular phenomenon and processes in a complex context (Dul et al, 2008). An explicit strategy with a clear goal and a proper method could provide researchers an unambiguous structure and guide them during the entire process of the research.
The research conducted in this thesis focuses on the disruptive innovation by studying the change of landscape in the global mobile phone chipset industry. Starting from Christensen’s disruptive innovation theory, the author tries to use the theoretical framework to capture the deep reason behind the change. Using the information collected around the entrenched companies who failed and those thrived such as MediaTek, the author illustrates the revolutionary events and circumstances and changes in the past decade. Moreover, MediaTek’s product life cycle from idea to achieve success in the market will be introduced in the empirical section together with supporting evidence in numerical and visual forms, in some instances financial figures of annual report, graphs, and tables. In current business and management research, it is very common to find a mix of both quantitative and qualitative methods (Saunders et al., 2007), related to observable empirics where they exist, and then via using, processing, manipulating numbers, additionally turn to look at the perceptions of those involved with these "fact" (Greener, 2008). Hence, this research uses a mixed method strategy, including quantitative and qualitative methods.

Hereunder lists the steps of the research:

- Review related theories on disruptive innovations
- Propose a number of hypotheses based on the disruptive innovations
- Conduct an empirical study targeting the mobile chipset industry
- Connect the empirics with the hypotheses
- Develop extensions to the hypotheses and make conclusions

### 2.2 Research Method

Regarding the other attribute of this research method, interviews are used to collect qualitative data. According to Kvale (1996), interviews could be facilitated to obtain information in a detailed manner, regarding personal feelings, experiences and perspectives, which might aid a researcher to deeper understand the phenomenon. In this research, the author will combine the method
of documentations and interviews. There are mainly three approaches used in conducting research, inductive, deductive approaches and abductive approach.

### 2.2.1 Abductive Approach

Abductive approach is the way of conducting research by weaving back and forth between empirics and theories. Additionally, in order to develop a good understanding of the "new" observation, the abductive approach typically contributes to providing a fresh perspective by borrowing existing theories from other scientific areas. The process of adductive research processes closes with providing conclusion and make up complementary theories is shown in Fig. 2.1, which is from rule to result to case.

![Figure 2.1: The Abductive Research Process (Kovás et al, 2005)](image)

### 2.2.2 Inductive Approach

As illustrated in Figure. 2.2, inductive approach aims at creating new general conclusions or theories directly from empirical phenomenon or observations without theoretical framework (Kovás et al, 2005), people usually call it a "bottom up" approach. Detailedly, inductive approach is moving from specific observations, then detect patterns and afterwards develops theories and concepts (Saunders et al, 2003). In an inductive approach to research, a researcher often begins by collecting that is from his or her interest. Once a substantial amount of data have been collected, the researcher will then take a break from data collection, stepping back to get a bird’s eye view of the data. At this stage, the
researcher looks for patterns in the data, working to develop a theory that could explain those patterns. Thus when researchers take an inductive approach, they start with a set of observations and then they move from those particular experiences to a more general set of propositions about those experiences (Saunders et al, 2003). In other words, they move from data to theory, or from the specific to the general.

Figure 2.2: Inductive Approach (Trochim, 2006)

2.2.3 Deductive Approach

Deductive approach is informally called "top down" Deductive research, which explores from a general regulations to a specific empirics or phenomenon (Andreewsky and Bourcier, 2000). As depicted in Figure. 2.3, in a deductive approach, researchers start with a theory that they find compelling and then test its implications with data. In other words, they move from a more general level to a more specific one. Deductive approaches have been widely adopted in scientific investigation. The researcher first studies the literatures others have done, reads existing theories of the phenomenon under study, and then make hypotheses that will be tested by evidence collected (Saunders et al, 2003).

Different from the both process of abductive research, which is from the rule to result to case, and the process of inductive research, which is from case to result to rule, the process of deductive research is from the rule to case to result, which is show in Fig. 2.3. Hence, we could see that the main difference between
inductive and deductive approaches to achieve is that, the goal of deductive approach is pursuing to verify theory, whilst inductive approach is with regard to generating of new theories of emerging from the observation. After comparison, in this case study, the deductive approach is suitable for this research to offer readers new insights in dealing with disruptive innovation happens in phone industry by bringing the theory from (Christensen, 2003). In this research the author starts by identifying theoretical knowledge in the field of disruptive innovation that was introduced by Christensen. After a closer verification, the author develops extensions to the hypotheses and makes conclusions. The aim of applying the process of deductive research process is to close with providing conclusion and try to make complementary theories in this research field. According to this research, the author conducts research on mobile phone industry with inspiration from the disruptive innovation theory developed by Christensen (2003) by using deductive reasoning approach. From there, the author will narrow down disruptive innovation theory into more specific hypotheses that can be tested in mobile phone chipset industry. Quantitative and qualitative methods are then applied to collect relative information and data to test hypotheses (Bryman and Bell, 2007). This ultimately leads the researcher to be able to verify the hypotheses with specific observation in the mobile phone chipset industry, guiding to an outcome of the original theory and achieving at a conclusion. Therefore, what his research aims to achieve is not generalizable to the population at large, but aims to contribute to the generation of theory
Research Methodology

(Bryman and Bell, 2007).

2.3 Data Collection

Following the research strategy and method that have been stated, the core part of the research is to find data that supports the hypotheses proposed by the author, thus making data collection is an important task. Generally speaking, there are mainly two kinds of data: qualitative and quantitative. Quantitative data have been collected by the author from public or private channels which consists of objective figures such as the financial reports, internal accounting reports, and market analysis conducted by professional consulting companies (Greener, 2008). Quantitative methods could contribute the researcher for the theoretical findings. Moreover, quantitative methods could aid the researcher to make a comparison and a standardized insight of the case study. Associating with an approach to testing theory, a quantitative approach often use numbers or facts and therefore a positivist or natural science model, and an objectivist view of the objects studied (Greener, 2008). In this research, the author tries to use annual report to make a visible comparison to exhibit what happened before and after the disruptive innovation banged the market.

2.3.1 Qualitative Data

Qualitative data in this thesis consists of first hand and second hand interviews. Qualitative data is usually collected by interviews and surveys that takes subjective factors into consideration (Yin, 1984). Additionally, the secondary interview materials were also applied by the author, although the interviews were collected by other researchers aiming to elaborate another academic study which compared to this research is different but holding a relevant purpose. These methods have been selected because of constrains of time and budget. Secondary interviews that are conducted by others can be used here to reflect the competitive advantage of a firm and to expose the reasons leading to its success or failure that are not seen publicly.

Interviews could be considered as a flexible method for collecting information for qualitative study (Bell et al., 2005; Bryman and Bell, 2007). Part of the
2.3 Data Collection

information collected is direct and first hand interview conducted by the author with professionals in the mobile phone industry. Besides this, secondary interviews used in the analyst as citations from references.

In this thesis, eight interviews were undertaken in different countries, with one in Sweden, one in Netherland and six in China through onsite visits and conference calls during a period from March 2014 to May 2014. The author chose the interviewees from three categories - competitors of MediaTek, customers of MediaTek and analysts focusing on mobile phone industry. Interviews from MediaTek’s competitors were chosen to provide information on how the entrenched ones failed when facing disruptive innovation. Interviews from the customers were taken to explain MediaTek’s competitive advantages such as cost leadership and differentiation. Interviews from the analysts are intended for a picture of MediaTek’s market position and the landscape of the mobile chipset industry.

<table>
<thead>
<tr>
<th>No.</th>
<th>Company</th>
<th>Date</th>
<th>Duration</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2014-03-04</td>
<td>20</td>
<td>Sweden</td>
</tr>
<tr>
<td>2</td>
<td>Competitor B</td>
<td>2014-03-05</td>
<td>30</td>
<td>Netherland</td>
</tr>
<tr>
<td>3</td>
<td>Competitor C</td>
<td>2014-03-20</td>
<td>30</td>
<td>China</td>
</tr>
<tr>
<td>4</td>
<td>Customer A</td>
<td>2014-04-15</td>
<td>30</td>
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</tr>
<tr>
<td>5</td>
<td>Customer B</td>
<td>2014-04-14</td>
<td>15</td>
<td>China</td>
</tr>
<tr>
<td>6</td>
<td>Customer C</td>
<td>2014-04-15</td>
<td>20</td>
<td>China</td>
</tr>
<tr>
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<td>2014-04-21</td>
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<tr>
<td>8</td>
<td>Analyst B</td>
<td>2014-04-20</td>
<td>30</td>
<td>China</td>
</tr>
</tbody>
</table>

Table 2.1: Overview of Interviews

2.3.2 Quantitative Data

As for quantitative data, the author mainly used secondary data collected from company websites and from analysts’ reports. According to (Greener, 2008), secondary data is data that did not collected by the researcher themselves directly from respondents or subjects. However the secondary data that was not collected in order to meet the researcher’s purpose, rather to for academic studies, organization’s operations or conduct by institutions to collect data for offi-
cial purposes (Greener, 2008). We can see secondary data collection with less bias as it is usually conducted by people who are not involved in the research. Especially as financial data from public companies are strictly audited by professional auditors and are subject to legal regulations, they are considered reliable and trustful. In this thesis, these financial data are carefully studied to provide evidence to support the hypotheses brought forward by the author. Meanwhile, well-established analyst firms such as Gartner and ABI Research are considered to provide good credit in the industries and markets they study. Hence, their annual reports on the semiconductor industry are also used by the author to illustrate the landscape of the semiconductor industry.

2.4 Data Analysis

Regarding qualitative data, firstly, the author transcribed the interview recordings into text. The interviews are around 205 minutes long in total and took more than two months to finish. In the empirical part, the author quoted many comments directly from interviews aiming at revealing a vivid and reliable story told by the interviewees.

It happened that some words and sentences were difficult for the author to understand due to lack of time and technical background. Fortunately, the author only encountered a few such cases, thus not affecting the analysis of the general idea of each question and answer. To overcome the difficulties due to lack of relative technical knowledge in the mobile phone industry, the author used the internet to search for background knowledge and studied them to better understand the data collected.

This research also applies secondary data, like reports from well-established analyst firms such as Gartner and ABI research, since they could give a rational view regarding the revolutionary of the mobile phone industry. After selective reading and codification, the author abandoned irrelevant data from the interviews and secondary interview, and tried to find out patterns in all the information the author selected.

Besides qualitative analysis, quantitative data could be interpreted in an objective way to verify the hypotheses. As explained previously, the author also
2.5 Research Quality

makes use of quantitative data, which refers to by applying numerical data that is used in the study to help in answering the research questions. The data in this research will be collected mainly through by using the financial reports of companies under study in order to have an rational insight of how disruptive innovation influenced them.

Furthermore, the quantitative data collected need to be better interpreted and illustrated for better understanding as suggested in (Saunders et al, 2003). In this case, the author compiled the data collected from the financial reports using Microsoft Excel, a tool that is specialized in data processing. The result is shown in the form of curves and charts.

2.5 Research Quality

As the National Academy of Sciences (2009) mentioned, the scientific research should be the foundation of trust so that the result of the study can be valid. According to Bryman (2012), in order to conduct a solid quality research, reliability and validity could be considered as criteria that researchers need to pay attention to. Reliability in this case means that the study should be able to be repeated with the result being the same overtime (Bryman, 2012). In order to address the reliability of this research, the author applies a few tools introduced by Creswell (2007), which are listed as below:

To use three different and independent sources of information which is called triangulation.

Detailedly describe the data from participants to final readers which is called transferability.

To make sure that different viewpoints and voices are presented which is called authenticity.

The researcher has to be able to self-criticize as it is called integrity.

Different sources, for instance scientific articles, annual reports, reports from consulting firms etc. were used by the author for eliminating the possibility of my own bias. Peer study groups are also reliable for the author, we need to check the status of progresses and give feedback to each other every two weeks. Validity is one of the main concerns of any research, which means the method
should be credible and research questions should be focused and distinct which could make contribution at the end (Colliver et al., 2012). According to Bryman and Bell (2007), validity can be categorized into two forms, internal validity and external validity. Regarding internal validity, it refers to whether the observation by the researcher matches the theories applied. External validity is about how the conclusion of the research can be generalized more widely than before.
Chapter 3
Theoretical Framework

In this chapter, the author presents concepts and theories used in the study, which provides an overall theoretical foundation for the analysis of the empirical study later. The theoretical part includes mainly two major aspects including sustaining and disruptive innovation, and organization competitive advantage.

3.1 Sustaining Innovation and Disruptive Innovation

The terminology of "disruptive" technologies comes from study of business management, and was defined by Christensen (1997) in his book "The Innovator's Dilemma" as: "Sustaining technologies improve the performance of established products, along the dimensions of performance that mainstream customers in major markets have historically valued. Disruptive technologies bring to a market a very different value proposition than had been available previously. They under perform products in established markets, but have other features that a few fringe (and generally new) customers value." Draughon (2000) follows Christensen (1997) and states "Sustaining technologies support traditional business models. Disruptive technologies enable the introduction of alternative business models to fundamentally change the way industries function".

According to Christensen (2003), a disruptive innovation is an innovation that helps a company create a new business model and value network, and eventually disrupts an existing market and value network, at the same time against entrenched incumbents and creates enormous value. Commonly, the term of disruptive innovation is used in business and technology literature to
describe innovations that improve a product or service in ways that the market does not expect and exist, typically first step could be realized by designing for benefiting a different set of consumers in a new market and later by lowering prices in the existing market against entrenched incumbents benefit (Danneels, 2004).

As illustrated in Figure 3.1, sustaining innovation is achieved by listening to the needs of customers in the existing market and continue creating new products that satisfy their foreseeable demand for the future. In most cases, the established market leaders are extremely good at exploiting sustaining innovations in order to reach the short-term operational target of their companies and care about immediate interests. This is because employees or managers need to be evaluated according to their performance once or twice a year, according to the performance management decision-making system to calibrate rating and make reward decisions (for instance, increase salary and grant stock options) (Gilliland et al., 1998; Hillgren et al., 2000 and Longnecker, 1987). Hence, in order to achieve their target and have a good performance evaluation result, most people prefer to sacrifice vague and uncertain interest and accomplish immediate interest.

In fierce competition environment, sustainability is somewhat in equal to
continuous innovation. It is essential for MNCs to generate innovation internally or acquire competitive advantages in order to maintain their competitive position. In order to be sustainable, MNCs need to create differentiated products or services that offer consumer benefits (Reinhardt, 1999). They may also need to improve scientific design and operation of the user interface, reduce cost in order to achieve competitive prices and achieve sustainability. Usually customers are sensitive to price, and innovation can lower the price of the products, hence it can capture more customers' eyes and gains more market share at the same time achieve sustainability. Thus, we can say that sustainability and innovation influence each other mutually. On the one hand, sustainability is a strong trigger to promote innovation (Nidumolu et al., 2009). On the other hand, innovation in turn puts a company's sustainability strategy into reality.

Regarding innovation, according to Christensen (1997, p.132), there are two distinct categories in innovations: sustaining and disruptive. Sustaining innovation is when the competitive race forces the dominant company to continuously develop better products to attract customers. In such a competition the incumbent supplier usually wins. In such case, business giants such as IBM and Microsoft seem to be dominant and everlasting. Disruptive innovation on the other hand, is when an emerging company commercializes a simpler or better product in a leaner and more cost efficient way so that its products are more attractive to the customers. In the case of disruptive innovation, the new comer usually outperforms the incumbents. It is this phenomenon that keeps the business world volatile and dynamic by bringing fresh elements and retiring the old ones. Disruptive innovation usually implies that the new comers attack the well-established ones from unprepared aspects (Christensen, 2003).

In the case of sustaining innovation, the entrenched firms appear to be well prepared for the continuous change of the market as they keep investing in the R&D and marketing activities. They look prosperous and capable of leading the industrial trend. However, they are unprepared from a cost structure and business model point of view, to take a smaller margin or to develop a lower quality and cheaper version of their lucrative product. In contrast, the new entrant is certainly more prepared for lower margin and cheaper products. As Christensen and Raynor (2003, p.43) mentioned: "When Canon's desktop photocopiers were a new-market disruption, in that they enabled people to begin conveniently
making their own photocopies around the corner from their offices, rather than taking their originals to the corporate high-speed photocopy centre where a technician had to run the job for them. When Canon made photocopying so convenient, people ended up making a lot more copies. Newmarket disruptor’s challenge is to creat a new value network, where it is nonconsumption, not the incumbent, that must be overcome”.

In the above examples, the established supplier focused mainly on improving the product at hand to increasing their margin by moving up the scale to more lucrative customers. They were "unprepared" to venture into lower margin, lower quality business and didn’t "expect" that a "smart" entrant will eventually topple them. There is also the classic case of the Mini Computer manufacturers. None of them ventured into the PC market, because their cost structure and resources allocation system didn’t allow them to compete. They geared their business model toward sustainable innovation by improving the speed and the power of the minicomputer while completely ignoring the emerging "lower quality, less efficient" but cheaper and more convenient Personal Computers (Christensen, 2003).

Disruptive innovation like this, starts at lower quality but with time its sales improve, quality improves and market share increases till eventually they topple the incumbents all together. Another type of disruptive innovation is the Low-End. This is what we call a disruption that takes root at the low end of the original product. According to Thompson (2013), great investments are both non-consensus and correct, and examining the valuation process shows that consensus tends to coalesce differently around each type of innovation.

Thompson suggested that there are four types of disruption that could shape an investment thesis (Thompson, 2013):

- **Low-end disruptive**: a dramatically cheaper way of producing worse products for customers who are over-served by existing options.

- **New-market disruptive**: a cheaper, more accessible, and worse-performing product that turns non-consumers into customers.

- **Quality-sustaining**: Christensen’s "sustaining innovations": incremental improvements to product performance, leading to higher cost; companies’ bread-and-butter when products are not yet good enough.
3.1 Sustaining Innovation and Disruptive Innovation

- **Efficiency-sustaining**: incremental innovations that make products cheaper and businesses more efficient; these are important all the time, but particularly when product performance becomes "good enough" for most customers.

Disruptions such as discount retailing can be considered pure low-end disruptions in that they do not create new markets or products, instead, they are simply low-cost business models that grew by picking off the least attractive of the established firms’ customers. Those customers really had enough improved quality and now needed simpler and cheaper products to do the job. New-market disruption is more complex. Because products and customers are entirely new, it’s harder for analysts to mistakenly force these innovations into the old paradigm. As a result, outlooks are more likely to be positive or mixed (Thompson, 2013). Although they look different, low-end and new-market disruptive innovations share one thing in common as both are unprepared by the entrenched ones. As the famous military general Sun Tzu has written in his book on the art of war (Lionel, 2007), "Attack when the incumbents are unprepared and appear where the incumbents least expects them”.

In order to survive, companies must satisfy customers with products and services, at the same time the companies also need to please investors with generating profit that they require (Christensen, 2003). Generally, good financial performance companies close to customers demands, existing operational system guiding their employees to follow the customers’ need, at the same time avoid divergent thinking and kill ideas that the customers don’t want. Another reasons is, one of features of disruptive innovations is low margin and vague market prospect that usually causes these companies not willing to invest in disruptive innovation and try to ignore it until the time the customers want disruptive innovation. Unfortunately, when this happens, it is usually too late.

### 3.1.1 Five Principles of Disruptive Innovation

According to Christensen (2003, p.xxii-xxvii), Christensen’s disruptive innovation theory consists of five major principles as described in the following subsections.
Principle #1: Companies Depend on Customers and Investors for Resources

One of Christensen’s theories is that while managers may think they control the flow of resources in their firms, in the end it is really customers and investors who dictate how money will be spent because companies with investment patterns that don’t satisfy their customers and investors will not survive (Christensen, 2003). The highest-performing companies, in fact, are those that are the best at this, that is, they have well-developed systems for killing ideas that their customers don’t want.

Good performance companies’ mission is to maintain their market share and retains their employees. Commonly, research, development, marketing and administrative costs are critical to remain competitive in their mainstream business, as they become bigger, the more profit and revenue need to be created just to ensure the smooth running and growth rate. Therefore, these companies are averse to enter new, small markets that destined to dominate the markets in the future.

According to Christensen (2003), it is very difficult for a company whose cost structure is tailored to compete in high-end markets to be profitable in low-end markets as well. In front of disruptive technologies, people in a well-established organization are seldom willing to allocate the critical financial and human resources needed to carve out a strong position in the small, emerging market.

Principle #2: Small Markets Don’t Solve the Growth Needs of Large Companies

The author follows Christensen’s view to make the second hypothesis that entrenched firms need to put their focus on existing big market to generate enough revenue and profit to justify the share price that capital market expects. However, when disruptive innovation occurs, the new markets usually are not that large. Hence as Chrisensen (2003) pointed, "Many large companies adopt a strategy of waiting until new markets are "large enough to be interesting"." This strategy is not often a successful strategy as will be elaborated in the empirical chapter.

Note that small firms can most easily respond to the opportunities for growth in a small market. Christensen suggested that the entrenched ones shall restructure their organization to allow smaller and smarter business units which
3.1 Sustaining Innovation and Disruptive Innovation

matches the size of the new market. As the market will eventually grow big someday, the entrenched firms will still be able to catch the opportunity despite of the current size of the market.

Principle #3: Markets that Don’t Exist Can’t be Analyzed

Entrenched firms usually are good at market analysis and have good plan for operational activities such as R&D and marketing. This is why well established firms always win in sustaining innovation (Christensen, 2003). This practice is valid when dealing with sustaining technology as the size and growth rates of the markets are generally foreseeable. As most executives are trained to manage sustaining innovation, they are good at analyzing and planning for things they can predict. In this case, the entrenched firms under good management will unlikely fail as their executives can always make reasonable decisions and following the trajectory that market analysts can predict. In this way, the bigger ones will always win as depicted in Fig. 3.1, which will result in the convergence of business world at one day to a few giant firms with the small ones forced out.

Fortunately, what makes the business world dynamic is the disruptive and uncertain changes that may occur, for which the executives of big firms are less prepared. "In dealing with disruptive technologies leading to new markets, however, market researchers and business planners have consistently dismal records", according to Christensen (2003), "the only thing we may know for sure when we read experts’ forecasts about how large emerging markets will become is that they are wrong".

Disruptive innovations create value networks in niche markets, which are different from existing technologies and where they might be seen to exist. Additionally, as Sood and Tellis (2005a, 2005b) mentioned, most time the new technology starts below the prior ones in performance. Usually, people would like to do research on a sound and mature market, and disruptive innovations and its new landscape is never shown up, hence there is no history data and information that can be analyzed.

As most of us know little in the case of disruptive innovations, the first-mover advantage can be sudden and big enough to overthrow the positions of established firms. Especially those entrenched companies with stringent and hierarchical management usually demand accurate and convincing market data
for every investment and project to be carried out. They can be paralyzed or make serious mistakes when faced with disruptive technologies (Christensen, 2003).

**Principle #4: An Organization’s Capabilities Define Its Disabilities**

The entrenched firms usually have significant advantages such as cutting-edge technology, strong branding effect or powerful retail channels. On the other hand, these capabilities that convey the companies to their peak time could be the very disabilities for them to fall. According to Christensen’s disruptive innovation theory, "when managers tackle an innovation problem, they instinctively work to assign capable people to the job. But once they’ve found the right people, too many managers then assume that the organization in which they’ll work will also be capable of succeeding at the task”.

As pointed out by Christensen (2003), the capability framework of a firm consists of three major factors - resources, process and value. Resources are relatively easy to obtain for large organizations. However, process and value are usually hard to change. Especially for established firms, it usually takes a long time for them to set up processes and values that are accepted by the majority. Once a process or value is set up, it is hard to change them as pointed out in (Christensen, 2003). However, the problem is that a process that is effective at one task might be ineffective at another, and a value that aims for the high-end market is hardly applicable to the low-end market. In other words, the capabilities of an organization usually defines its disabilities. This will be further elaborated with empirics in Chapter 4.

**Principle #5: Technology Supply May Not Equal Market Demand**

According to the disruptive innovation theory in (Christensen, 2003), at the beginning, disruptive innovation could be utilized only in niche markets and applied by small companies, although afterwards they could dominate the mainstream markets. However, the pace of disruptive innovation progress often exceeds the rate of improvement that customers want or demand. The disruptive technologies that underperform relative to customers’ expectation in the mainstream market today, but the technologies will become directly competitive to-
morrow. Once the disruptive technologies become more mature, and two or more products’ performance are adequate, customers tend to look other criteria for choosing. These criteria are for selecting, for instance convenience, price, reliability, all of which are areas in which the newer technologies often have advantages.

This principle suggests that once the performance of the technology goes beyond the need of consumers, the differentiation that the entrenched companies have will be diluted as the performance of the disruptive technologies can suffice the need of consumers though they are still inferior to those held by the entrenched ones. Meanwhile, as the disruptive technologies usually have cost leadership as they emerged from the low-end market, the competitive advantage will shift in favor of the new comers emerging from the small and low-margin markets.

### 3.2 Organization Competitive Advantage

According to the author, the competence of an organization consists of two major factors: cost leadership and differentiation. This theory was initially proposed by Michael Porter (1985) as he proposed the theory of competitive advantage in 1985. According to the theory, the advantage derives from attributes that allow an organization to outperform its competitors. Being different from the thesis which is focusing on company-based case study, Porter’s competitive advantage theory emphasizes productivity growth as the focus of national strategies, which is built up on the hypothesis that cheap labor is ubiquitous and natural resources are not necessary for a good economy. On the other hand, born on the small island of Taiwan with limited natural resources, the success of MediaTek is a good evidence of the competitive advantage theory as elaborated in Chapter 4.

According to Porter (1985), it is hard for the company manages to maintain its cost leadership while keeping differentiation. However according to Oskarsson and Sjoberg (1994) differentiation and cost leadership are not necessarily conflicting strategies. Moreover Karnani (1984) argues that differentiation does not need to be compromised by launching low costs leadership. The effect of
an increase in differentiation on market share is dependent on two opposing forces. On the one hand, an increase in differentiation most likely leads to a high cost position independent of scale, which result in a high average cost position (cost increasing effect). On the other hand, improved differentiation generates competitive advantage, which leads to increased market share, and following, to a low average cost position. For example, Apple Inc., the one that leads the high-end smartphone market with its iPhone series, has a ground-breaking technology - iOS, the smartphone operating system and iTune, the online shop where users can purchase their favorite music and software with reasonable price. When iOS was born, incumbent phone companies like Nokia did not even understand what a smartphone should look like. From cost advantage point of view, Tim Cook, then COO of Apple, implemented one of the tightest cost control procedure at Apple. Service quality wise, Apple is at least as good as Nokia and better than most phone vendors. Fashion-wise, Apple has represented the design fashion by its cutting-edge UI through many years and has a large number of fans, who only recognize this brand. In comparison, Apple outperforms Nokia in all aspects. In such a way, Apple beats incumbent phone vendors such as Nokia and Motorola in competitiveness.

3.2.1 Cost Leadership

A pricing strategy in which a company offers a relatively lower price to stimulate demand and gain market share and achieve sustainability. Generally, cost leadership is about being the lowest cost producer in the industry (Porter, 1985). For an organization to gain competitive advantage, it must achieve overall cost leadership in an industry it is competing in. Usually, consumers are sensitive to price and quality (Engel, 1968), hence these are crucial for companies competing in a price-sensitive market. However, although pursuing a cost leadership strategy is vitally important, companies also need to consider about differentiation. Companies competing in the industry through product and service differentiation will need to focus on cost effectiveness and quality to maintain or enhance the value perceived by their target customers (Porter, 1985). In emerging market, the core of the cost leadership strategy is emphasizing of providing products and services at the lowest cost per unit within an entire in order to
achieve competitive advantage and keep sustainability (Li et al., 2008). Therefore we could understand the aim of this strategy is to pursuing to become the producer with lowest cost in the industry. Why is cost leadership potentially so important? Cost leadership could aid enterprises to offer a relatively low price to stimulate consumption demand and achieve the goal of gaining market share (Murphy, 2013). In order to gain the advantage, and launch products with more competitive price in the market compared to its competitors, the enterprise ought to reduce of each and every cost that influences its operation (Ferfeli et al, 2009).

### 3.2.2 Differentiation

As suggested by Porter (1985), differentiation is also a generic strategy to achieve competitive advantage. A firm seeks to be unique in its industry along some dimensions that are widely valued by buyers. It selects one or more attributes that many buyers in an industry perceive as important, and uniquely positions itself to meet those needs. It is rewarded for its uniqueness with a premium price (Porter, 1985). Differentiation can be anything including technology leadership, quality of service or even fashion. Some features can be measured quantitatively while others are subjective and difficult to measure with numbers.

For example, (Asch et al, 2001) argue that the growing importance of a product’s quality depends on two factors - The first one being the national income: as nations prosper, consumers wish to buy not just a greater quantity of goods and services but also higher quality products. The other factor is the liberalization of world trade: in the context of the economic globalization, the suppliers from the developed countries increasingly face the competition of those located in low-wage countries (Asch et al, 2001). As a consequence, many firms in the developed countries have to move up in the value chain by upgrading their capability to produce more sophisticated products that embody highly skilled labor or cutting-edge technologies as their competitors in the developing world usually enjoy cheaper labor and material costs.

To achieve differentiation strategy requires a firm to choose attributes in which to differentiate itself from its rivals. In this case, the attribute can be the product itself, the retail channel, the branding strategy, or any other factors that
can promote the firm’s image to achieve price premium. On the other hand, it is important to choose the right areas to invest so that differentiation is achieved at minimum extra cost. Otherwise, the premium prices will be nullified by the significant inferior cost position.

Differentiation is a dynamic factor which can change in short period of time. For example, when a firm’s differentiation factor is certain technology, it has to make sure its competitors will not be able to obtain the same technology before its own gets upgraded. This is proven difficult when the technology becomes mature and standardized. Once a firm’s unique technology to differentiate becomes standard, the advantage over other firms will vanish. It must find other things to differentiate.

According to Principle #5, when a certain technology matures and its development goes beyond the need of the market, it will become harder for the firms in developed countries to maintain their differentiation in technology thus leaving them vulnerable in front of disruptive innovation especially those initiated from the developing countries.
Chapter 4
Empirics

Ever since the 1990’s, mobile phones have started entering common families covering billions of population. Traditional phone vendors such as Ericsson, Motorola and Nokia led the first round of momentum and created huge business success in the Chinese market. Since Apple’s release of its first generation smartphone iPhone in 2007, the smartphone market has started taking off. However, due to the growing but still limited purchasing power and lack of knowledge to use more complex smartphones, the penetration of smartphone market was still limited to the high-end market, which was dominated by companies such as Nokia, Sony Ericsson, HTC and Apple. Meanwhile, mobile phone chipsets, which form the core part of a smartphone, are only available from companies such as Qualcomm Inc. and ST-Ericsson etc. (Boxall, 2014). In order to build a smart phone in the traditional way of manufacturing, the vendor not only needs to invest several millions of USD but also need to set up a team of hundreds of experienced engineers which are not easy to find in the labor market. Hence the smartphone market experienced significant growth mainly in Western Europe and U.S. with the price segment mainly between 300USD and 600USD. The market with price lower than 100USD was still dominated by low-end feature phones from Nokia and other vendors.

It is well known that the R&D procedure of smartphone used to be lengthy and costly due to the comprehensive knowledge required by the manufacturers. For mobile phone makers, chipsets have always been the bottleneck. A chipset is a set of electronic components in an integrated circuit that manages the data flow between the processor, memory and peripherals; chipsets play a crucial role in determining mobile phone system performance (Carsten, 2012).
As depicted in Figure 4.1, a mobile phone chipset usually contains a number of key IC modules including the application processor and baseband unit, memory controller, power management IC, connectivity IC (for Wi-Fi and Bluetooth), navigation IC (for GPS/Galileo/BeiDou navigation) and an RF (radio frequency) transceiver IC and a PA (power amplifier) IC. The chipset and the display screen consist of the largest portion of the mobile phone’s cost. Chipset technology is the most sophisticated part inside a mobile phone and used to be controlled by a few global giants such as Texas Instrument, Ericsson and Nokia. Even Intel did not have such technology until the acquisition of Infineon’s wireless division in 2009. Meanwhile, due to the diversified expertise required, it was rare that all IC modules were supplied by a single vendor. Instead, it was common that IC modules used inside a phone were from over ten different IC suppliers. In the past, most wireless and mobile semiconductor suppliers can be broadly classified into four categories - baseband modem, application processor, connectivity solutions, analog and power management.
4.1 The Rise of MediaTek

MediaTek Inc. is a mobile phone chipset vendor emerging from Taiwan. The company noticed that huge opportunity existed in this market because it represents over half of the global population. It created a new business model by supplying turn-key solutions (a complete set of IC module together with the reference design) to mobile phone vendors, which disrupted the traditional business model played by entrenched incumbents. MediaTek’s turn-key solution not only provide competitive products to giant companies for instance Sony, Samsung etc., but also allow middle and small sized mobile phone vendors to produce high-quality smartphones with much less investment and shorter time compared to the traditional ways (Chen et al., 2013; Rong et al., 2009). MediaTek collaborates with its customers to build a new business model, under this new model MediaTek gain market share from entrenched incumbents, meanwhile hurts them as well. The competition in phone industry is becoming fiercer than past decades, turn-key solution aids its customers could produce high-quality with low-price smart phones in order to gain more market share and achieve business success. Because of using turn-key solution, some mobile phone vendors could provide people smart phones with low price, and low-income people could choose to use them which could improve their life quality instead of using feature phones produced by entrenched incumbents.

MediaTek started out as a spin-off from United Microelectronics Corporation (UMC). Before MediaTek was spun off from UMC, UMC was Taiwan’s fist indigenous semiconductor company that participated in the full value chain of designing, manufacturing, and selling integrated circuits (ICs). But the establishment and enormous success of its competitor across the street - Taiwan Semiconductor Manufacturing Company (TSMC) caused UMC to spin off its IC design activities into several units (Mat, 2013). Among them, MediaTek had a focus on multimedia devices. The current president Ming-Kai Tsai joined UMC in 1983 as director of R&D. From 1989 to 1994, he served as the executive vice president of a business unit that covered computer, communication, and consumer electronics. From 1994, he oversaw the development of the company’s memory, consumer, and multimedia business units. Thus, when the spin-off came, Tsai was the logical leader (Shih et al., 2010). While still at UMC, Tsai
recognized the rising importance of CD-ROMs to the personal computer industry as replacement for floppy disks. After Tsai successfully led MediaTek to take over Japanese suppliers as the largest supplier of CD-ROM/DVD-ROM and Blu-ray DVD player chips, the company started to ride the rapidly growing demand in mobile phone market.

![Financial Data of MediaTek, Inc. (Unit: Million USD)](image)

**Figure 4.2: MediaTek’s Financial Data**

As illustrated by Fig. 4.2, MediaTek’s revenue got a hit around 2011. According to the author’s investigation, this was partly due to MediaTek’s mistake in failing to recognize the sign of Android-based smart phone boom. Around 2009, when MediaTek was choosing operating systems for its smart phone platform, it chose Windows Mobile from Microsoft. The reason was that HTC, a major Windows Mobile-based cell phone manufacturer, became a stock leader in Taiwan thanks to the hot sales of Windows Mobile-based products (People’s Daily, 2010). This was one major reason why Mediatek chose Windows Mobile platform. Moreover, at that time Windows Mobile was much more mature compared to Google’s Android. However, one year later, promoted by leading cell phone makers including Samsung, HTC, LG and Motorola, Android-based smart phone quickly occupied the market leaving MediaTek outside of the door. It was only in 2012 when MediaTek adopted Android as the OS platform, its revenue started recovering.

By 2013, MediaTek had become the largest mobile chipmaker in Taiwan. Its
chips power devices from the likes of Lenovo, Sharp and Acer, as well as Chinese giants like ZTE and Huawei. It generated about $4.5 billion in revenue in 2013 selling chipsets for some 500 million phones, easily eclipsing Samsung, HTC and Apple in total volume. Yet few know who MediaTek is. (Mat, 2013)

4.1.1 MediaTek’s Cost Leadership

As the focus of this thesis is disruptive innovation instead of technical benchmarking, the author will not address the technical details of MediaTek’s products in comparison to those from its competitors. To make a simple explanation, as depicted in Fig. 4.3, taking MediaTek’s 3G smart phone SoC MT6589 as an example, its technical specification is similar or even better than the mainstream Solution A and B from another entrenched player. Meanwhile, according to the investigation conducted by the author, the cost of its products is significantly lower than those from Qualcomm.

Figure 4.3: Specification of MT6589 in Comparison with Mainstream Products in 2012 (McGrath, 2013)

McGrath (2013) provides certain evidence of MediaTek’s cost leadership.
Compared to entrenched players such as Qualcomm, MediaTek has a different mindset in product R&D, it puts a lot of effort on reducing the cost of its products. For semiconductor companies, the cost of an integrated circuit is generally determined by the silicon area of the chip. MediaTek’s products are known to be smaller than those from Qualcomm in silicon areas. For example, the analyst firm ABI reported that Mediatek’s transceiver measures less than 7 square millimeters and supports 2G and 3G protocols. Transceivers with this functionality are typically larger than 20 square millimeters. It also reported that Qualcomm’s current solution is more than 25 square millimeters in (McGrath, 2013).

McGrath (2013) shows that MediaTek’s product competitiveness is close to, or even higher than that of Qualcomm especially from a cost perspective. This gives MediaTek a powerful weapon when competing with Qualcomm in the middle-end and low-end markets which are price sensitive.

It was also mentioned in (McGrath, 2013) that Mr. Mielke has an opinion that “Qualcomm will remain the leader of the pack as long as additional technology is required. But once the mobile device reaches a point where consumers are satisfied with performance, watch for Mediatek and companies with the same mindset to come on very strong.”

### 4.1.2 MediaTek’s Differentiation

The differentiation used by MediaTek to gain competitive advantage is its "reference design" based turn-key solution. For its mobile handset chipsets, MediaTek supplies what it calls "reference designs" - which include the chip and the operating system, camera, display and more - that need little more than polish and personalization from the manufacturers branding and selling them (Mat, 2013). The "reference design" is a technical blueprint for the system that included both hardware and software. On the hardware side, it included a schematic and a printed circuit board layout for a typical implementation. In that case, all they had to do was add a plastic case and they would be halfway there. This is called turn-key solution which has worked exceptionally in the feature phone era, and now MediaTek for once again has successfully applied it to the smart phone market. As depicted in Fig. 4.2, the financial data shows that MediaTek’s revenue and profit was hit in 2011 due to its slow transition from feature phone
4.1 The Rise of MediaTek

era to smart phone era. Though in 2012, it finally picked up its momentum and experienced significant growth in 2013. The turn-key solution also change the game in mobile semiconductor supplier circle in the way that only a handful suppliers managed to survive by providing a complete solution including all components depicted in Figure. 4.1. Among them are Qualcomm, MediaTek, Intel and Spreadtrum etc. Many traditional suppliers such as TI, ST, NXP and EMP have been either forced out of the market or have survived in a very limited market segment.

While MediaTek uses cost leadership to gain advantage over the entrenched firms such as Qualcomm, it keeps trying to differentiate itself from other low-end chipset suppliers such as Spreadtrum by setting high standards for its products, integrating all mainstream features into its base at what it called tier-one performance. For example, its strategy was to offer audio quality better than that available on an Apple iPod, speech quality better than a typical Nokia handset, modem performance better than Nokia and so on, in its base platform as well as a host of features (Shih et al, 2010). "We did a comparison on MediaTek’s WCDMA/HSPA platform, its modem performance in many field test cases is better compared to the mainstream Qualcomm modems. Throughput-wise it is about 10% - 20% higher. I personally think it set the record for 21Mbps HSPA modem performance in year 2012", according to an employee of one of MediaTek’s competitors in interview No.3.

In 2013, MediaTek launched its "octa-core" chip, the MT6592, claiming it to be the first of its kind that can use all eight processors simultaneously. Designed to be both powerful and energy efficient, the chip has a clock speed of 2 GHz and is built with ARM’s Cortex-A7 processor cores. "Although MediaTek initially positioned the product towards mid-range smart phones priced at $300-$400, very soon its customers started flooding the market with products priced at $150," said an executive of a top five smart phone vendor interviewed by the author in interview No.4, "Eventually MT6592 was a very successful product as it helped MediaTek’s revenue surpass Nvidia to be ranked the fourth on the fabless IC vendors’ ranking. However, this success is barely close to Ming-Kai Tsai’s ambition - to be seen as an alternative choice other than Qualcomm in the high-end market."
4.2 MediaTek’s Competitors in Mobile Chipset Business

The rise of MediaTek happened in a sophisticated global background which needs further elaboration with empirics. One of the reasons is that the mobile phone chipset industry is a technology intensive industry which makes it hard for readers without relevant technical background to understand. For a better understanding of the landscape change of the mobile phone chipset industry, the author conducts a detailed elaboration of all major players in this industry during the past ten years, followed by analysis of financial data and interviews to explain how some of them failed while others succeeded.

4.2.1 Texas Instruments

TI (Texas Instruments) is an American company founded in 1951 that designs and makes semiconductors, which it sells to electronics designers and manufacturers globally. Headquartered at Dallas, Texas, United States, TI used to be the third largest manufacturer of semiconductors worldwide after Intel and Samsung, the second largest supplier of chips for cellular handsets after Qualcomm. The company produced the world’s first commercial silicon transistor. In the 90’s TI played dominant position in mobile phone chipset market (Muppala, 2009).

As depicted in Fig. 4.4, revenue from its wireless business used to form half of the total revenue of TI’s semiconductor business (Texas Instruments, 2014). However, the business reached its peak in 2006 followed by drastic downward change. According to Muppala (2009), TI announced its intention to sell its merchant base band business late 2008. Earlier 2009, TI declared this business would be run as end-of-life case after failing to find a buyer at a reasonable price. The wireless division at TI took a huge hit in 2008 - revenue was down 19% to $3.38 billion, and profit dropped 55% to $347 million. Operating margin was down to 19.5% from 25.3% in 2007 and 23.6% in 2006. The suffering has continued into 2008. Compared to the year-ago quarters, revenue fell by 42.48% in 4Q08; 40.17% in 1Q09; and 33.37% in 2Q09 respectively. Baseband revenue in particular dropped 31% in 4Q08. TI’s share of baseband revenue fell to 19.7%
4.2 MediaTek’s Competitors in Mobile Chipset Business

from 22.1% in the previous quarter (Muppala, 2009).

The fall of TI is partly due to its biggest customer - Nokia. In late 2008, Nokia, a major customer to TI, who used to source most of its baseband needs from TI, adopted a multi-sourcing strategy in late 2007. Meanwhile, TI’s market share in the 2G/2.5G feature phone market dropped quickly due to the turn-key solutions from MediaTek and Spreadtrum that drastically lowered the requirement for small Shanazhai vendors to enter this market. According to interview No. 4, "TI used to take over 60% of the feature phone chipset market in China. It used to require significant investment as much as several millions USD to use TI’s chipset solutions in making a mobile phone. Just after MediaTek’s turn-key solution emerged, the bar was lowered to as low as 500,000 USD which made it possible for small and even family-based companies to make feature phones based on the copy of big brands - they are called Shanzhai phones". As TI did not have its own 3G modem solution, it was hard for itself to compete in the booming 3G smart phone market. After losing the position as top cellular baseband provider to Qualcomm in 2007, TI quickly dropped along the ranks of wireless chipset suppliers. One of the major reasons is that TI’s mobile development platform does not provide a complete solution for a handset design. The designer needs to make another stop at a baseband provider. This might turn out to be a big disadvantage for TI if the trend to consolidate to save continues (Muppala, 2009). As depicted in Fig. 4.4, TI’s revenue from baseband went down to negligible level in 2013.

4.2.2 ST-Ericsson

Dated back to the GSM era of 2000, the Royal Philips Electronics was one of the largest suppliers of cellular chips (the modem chips inside each mobile phone) globally to customers including Ericsson and Nokia (Clarke, 2008). By then, only a handful of companies had the know-how to develop modem chips. At that time, the bar for entering the mobile phone market was so high that only a handful MNC had the technology and they seemed dominant and safe in continuous innovation as the wireless standardization is controlled by these giants. In 2006, Royal Philips Electronics spun off its semiconductor business as an independent company namely NXP Semiconductor N.V. and later privatized it by the American private equity firm KKR (Kolberg Kravis Roberts).
ST Microelectronics (STM) was formed in June 1987 by the merger of semiconductor companies SGS Microelettronica of Italy and Thomson Semiconductors, the semiconductor arm of France’s Thomson. STM was successful in supplying mobile phone application processors (namely Normadik) to Nokia and was ranked the 6th in the wireless semiconductor ranking in 2006.

On 10 April 2008, NXP and STMicroelectronics announced that they would combine their wireless operations in 2G, 2.5G, 3G, multimedia, connectivity and future wireless technologies to form a new company - ST-NXP Wireless. The combined venture was created from businesses that together owned significant portfolios of communication and multimedia patents. At that time, both NXP and ST were facing challenges from emerging players in 2G/2.5G market such as MediaTek and Spreadtrum while their 3G product portfolio was not strong enough to compete with Qualcomm.

In order to further strengthen ST-NXP wireless’s competitiveness, the board decided to make a further step - to merge with another capable player - Ericsson Mobile Platforms (EMP). EMP was formed in 2001 from Ericsson Mobile Communications during the European telecom crisis around the year 2000. It was a pure platform company after the transfer of all handset products to Sony Ericsson. Some of EMP’s customers were Flextronics, HTC, LG, NEC, Sagem, Sharp and of course Sony Ericsson. Thanks to Ericsson’s heritage, EMP was
4.2 MediaTek’s Competitors in Mobile Chipset Business

one of the first two companies in the world that commercialized 3G WCDMA modem chips, the other being Qualcomm. Despite of the heritage and technical advantage, EMP failed to generate real revenue and has always paved its way under the heavy burden of its unhealthy cost structure (Ericsson, 2014). ST-Ericsson was formed on 3 February 2009 when STMicroelectronics and Ericsson completed the merger of Ericsson Mobile Platforms and ST-NXP Wireless into a 50/50 joint venture.

In 2008, the Deustche Bank analysts divided 3G modem chip supplying companies into four tiers based on their understanding of the roadmaps and execution status of 11 companies. Among them, Qualcomm and TI were included in the top rank. EMP and a privately held company Icera Inc. were in the second tier. NXP was in the third tier and ST in the fourth (Clarke, 2008). According to Deutsche Bank, then there were only three HSDPA (advanced version of WCDMA) vendors; Qualcomm, EMP and Icera (Clarke, 2008). By then, ST had the third largest wireless revenue and NXP the fifth. EMP was the major chipset supplier to Sony Ericsson and was one of the only three HSDPA vendors. The parent companies thought that by combining the three together, a giant that can challenge the top one - Qualcomm can be formed. However, the management did not understand that the situation has changed. The board managed to find Gilles Defassy as the CEO of the new company. Mr. Defassy had years of experience in leading TI’s wireless division in its peak time, and he was expected by the board to lead the JV to compete with Qualcomm, the No. 1 player in the mobile chipset business.

"At the beginning, everyone was excited coz the JV had strong parents. Ericsson was the largest mobile network equipment vendors worldwide which is a major holder of cellular patents, and ST with NXP form two out of three major European semiconductor companies except Infineon.", a former ST-NXP employee commented in interview No.2, "But things did not get better. We suddenly became a company of 8000 people with many sites doing overlapped work and similar products. Soon everyone started wondering if our site will be closed. At lunches, people kept discussing rumors and nobody wants to take responsibilities. Soon the summer vacation came, and people started leaving for vacations."

"When we had Sandeep, during all employee meetings he said things like "Well, the LG CEO told me that he needs a chip that can cost this many dollars and has these
features”. Then we got Puskaric as a replacement and suddenly it was all about building brand awareness and no technology. And then the biggest customer Sony Ericsson kept on doing feature phones and asking for platforms to suit that kind of phone. And when they realized the feature phone was dead they turned to our arch enemy Qualcomm for smartphone platforms.”, according to interview No.1. Dr. Sandeep Chennakeshu was the former CEO of EMP who led the company during its golden age. Robert Puskaric was his successor before the formation of the JV.

According to interview No.2, the interviewee said “The CEO of ST-Ericsson said that we shall focus on the big customers like Nokia and Samsung. But the change of management at Nokia discontinued the Symbian smart phone platform and move on to Windows Phone which by then only had Qualcomm as the only certified chipset supplier. The feature phone volume at Nokia was shrinking quickly due to those white-box phones using MediaTek and Spreadtrum’s chipset. ST-Ericsson was moving too slowly in a very dynamic market like a sinking ship with 8000 people on it”.

ST-Ericsson tied its future to the fate of traditional mobile phone companies such as Nokia and Sony Ericsson. These vendors are considered to have occupied the high-margin market. However, as disruptive innovation occurs, they were losing their momentums while those new comers emerging to take over. ST-Ericsson as many entrenched ones are used to listen to their "most important” customers and by doing that, the company was lost in the transition from
the feature phone to the smart phone era.

On 11 December 2012, ST-Ericsson came to an end after its parent company STMicroelectronics decided to withdraw from the JV, citing loss of market share due to ST-Ericsson failing to attain break-even. Since the formation of ST-Ericsson in 2009, ST has slipped from 5 to 7 in global semiconductor firms’ rankings. On 18 March 2013, the parent companies announced that the joint venture was to be closed down, with the parent companies taking over parts, but not all, of its operation and products. Effective August 2, 2013 Ericsson took back the design, development and sales of the LTE multimode thin modem solutions, including 2G, 3G and 4G interoperability. ST has taken on the existing ST-Ericsson products, other than LTE multimode thin modems, and the GNSS (Global Navigation Satellite System) connectivity solution was sold to a third party (Ericsson, 2013).

4.2.3 Qualcomm

Qualcomm Incorporated is an American global semiconductor company that designs, manufactures and markets digital wireless telecommunications products and services. Headquartered in San Diego, CA, USA, the company has 157 worldwide locations. The parent company is Qualcomm Incorporated (Qualcomm), which includes the Qualcomm Technology Licensing Division (QTL). Qualcomm’s wholly owned subsidiary, Qualcomm Technologies, Inc. (QTI), operates substantially all of Qualcomm’s R&D activities, as well as its product and services businesses, including its semiconductor business, Qualcomm CDMA Technologies (QCT). QCT offers wireless solutions ranging for CDMA, UMTS, GSM and LTE technologies, providing support for both 3G and 4G networks and devices. With Qualcomm Atheros, Inc., a subsidiary of QTI, Qualcomm offers a wide portfolio of solutions ranging from Wi-Fi, GPS, Bluetooth to FM radio etc.

Qualcomm has helped to establish the CDMA2000, WCDMA and LTE cellular standards. The company is now focused on developing and licensing wireless technologies and selling mobile phone chipsets that implement them. Qualcomm is also the largest system-on-chip (SoC) supplier to smart phone vendors based on its product line named after Snapdragon (Clarke, 2008). The SoC incor-
oporates several ARM processors, graphic processing units (GPU) and wireless modem including technologies described in last paragraph. Fig. 4.6 shows that Qualcomm is the biggest winner of the smart phone era so far as it revenue experienced fast growth from 2004 to 2013. According to Fig. 4.22, Qualcomm is the largest fabless IC company measured by revenue in the world in 2013. Here fabless IC company means a company that only designs its IC but does not manufacture them. Instead, it sends the design to be manufactured by semiconductor companies such as TSMC.

Thanks to Qualcomm’s leading position in the wireless industry, its products have been widely used in the high-end market with high margins. Its customers include giants such as Apple and Samsung. Of the 47 million LTE-capable chipsets that were shipped 2012, Qualcomm accounted for nearly 86% of the market (Trefis Team, 2013). Qualcomm has been a successful example of entrenched company benefiting from disruptive innovation.

![Financial Data of Qualcomm Inc. (Units: Million USD)](image)

**Figure 4.6:** Qualcomm’s Financial Data

### 4.2.4 Intel

Intel Corporation is an American multinational semiconductor chip maker corporation headquartered in Santa Clara, California. Intel is one of the world’s
largest and highest valued semiconductor chip makers, based on revenue. It is the inventor of the x86 series of microprocessors, the processors found in most personal computers (Intel Corp, 2014). Intel’s core business is x86 based CPU used in desktops and servers. Meanwhile, it is trying hard to expand the market share of its Atom processors which target the mobile phone and tablet market (Intel, 2014).

Infineon was the spin off from the semiconductor division of Siemens. Its wireless product line division (Infineon Technologies AG Wirless Solutions) was one of the major suppliers of 2G/2.75G chipsets to mobile phone makers. However, its 3G solution was too late to enter the market and incurred heavy financial loss before it was acquired by Intel in 2010. Now the same group of people forms Intel Mobile Communication. The financial data of this division is included as part of the Other Intel Architecture (OIA) in Intel’s annual reports since 2008 (Intel, 2014).

As depicted in Fig. 4.7, the revenue of OIA grew from 1763 million USD in 2008 to 5005 million USD in 2011, which is aligned with the growth of mobile internet and smart phone market. However, starting from 2012, its revenue decreased to 4379 and then 4092 million USD in year 2013. "Net revenue for
Empirics

the Other IA operating segments decreased by $286 million, or due to lower netbook platform, feature and entry phone components, and Multi-Comm unit sales. To a lesser extent, lower Multi-Comm average selling prices contributed to the decrease. These decreases were partially offset by higher ISG revenue on increased platform average selling prices. Operating results for the Other IA operating segments decreased by $1.1 billion in 2013 compared to 2012. The decline in operating results was primarily due to approximately $590 million of higher operating expenses in the Other IA operating segments on RD investments in our smartphone and tablet products as well as higher cost of sales as we ramp our tablet business. Additionally, lower netbook platform and Multi-Comm revenue contributed to the decrease. These decreases were partially offset by higher ISG revenue,” as presented in Intel’s 2013 annual report (Intel, 2014).

Intel used to have an internal division making ARM based communications and application processors until it sold the business to Marvell for a purchase price of $600 million plus the assumption by Marvell of certain liabilities in 2006 (Intel, 2006). As elaborated later in Sec. 4.4.4, Intel has not been able to replicate its success in the PC era in the smart phone boom due to several reasons. As the PC market is shrinking due to various disruptive technologies such as the smart phone and cloud computing, Intel is facing challenges in maintaining its leadership in the coming years as further elaborated in Sec. 4.4.5.

4.2.5 Spreadtrum

Spreadtrum Communications, Inc. (NASDAQ:SPRD) is a fabless semiconductor company headquartered in Shanghai, China which produces chips for mobile phones. It is the world’s 14th-largest fabless semiconductor company measured by 2013 revenues as depicted in Fig. 4.22 according to IC Insights (2014).

Spreadtrum was the first company in the Asia pacific area to produce GSM chipset in large volumes, actually one year before MediaTek entered the same market. Although started earlier, Spreadtrum encountered various difficulties including product quality issues and investing too much of its limited resources to the Chinese born TD-SCDMA 3G standard which did not enter massive deployment until year 2009. In between 2008 and 2009, its revenue got a hit but quickly recovered from the crisis. From 2010, Spreadtrum’s customers accounted for 50% of TD-SCDMA handset sales in China Mobile’s TD-SCDMA
handsets including all major smartphone vendors such as Samsung, Huawei and HTC.

In between 2009 and 2012, Spreadtrum was considered a serious challenger to MediaTek. In 23 Dec. 2013, Spreadtrum was acquired by the Chinese Tsinghua Unigroup and delisted from Nasdaq. In 2013, Spreadtrum’s revenue reached 1 billion USD as depicted in Fig. 4.8.

![Financial Data of Spreadtrum Inc.](image)

**Figure 4.8:** Spreadtrum’s Financial Data

Spreadtrum’s business model is similar to MediaTek’s turn-key and white-box model, except that it managed to become a supplier of tier-1 mobile phone vendors such as Samsung. On the other hand, it is known to be aggressive in lowering the price when competing with MediaTek in the low-end market. As illustrated in Fig. 4.8, the revenue of Spreadtrum in 2013 booked a stunning growth rate of 48% mainly thanks to the boom of the TD-SCDMA market. According to interview No.5 by an executive of a major global mobile phone vendor, "Spreadtrum has very competitive products such as the 8810G for low-end TD-SCDMA smart phones. Meanwhile, its products have been adopted by big players such as Samsung which makes it very attractive for other customers as the product quality has been tested already by Samsung. The weakness of Spreadtrum is its limited R&D capability when developing new technologies. The company recently acquired a WCDMA modem company namely MobilePeak which was founded by Qiuzhen Zou, a former VP engineering of Qualcomm. Though it had difficulties in integrating the
team acquired and had to terminate the employment of Qiuzhen Zou as its Chief Technology Officer. Compared to MediaTek, Spreadtrum has limitations in long-term R&D plan which is probably due to its smaller size and limited financial resources available. The recent acquisition by Unigroup could be an opportunity for Spreadtrum to be more aggressive in R&D investment and price wars.”

As elaborated later in Chapter 5, Spreadtrum is a follower and competitor to MediaTek rising from the low-end market as it has relatively lower cost structure. MediaTek has to differentiate itself from Spreadtrum in technology and branding in order to maintain competitive advantage.

4.3 What Can Financial Data Tell Us?

By analyzing the financial data of the major players listed in the above sections, the author come to the following recognitions:

- The market of CPU for desktops and servers went through its peak in year 2011 as depicted in Fig. 4.7.

- The revenue growth of Qualcomm, MediaTek and Spreadtrum reflects the boom of smart phone market. This coincides with the shrink of the desktop market. According to the analysis firm Gartner (Norwood et al, 2014), “In 2013, Qualcomm’s semiconductor business grew 30.6%. This was achieved due to its market-leading position in smartphone application processors and Long Term Evolution (LTE) baseband processors. The company continues to outperform the market, with its mobile station modem unit shipments increasing 21% during 2013”. As MediaTek and Qualcomm topped Gartner’s Relative Industry Performance index analysis by significantly outgrowing their peers in the mobile handset market. MediaTek accomplished this by focusing on the low-tier and mid-tier segments in China and other emerging markets; Qualcomm dominated the Tier-1 OEMs and high-end segments (Norwood et al, 2014).

- As boosted by the Shanzhai market using turn-key solution, MediaTek and Spreadtrum’s revenue grew quickly by taking advantage of the disruptive innovation such as ARM CPU and Android OS.
4.4 Five Disruptive Innovation Factors

- TI’s plunge in revenue and profit due to its loss of market share in 2009 is aligned with the peak of MediaTek’s revenue and profit in 2009. It shows that as disruptive innovations such as turn-key and Shanzhai emerge, the entrenched one may quickly lose its competitive advantage to new comers as it was not prepared for the change.

- Intel’s OIA group is not prepared for the smart phone boom which is reflected by the marginal revenue inside Intel and heavy losses booked from 2008 to 2013. Though Intel has not given up this market but keeps strengthening its position in this area as elaborated later in 4.5.2.

4.4 Five Disruptive Innovation Factors

During the interviews, the author realized step by step that there are five things including technologies and business models, which are most frequently mentioned by the people under interview. According to Christensen’s disruptive innovation theory, these five factors are considered by the author to be disruptive and elaborated in the following sections. When these factors work together, the landscape changed in the semiconductor industry which would result in the entrenched ones to fall while new comers to rise.

4.4.1 Turn-key Solutions

Unlike traditional chipset vendors, MediaTek’s turn-key solution changed the whole mobile phone industry. As explained in (Shih et al, 2010), MediaTek provided its customers with a reference design, a technical blueprint for the system that included both hardware and software. On the hardware side, it included a schematic and a printed circuit board (PCB) layout for a typical implementation. MediaTek provided these in electronic form so that customers could easily modify them. Customers could also choose to use them directly without modification. In that case, all they have to do is to add a plastic case and they would be halfway there. Fig. 4.1 shows the implementation of the MT6253 Reference Design in a typical feature phone.

For software development, at feature phone’s era, MediaTek provided a
complete set of software development tools for their customers. Their customers can run the programs written for the phone on the development tool (namely simulator) which would behave exactly as the phone would. The simulator would duplicate the software environment for the handset (Shih et al., 2010). With the help of these tools, MediaTek’s customers had for the first time had the ability to customize a feature phone’s software with around 10 people (Shih et al., 2010).

Besides the standard hardware and software reference design. MediaTek even provided training to its customers in using these tools. Moreover, it sent out FAE (field application engineers) to customer sites to support them (Shih et al., 2010).

The only problem left is that there are still a few components that MediaTek do not supply directly which might be an obstacle for its customers to integrate together and produce a high-quality phone. To solve this problem, MediaTek did an intensive testing and qualification on the most available third-party components that its customers might want to use and had all the information published openly to its customers (Shih et al., 2010; Chen et al., 2013). Therefore, a white-box phone maker can easily decide which component to choose depending on budget available and quality expected. The readers can think of the sandwich fast-food chain Subway where customers can pick what they want and pay according to their choices. Meanwhile, MediaTek has been constantly trying to integrate more and more components to its chipset solution thus steadily reducing the number of components required on the printed circuit board (PCB) and reducing the number of PCB layers to reduce cost. For example, “MediaTek’s MT6572 is the world’s first dual-core SoC with integrated Wi-Fi, FM, GPS and Bluetooth functions targeted at the entry segment and also enables a cost-effective 4-layer PCB design” (MediaTek Inc., 2013). For small and middle-sized smart phone vendors such as Xiaomi, this allows them to produce smart phones at low cost and short time-to-market.

This made it very challenging for the traditional suppliers to maintain their market share. For example, TI used to offer independent application processor - its OMAP series (Texas Instruments, 2014). However, due to the prevalence of MediaTek’s solutions where application processor and modem are integrated into a single chip, fewer and fewer phone vendors are willing to adopt OMAP
which would require them to find a modem from elsewhere. Hence TI has been forced out of this market by in 2013.

The turn-key solution changed the competition base of the mobile phone industry. Starting from the feature phone era, it helped many white-box phone companies to thrive and profit. After entering the smart phone era, it helped new entrants to quickly design high-quality smart phones even before the traditional vendors and reshaped the mobile phone market landscape.

### 4.4.2 Shanzhai - The White-Box Model

Dated back to the earlier 2000, the basic functions of mobile phones are voice calling and text messaging. And the market leaders were Nokia, Ericsson, Motorola and Siemens. The chipsets used in those phones were supplied mainly by TI and the internal semiconductor divisions of these giant phone companies. Starting from 2000, TI was the largest supplier of mobile phone chipsets until it was replaced by Qualcomm due to the rise of smartphone market.

According to Ming-Kai Tsai, Chairman and CEO of MediaTek, "The term "Shanzhai Ji" discounts the huge economic value these handsets have created. The makers of these phones have created a classic "disruptive innovation" by addressing new markets with cost-effective solutions. If you look closely, you will find that many of these handset makers are quite innovative." (Shih et al, 2010).

When MediaTek started, much of the world’s attention in the first decade of the 21st century was focused on the deployment of the third generation (3G) mobile communications. As a new comer, MediaTek was confronting challenges selling its chipsets to tier-1 companies like Nokia, Motorola, or Samsung, where it faced entrenched competitors like Infineon, Freescale, STMicroelectronics, NXP Semiconductors, and Texas Instruments. Those companies were all chasing 3G in developed markets. So MediaTek offered products for 2.5G or 2.75G, that is, 2G signaling technology that included general packet radio service (GPRS) for data handling and targeted the Chinese market where 3G was not yet deployed (Shih et al., 2010). The company enjoyed great success riding the explosive growth in China, as China and South Asia rapidly became the largest handset market in the world.

As depicted in Fig. 4.9, the shipments of smart phones have surpassed that
of feature phones. The term “feature phone” is intended for customers who want a moderately priced and phone without paying the same price of a high-end smart phone. A feature phone has additional functions over and above a basic mobile phone which is only capable of voice calling and text messaging. Different from the feature phone era, smart phones have a higher standard regarding hardware and software. As elaborated later in Sec. 4.4.3, Android OS from Google provides a standard platform for smart phones which lowered the bar for small vendors to enter this market. Companies such as Qualcomm, MediaTek and Spreadtrum managed to ride on this opportunity. The change from feature phone to smart phone also created an opportunity for new mobile phone vendors to emerge. As depicted in Fig. 4.10, Chinese local brands have emerged while a few traditional brands such as Nokia and Sony Ericsson have lost their market leadership.

In (Shih et al, 2010), MediaTek’s president Tsai had a dilemma when the article was written. At that time, MediaTek’s major customers were small vendors selling copies of mobile phones without proper license and only in developing countries. In (Shih et al., 2010), a communication manager from Nokia said “We are not happy to see Shanzhai mobile phones thriving,” and wanted better regula-
tion, as the emergence of Shanzhai phones stained Nokia’s brand and threatens its reputation.

A few years later, when we look back, the "white-box" phones did not destroy Nokia. It was Nokia’s own mistake that buried its leadership when facing disruptive products such as Apple’s iPhone and Samsung’s smart phones powered by Android. Meanwhile, the market of "Shanzhai" also vanished because most small vendors have quit the business due to the reason that a few of them managed to grow big enough and become established brands, just like Nokia. They learned to lower the price by adopting MediaTek’s turn-key solution while maintaining high quality. Hence consumers no longer need to buy Shanzhai phones but turned to these new brands like Xiaomi, Lenovo, Yulong, ZTE and Huawei as depicted in Fig. 4.10.

![Figure 4.10: Chinese Smart Phone Market Share (Blodget et al, 2013)](image)

According to the authors in (Shih et al., 2010), MediaTek’s integrated solution approach to the mobile phone handset market had unleashed the Shanzhai phenomena, as well as a new wave of innovation at the low end of the market. Millions of consumers who had never before owned a mobile handset had a plethora of affordable choices from hundreds of makers. And those makers
had generated innovative products tailored to the needs of niche segments that were ignored by tier-one brands. MediaTek chipsets were now in handsets sold in 102 countries (Shih et al, 2010). The authors in (Shih et al, 2010) also raised questions such as whether MediaTek need to do something to cut supply to illegal knock-off phone manufacturers?

As Tsai pointed out in (Shih et al., 2010), "Knock-off" phones are just a transient phenomena. In the beginning, those makers had limited capabilities to make mobile phones. Hence for them, 100% imitation and copying of a brand was the only way for them to survive. But over time, as they learned, both from the market, and by using the MediaTek turn-key solution, they could provide more and more innovative features on their own without resorting to copying.

Now if we look back to the article written in (Shih et al., 2010), we will find Tsai is correct. Worldwidely, new brands have emerged from the Shanzhai vendors to enlist them to the top 10 suppliers of smart phones. Companies like ZTE, Huawei and Lenovo have taken the market share that used to belong to Nokia, Motorola, HTC and Sony Ericsson as illustrated by Fig. 4.20 and 4.21. Meanwhile, old brands such as HTC and Sony have officially taken MediaTek’s chipset into their products.

### 4.4.3 Android Operating System

Android is an operating system based on the Linux kernel (Open Hanset Alliance, 2012), and designed primarily for touchscreen mobile devices such as smartphones and tablet computers. Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliance - consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. The first publicly available smartphone running Android, the HTC Dream, was released on October 22, 2008. As depicted in Fig. 4.11 and 4.12, the number of smart phone and tablets using Android OS has since then dominated the market. Except for Apple’s proprietary operating system - iOS and Microsoft’s Windows Phone OS used mainly by Nokia, Android has become the defacto standard for smart phone OS. For the traditional phone vendors such as Nokia and Sony Ericsson, they can no longer differen-
4.4 Five Disruptive Innovation Factors

Differentiate them from others by owning their proprietary OS – Symbian. Now that everyone is at the same starting point, the competition has changed drastically.

![Figure 4.11: Global Smart Phone Market Share by OS (Blodget et al, 2013)](image)

4.4.4 ARM Processors

There are two giants in the computer processor industry. One is Intel, which builds most of the processors in today’s PCs and servers. The other is ARM Holdings, in Cambridge, England (Courtland, 2012).

The two companies have quite different business models. Intel designs processor chips based on its x86 architecture and also manufactures these chips on its own. Since 22 years ago, Intel has retained the No. 1 position in global semiconductor ranking (Norwood et al, 2014) using the tick-tock model illustrated in Fig. 4.13.

"Intel’s “tick-tock” model inspires confidence in the future of microprocessors and the devices that depend on them. Following this model, Intel commits to and has successfully delivered-continued innovations in manufacturing process technology and processor microarchitecture in alternating “tick” and “tock” cycles” (Intel Corp., 2014).
In the "tick-tock" model, a tick delivers a new chip manufacturing process technology as "With every "tick" cycle, look for Intel to advance manufacturing process technology and continue to deliver the expected benefits of Moore's Law to users. The typical increase in transistor density enables new capabilities, higher performance levels, and greater energy efficiency - all within a smaller, more capable version of the previous "tock" microarchitecture". And a tock delivers a new microarchitecture, "In alternating "tock" cycles, expect Intel to use the previous "tick" cycle's manufac-
turing process technologies to introduce the next big innovation in processor microarchitecture” (Intel Corp., 2014). As Intel controlled the whole flow of desktop and server processor design and manufacturing, as a typical example of entrenched company, it has successfully guarded its dominance in sustaining innovation.

ARM on the contrary, has a quite different business model as illustrated in Fig. 4.14. In this model, ARM only design its ARM architecture based processors in the format of so called intellectual property (IP), then licenses the IP to its customers called fabless companies who design system-on-chip (SoC). These fabless companies will then send their designs to be manufactured by third-party foundries such as Taiwan Semiconductor Manufacturing Corporation (TSMC) and United Microelectronics Corporation (UMC). ARM started as a small company focused on licensing its IP to customers at relatively low prices.

It is well-known that since the 90’s Intel’s x86 architecture has dominated the PC and server market for general computing. ARM’s processor cores were not powerful enough when compared to the x86-based Intel processors. However, thanks to ARM’s reduced instruction set computer (RISC) architecture, they consume significantly less power which makes them attractive for embedded and mobile devices which have a stringent power budget. ARM CPU designs can be found in most of the embedded devices - including Google TV and Apple’s iPhones/iPad. Thanks to its vast ecosystem of partners has established near-complete dominance of the market for the core logic inside smartphones and tablets (Courtland, 2012). Almost all Android based smart phone chipsets contain one or several ARM CPU IP.

Figure 4.14: Business Model of ARM (ARM Holdings, 2010)

Based on ARM’s business model with low margin, and its advantage in low
power consumption, it managed to expand its penetration in the embedded system industry and later in the mobile phone industry during the big bang of mobile internet era. It is considered to be market dominant in the field of processors for mobile phones (smartphones or otherwise) and tablet computers and is arguably the best-known of the ‘Silicon Fen’ companies (Nikkei News, 2011). Thanks to ARM’s licensing business model, now that all semiconductors can design their own chip with ARM’s CPU instead of having the industry dominated by Intel like what it did in the PC world. What makes it worse is that as the computing power of smart phone is increasing quickly, more and more application previously only available on desktops can run at smart phones and tablets which is much more convenient than a desktop. This trend causes the growth PC semiconductor market to slow and even starting to shrink. As most chipset vendors are licensing from ARM, it is hard for them to differentiate in CPU technology. This gives companies like Qualcomm and MediaTek a chance to differentiate in service and cost leadership.

Following the standardization of OS and the ARM CPU, the difference between smart phones has been marginalized. According to Porter’s theory on organization competitiveness as elaborated in Sec. 5.1.1, these changes allowed quite a few new comers to challenge the entrenched ones’ market position.

But the demand for energy-efficient chips is reshaping the industry. As the PC market flattens, Intel aims to capture a sizable chunk of the rapidly growing mobile market, which rose to nearly half a billion smartphones in 2011. And chip designers in ARM’s camp are eyeing a US $50 billion server market, fueled by the rise of social networking and cloud computing (Courtland, 2012). As depicted in Fig. 4.15, according to IC Insights MicroProcessor Unit (MPU) ranking report, in 2013, among the top 10 microprocessor suppliers, only top-ranked Intel and fourth-place Advanced Micro Devices supply processors built with the x86 microarchitecture. The remaining top suppliers develop and sell mobile MPUs built with RISC processor cores licensed from ARM (IC Insights, 2014). Among them, Qualcomm, MediaTek and Spreadtrum enjoyed the fastest growth.

The ranking tells that Intel continues to dominate the microprocessor business, accounting for nearly two-thirds of the market’s total sales in 2013, but the company’s huge MPU market share is being chipped away by strong growth
4.4 Five Disruptive Innovation Factors

in ARM-built processors for smartphones, tablets, and new high-density microservers, which can lower cost in data centers for high-volume Internet traffic and cloud-computing services. Intel’s total MPU sales fell by about 2% to $36.3 billion in 2013, following a 1% decline in 2012, primarily due to slowing demand for x86 in personal computers (IC Insights, 2014).

4.4.5 Smart Phone and Cloud Computing

The boom of smart phone subscribers as depicted in Fig. 4.16 has triggered a drastic change of the consumer electronics market. As depicted in Fig. 4.16, the number of smart phones and tablets shipments in 2013 has dwarfed the PC shipments by four times. Meanwhile, thanks to the fast growing internet bandwidth and cheaper computer processing power as stated in Moore’s law, cloud computing is further accelerating this change.

As defined by National Institute of Standards and Technology, cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models (Mell et al., 2011).
As cloud services may be offered in a public, private or hybrid network. Google, Amazon, IBM are typical cloud service providers. Taking Amazon’s Amazon Web Services (AWS) as an example, clouding computing has drastically changed our life. Online video provider Netflix is able to support seamless global service by partnering with AWS for services and delivery of content. AWS enables Netflix to quickly deploy thousands of servers and terabytes of storage within minutes. Users can stream Netflix shows and movies from anywhere in the world, including on the web, on tablets, or on mobile devices such as iPhones (Amazon Web Services Inc., 2014)

As more and more media contents are stored over the cloud with much lower cost, consumers are getting used to direct streaming from the cloud especially when watching online videos. This reduced the need for ordinary users to buy a desktop PC with an optical drive and large magnetic drives to store large amount of data. Instead, a tablet or a smart phone can fulfill most of the jobs done by a traditional PC.

Let us do not forget that most tablets and smart phones are powered by ARM instead of x86 CPU. This further accelerated the marginalization of PC processor
vendors such as Intel and AMD, and gave opportunities to ARM based semiconductor companies such as Qualcomm and MediaTek to boost their market share.

![Figure 4.17: 130USD Smartphone Redmi using MT6589 Chipset](image)

New entrants such as Xiaomi from China by selling low-price smart phones, tablets, smart TV and OTT boxes (Over The Top box is an internet based replacement of traditional cable TV), all based on ARM based processor and Android OS, with its own customized user interface - MIUI and its cloud service, took significant market share in very short time. Founded in 2010, the company claimed it as a mobile internet company and has become one of the leading tech firms in China been valuated at over 10 billion USD with 3000 employees by 2014. In 2013, it sold 20 million smart phones. In 2014, partly thanks to its low-end smart phone Redmi, as depicted in Fig. 4.17, using MediaTek’s MT6589 chipset which a retail price of only 130USD, the company set a plan to sell between 40 to 60 million smart phones. “Xiaomi’s goal is not to make money directly by selling smart phone hardware. We aim for controlling the access channel to the mobile internet. By doing that, we can profit from our value-added application software and services. As MIUI is constantly being improved by receiving feedbacks directly from our customers through our online community for our fans, we managed to build a sticky customer relationship, thus making us somewhat the Chinese version of Apple which is affordable for the mass population”, according to MIUI’s chief architect in interview No.6. In the author’s opinion, cloud based internet service
together with MIUI-based smart terminal ecosystem are the basis of Xiaomi’s market value.

As depicted in Fig. 4.18, according to the author’s understanding, the consumer electronics market is experiencing a change of landscape driven by the convergence of traditional home electronics industry and the internet industry. On the left side of the figure, we can see that traditionally, there have been three different business sectors in the past decade as mobile phone vendors, TV vendors and PC vendors. When disruptive innovation occurs, the ecosystem is likely to be changed. As driven by disruptive technologies such as smart phone and cloud computing, the three different sectors have started converging to an ecosystem based multi-screen model. Good examples are the iOS based ecosystem from Apple, and Android ecosystem based firms like Xiaomi.

![Convergence of Multi-Screen Devices](image)

**Figure 4.18: Convergence of Multi-Screen Devices**

Fig. 4.19 illustrates the author’s image on the five disruptive factors that will bring chances to the new comers and challenges to the entrenched ones. Starting from the left, disruptive innovations such as ARM processors and Android OS enabled the boom of smart phone market. Meanwhile, as most smart phones (except those from Apple Inc.) are based on ARM processors and Android OS, the difference between smart phones and tablets has become less. The Shanzhai (white-box) model and turn-key solution together created an ecosystem that
allowed many new mobile phone vendors like Xiaomi to emerge from the low-end mobile phone market. When the three changes aforementioned apply to the market together, the landscape of smart phone / tablet market is changed with some entrenched players forced out (e.g. Nokia) and a few new comers (e.g. Huawei/ZTE/Lenovo) rose to the top as shown by the data in Fig. 4.10, 4.20 and 4.21.

Smart phone boom together with cloud computing directly caused the shrinking of PC market as depicted in Fig. 4.16, which forms a fundamental threat to the entrenched one - Intel. As Qualcomm and MediaTek rose as the winners of the change of mobile phone chipset market, they are considered by the author to have the chance to challenge Intel’s dominant position in semiconductor industry.

As depicted in Fig. 4.22, companies such as Qualcomm, MediaTek and Spreadtrum enjoyed the fastest growth in 2013 as their revenues were boosted by the smart phone boom.
**Figure 4.20:** Global vs Chinese Smart Phone Shipment (Blodget et al., 2013)

**Figure 4.21:** New Brands from China are Emerging (Blodget et al., 2013)
4.5 Defense from the Incumbents

Every winner has its followers. As Qualcomm took the ride on ARM processors and Android OS to be the king of mobile SoC with two digits growth in the a few years past, it now considers MediaTek a serious threat who took the ride on other disruptive innovations such as turn-key and Shanzhai model. Meanwhile, Intel is taking Qualcomm and MediaTek as serious competitors to challenge its dominating position that came into place 22 years ago. Intel has been the dominator throughout the PC age while it has lost its momentum as the world transits to mobile age. In 2013, Qualcomm has already surpassed Intel in capital value though Intel still has the largest revenue in the semiconductor industry.
The incumbents will try everything to defend their leading position when facing disruptive innovations.

4.5.1 Qualcomm’s QRD

In order to defend against MediaTek’s turn-key solution, Qualcomm initiated a program namely "Qualcomm Reference Design (QRD)". "The QRD Preferred Vendor program connects software developers with device manufacturers and provides hardware component vendors with a path to tap into the high-volume demand for quality, cost effective components. For device manufacturers, QRD includes the tools and resources to quickly and cost effectively commercialize a device: including access to providers of third party software applications and hardware components which have been tested against various QRDs and deliver the features and capabilities designed to appeal to today’s demanding consumers" (Qualcomm Inc., 2014). In other words, Qualcomm realized that MediaTek’s turn-key solution is a means of disruptive innovation and has to quickly respond to it instead of losing its competitive edge like the ones that passed away, such as TI and ST-Ericsson. QRD is Qualcomm’s own version of turn-key solution to catch up with MediaTek regarding service and response time.

However, so far QRD has paved its way towards its initial goal. "Qualcomm is still much larger than MediaTek with a glorious history that makes its culture quite different from that of MediaTek. Although QRD was initially aimed for small and middle-size phone vendors, the program has not made enough process as it encountered problems such as the bureaucracy of large companies. Since 2012, MediaTek has outnumbered Qualcomm in 3G smart phone chipset volumes in the Chinese market which is the single largest market in the world, thanks to its complete and cost-effective product lines that covers from low-end to high-end market. Although for some products, the unit price of Qualcomm’s chipset is lower than that from MediaTek, many customers still chose MediaTek as its overall R&D and integration cost is lower. Compared to MediaTek’s turn-key service, QRD still needs to improve its service to attract more customers", according to an analyst in interview No.7.

Qualcomm has been the winner so far in the smart phone era. However, whether it can maintain its leadership in the mobile phone chipset industry is
a question as the annual growth rate of smart phone market has slowed down after years of two digits growth. As the technology evolution has slowed down and competitors such as MediaTek is quickly catching up, it will have to find ways to differentiate itself in order to maintain its current cost structure.

4.5.2 Intel’s White-Box Tablet Chipset

Intel, the legend of the PC era almost missed the booming of smart phone market. Its X86 based Atom application processor together with wireless modem acquired from Infineon encountered various problems so that it has to watch Qualcomm and MediaTek snapping profit from the smart phone market without being able to do anything. Nevertheless, Intel is still the largest semiconductor company in revenue and maintains its leading position in semiconductor manufacturing.

In 2014, Intel chose to fight back by accelerating its chipset volume in the white-box tablet market. Intel’s CEO Brian Krzanich made a target at CES that Intel will sell 40 million tablet chipsets in 2014. And similar to Qualcomm, Intel also invested heavily in expanding its capability in turn-key solutions and FAE service, something it has never bothered to do.

According interview No.8, “Intel’s strategy is so aggressive that its customers who make tablets using Intel’s Atom processor based chipsets will be subsidized that even makes the unit price per chipset as low as zero. Meanwhile, Microsoft has waived Windows 8 license fee for tablets under 9 inches. As we understand, Intel is trying hard to build up an ecosystem to ensure it has a strong existence in this market as the traditional PC market is shrinking. For example, Intel has significantly increased the size of its FAE support team in Shenzhen, the hometown of Shanzhai. And it even reduced the PCB layers of its reference designs from eight to six, and will further reach four layers to reduce the cost of integration. This is a big step for Intel as it finally changed its mindset to pay attention to the low-end market”.

According to the author, it is a question whether Intel will be able to maintain its leadership in the semiconductor industry as the disruptive innovation is changing the industry drastically.
In this chapter, the author re-examines the hypotheses made in the theory part using the empirics elaborated in Chapter 4. First, the competitive advantage of MediaTek is analyzed from two aspects. Following that, five hypotheses based on Christensen’s disruptive innovation theory proposed in (Christensen, 2003) are studied to connect to the findings in the empirical part. In the end, strategies for the incumbents are proposed when facing disruptive innovation.

5.1 Organization Competitive Analysis

As elaborated in (Shih et al., 2010), MediaTek’s competitiveness in the feature phone era mainly lies in its turn-key solution. In this thesis, the competitiveness of MediaTek in the smart phone era was further elaborated in Sec. 4.1. According to Christensen (2003), organization competitive advantage can be analyzed from two perspectives - organization competitiveness and business model.

5.1.1 Organization Competitiveness

In Sec. 3.2, the author suggests that the competence of an organization to be represented two major factors: cost leadership and differentiation. When a firm manages to maintain its cost leadership while keeping differentiation, it is hard to her not to succeed.
Cost Leadership

As elaborated in Sec. 3.2.1, according to Porter (1985), cost leadership is about being the lowest cost producer in the industry. As MediaTek rose from the low-end market by providing cheaper but high-quality chipset and service to its customer (Shih et al, 2010), cost leadership is considered as its key competence. Especially as illustrated in Fig. 5.1, the price of smart phone average selling price is dropping fast, which will make smart phone vendors more sensitive to cost. As mentioned in the empirical part, MediaTek could gain a larger market share and force some entrenched companies out of the market by supplying products with similar or even better performance at lower cost.

In the author’s opinion, this can be explained using Christensen’s theory and the Principle #5 in this thesis that as the technology supply surpasses the need of the mass market, disruptive technologies with lower margins will emerge to shake the position of high-end market leaders such as Qualcomm. As the technology evolution slows down, the leadership of Qualcomm will be challenged by new comers such as MediaTek as they will eventually catch up in technology.
Differentiation

As the theory part pointed out in Sec. 5.1.1, to achieve a differentiation strategy requires a firm to choose attributes in which to differentiate itself from its rivals. MediaTek’s differentiation consists of several parts - technology leadership, service leadership and wide product line.

In Sec. 4.1.2, the author explained that MediaTek’s differentiation stems from its turn-key solution and its high standard on its products. As MediaTek kept investing on R&D, its has managed to catch up with the entrenched ones such as Qualcomm in technology roadmap. For example, "MediaTek’s technology in LTE and application processors is very impressive from both performance and cost perspectives. From our point of view, MediaTek’s MT6595 SoC will be very successful in the market and create pressure for Qualcomm who is currently enjoying the dominant market share in LTE smartphone chipset market", according to an executive of a smartphone vendor interviewed by the author in interview No.4. Moreover, as elaborated in Sec. 4.1.2, the entrenched ones such as Qualcomm will likely maintain their leader’s position as long as additional technology is required by the market. Hence MediaTek’s strategy is to compete with them using cost leadership. As the time comes when most consumers are satisfied with the performance of products, Qualcomm will find it harder to differentiate itself from MediaTek. Meanwhile, MediaTek will have to compete with lower-end suppliers such as Spreadtrum using its technological advantage to differentiate itself from them so that it can maintain its relatively higher cost structure compared to them.

As illustrated in Fig. 5.2, the vertical axis represents the product performance and the horizontal axis marks the price/cost. In case we partition the mobile phone chipset market into three segments - low-end, middle-end and high-end, MediaTek currently occupies the middle-end zone. It attacks Qualcomm from below using the weapon of cost leadership, while competing with Spreadtrum from above using its technology differentiation.

As more and more low-end users want to have smart phones with higher specification and the middle-class population around the world is growing, the middle-end zone will grow to be the biggest market segment. According to the author’s finding in Sec. 4.1.1 and Sec. 4.1.2, MediaTek’s strategy is to attack the middle-end market. This strategy has been further confirmed by MediaTek as
its chief marking officer - Johan Lodenius said "Our take on the market is that the low-end is being pushed up and the high-end is being pushed down for a number of reasons, so what we will get is a much larger sweet spot of high-performing products at a good price." (Ricknäs, 2013).

5.1.2 Business Model and Ecosystem

Generally, we could say that a business model is potentially relevant to all firms. As elaborated in Chapter 4, MediaTek’s turn-key solution is a new business model that allows smaller phone vendors to compete in a market that used to belong to a handful giants. Meanwhile, new comers in the smart phone industry such as Xiaomi also created a new business model as it does not directly profit from selling hardware, but profit most from its ecosystem and internet services. The reason why traditional players such as TI and Nokia failed, can be explained using Christensen’s (2003) theory as he pointed out that the incumbents usually fail as they still heavily rely on existing resources and value network when disruptive innovation enters their territory aggressively. He also relates that disruptive technology provides opportunities to new players and
creates a new business platform. At an earlier time, (Porter, 1985) argues that two business models in the same market of the same industry might mutually conflict. Moreover, Markides (2004) states the challenges for companies faced with two different business models are trying to benefit from both, keeping growing in the existing one and exploring new opportunities from the emerging one. However, it is very hard to handle the both business model, no mention about getting benefits from the two. This explains why it was impossible for the entrenched ones such as ST-Ericsson and TI to change their old business model to the turn-key based business model. There are existing constrains to obstruct entrenched incumbents to adopt strategy according to the change that bringing by disruptive innovation, for instance inherent benefits. In Sec. 4.5.1 and 4.5.2, the empirics further explain how hard it is for incumbents to change their business model.

From a conceptual perspective, a business model includes all aspects of company’s activities to develop a profitable offering and delivering it to its target customers (Sinfield et al, 2011). According to an earlier article in Harvard Business Review, Osterwalder (2005) states that a business model is the blueprint of how a company does business. Moreover Slywotzky et al., (1996) defined the business model as "the totality of how a company selects its customers, defines and differentiates it offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits."

Disruptive innovation usually occurs with the change of business model. As will be elaborated in the empirics part, the change of business model in the smartphone industry accelerated the change of landscape of the chipset industry. New comers like MediaTek’s change of business model in the chipset industry also coincides with the change of the smart phone industry as mobile internet destroyed the old market and created a new one. MediaTek’s business model is based on its turn-key solution. As the turn-key solution was initially tailored for small and middle-sized mobile phone vendors, it can effectively lower the bar for new comers to enter the new market with lower-margin. According to the disruptive innovaiton theory in (Christensen, 2003), eventually the lower-margin market will grow and shift upward to the mass market in the middle. Hence MediaTek is likely to have a better chance to grow together
with these small and middle-sized vendors when the shift occurs. This makes MediaTek’s business model more advantageous when facing disruptive technologies. On the other hand, MediaTek’s turn-key solution itself is a type of disruptive innovation as elaborated in Sec. 4.4.

5.2 Connecting Empirics to Theory

As presented in Sec. 3.1, innovation can be categorized as sustaining innovation and disruptive innovation. In Sec. 4.4, the author summarized the five disruptive factors that are related to the rise of MediaTek, which are

- White-box model
- Turn-key solutions
- Android operating systems
- ARM processors
- Smart phone and cloud computing

As the goal of the thesis is to prove that Christensen’s theory on disruptive innovation is applicable to the change of landscape in the mobile phone chipset industry, the author checks the five principles in Christensen, 2003 in the following sections.

5.2.1 Principle #1: Companies Depend on Customers and Investors for Resources

As Christensen pointed out in (Christensen, 2003), “The highest-performing companies, in fact, are those that are the best at this, that is, they have well-developed systems for killing ideas that their customers don’t want. As a result, these companies find it very difficult to invest adequate resources in disruptive technologies - lower-margin opportunities that their customers dont want - until their customers want them. And by then it is too late.”
The entrenched ones such as TI and ST-Ericsson had Nokia and Sony Ericsson as their most important customers. For example, according the interview in Sec. 4.2.2, Sony Ericsson kept on doing feature phones and asked ST-Ericsson to focus on delivering platforms to suit its need. The mistake made by Sony Ericsson indirectly caused ST-Ericsson’s not being able to allocate adequate resources to develop smart phone chipsets. The same thing happened to TI and ST-Ericsson when their biggest customer Nokia’s feature phone volume dropped while it also lost directions in the smart phone market due to the rise of iPhone and Android based smart phones. As for any customers, the highest priority is to profit, Sony Ericsson would not wait for ST-Ericsson to deliver smart phone chipsets but quickly shifted to Qualcomm for smart phone platforms. This story well proves that over listening to customers’ opinion, especially those customers without a long-term vision is highly risky when facing disruptive innovation.

In contrast, when MediaTek decided to enter the mobile phone chipset market around 2000, Ming-Kai Tsai allowed an internal department to be set up and continuously invested in the R&D for five years without a customer (ChinaTimes, 2014). At that time, major mobile vendors such as Nokia and Motorola would not use products from MediaTek. Their only customers were limited to the small vendors in mainland China. These customers are small and very sensitive to cost. As MediaTek depended on these customers, the company had to find a way to work with them. In such a way, MediaTek created turn-key solution which significantly lower the bar for its customers to enter this market. Hence, the success of MediaTek and turn-key solution is another proof of the first principle by Christensen.

5.2.2 Principle #2: Small Markets Don’t Solve the Growth Needs of Large Companies

According to Christensen, the entrenched companies need to maintain their share prices and create internal opportunities for employees to grow in their career path. However, it is common that for them, the new markets are either not large enough or have too low margin. Hence the larger and more successful an organization becomes, the weaker it becomes when exploring the emerging
markets for growth (Christensen, 2003).

The entrenched companies such as Nokia dismissed the white-box market as it represented a market with low margin and even illegal operations. However, according to Christensen’s definition in (Christensen, 2003), the white-box handsets makers indeed can be considered as disruptive innovation, they started at lower quality but with time and increased sales, quality improved and market share increased till eventually they toppled the incumbents all together.

As explained in Sec. 4.2.1 and 4.2.2, in the golden age of TI and EMP, their focus was on big customers such as Nokia and Sony Ericsson. Supporting the small vendors and the white-box market was considered not interesting enough for the management people. Therefore, these firms skipped the small and middle-sized vendors. Meanwhile, MediaTek’s mobile phone division was small enough to feel comfortable to work with these small and middle-sized vendors. To compete in these small markets, MediaTek had come up with more efficient solutions namely turn-key which later became the industrial standard as elaborated in Sec. 4.4.1. Years later, when the large phone vendors such as Nokia and Sony Ericsson went into troubles, TI and EMP (then ST-Ericsson) realized it was important to attract emerging customers. However, their organization structure was not suitable for supporting these new customers as they are already used to the turn-key solution from MediaTek.

In contrast, then MediaTek was still a small company of 2000 people which made it a good match for this new market of white-box handsets (ChinaTimes, 2014). As explained in Sec. 5.1, MediaTek’s turn-key solution at the very beginning lowered the bar for small and middle-sized vendors to enter the feature phone market. Moreover, it reshaped the R&D and manufacturing flow of the modern mobile phone industry. This created a potential for new comers to overthrow entrenched phone vendors’ market leadership.

5.2.3 Principle #3: Markets that Don’t Exist Can’t Analyzed

"In dealing with disruptive technologies leading to new markets, however, market researchers and business planners have consistently dismal records," according to Christensen in (2003), "The only thing we may know for sure when we read experts’ forecasts about how large emerging markets will become is that they are wrong." This principle
is evident in the change of mobile phone industry. Before Apple released its first version of iPhone, very few analysts were able to foresee the drastic change that would occur in the mobile phone industry as Apple was relatively a new comer to the mobile phone industry at that time.

In Sec. 4.2.1, the example of TI shows that TI was not able see how large the Shanzhai market would be and how large the 3G smart phone market would be. Hence TI’s management did not invest enough in the R&D of 3G modems and was not ready for the disruptive innovation of Shanzhai. Meanwhile, Sec. 4.2.2 shows that ST-Ericsson did not foresee the smart phone market as its major customers such as Sony Ericsson and Nokia were asking them to deliver what they considered important until the smart phone market grew too big to be neglected.

This principle is applicable not only to entrenched ones, but also to the new comers. As elaborated in Sec. 4.1, MediaTek missed the early prosperity of Android smart phone market as it did not foresee the fast growing market of Android when it decided to bet on Windows Mobile. Being another proof of Principle #3, MediaTek was only able to base its decision on the success of HTC built upon Windows Mobile instead of analyzing the Android market as it did not exist when the decision was made.

5.2.4 Principle #4: An Organization’s Capabilities Define Its Disabilities

Nokia used to have a good reputation for producing reliable and high-quality mobile phones which is the very capability the entrenched one had. Its advantage in hardware design and manufacturing turned out to its disability in the smart phone era as it underestimated the consequence of disruptive things such as Android and turn-key solutions as elaborated in Chapter 4.

TI used to have its OMAP platform which is very successful in multimedia processing. However, due to its success in the OMAP series, it overlooked the importance of 3G modem technology and did not invest enough in it, thus making its OMAP solution not attractive when competing with integrated solutions from others such as Qualcomm and MediaTek.

Intel is the No.1 semiconductor manufacturing company worldwide and
had a legendary x86 architecture for CPU which generates much higher margin compared to the smart phone chipsets. This made Intel overlooked ARM’s growth in the smart phone era until it found that smart phone boom has caused the shrink of PC market. Furthermore, Intel’s capability in manufacturing and traditionally strong position when facing customers made it overlooked the need to provide onsite FAE to small and middle-sized customers. The success of its x86 architecture in the PC era caused it to base its mobile chipsets on the x86 architecture while not being able to solve the power issues which made it difficult for Intel to penetrate the smart phone market. In the PC era, Intel’s way of quality control is by strictly limiting the number of components suppliers for its white-box reference designs. This ensured the quality of products based on Intel’s solution while keeping up the cost for its customers in R&D as elaborated in Sec. 4.2.4 and Sec. 4.5.2.

Nokia did invest heavily in the R&D of Symbian OS which was one of the core competence of Nokia. When Android was released by Google, it was only used in a much smaller market compared the then dominating Symbian ecosystem. The capability of Nokia in Symbian made it pondering in front of the choice of smart phone OS until it finally realized that Symbian was not suitable for the smart phone era. However, it was too late as Android has quickly improved and created a successful ecosystem.

Taking MediaTek as an example elaborated in Sec. 4.1, its capability in the Shanzhai market also defines its disability when it tries to penetrate the high-end market. As elaborated in Sec. 4.1.2, MediaTek launched its “octa-core” chip, the MT6592, in 2013 targeting the product towards mid-range smart phones priced at $300-$400. However, very soon the smart phone market was filled by MT6592-based smart phones priced at $150-$200. Although MediaTek gained market share and rised revenue thanks to the new product, it still has a long way ahead to be considered as an alternative solution in the high-end market. This is partly due to the reason that MediaTek’s process and culture was formed all together with the turn-key solution targeting low-end market. To penetrate the high-end market, it will need significant redesign of its brand image and even mindset.
5.2 Connecting Empirics to Theory

5.2.5 Principle #5: Technology Supply May Not Equal Market Demand

“Disruptive technologies, though they initially can only be used in small markets remote from the mainstream, are disruptive because they subsequently can become fully performance-competitive within the mainstream market against established products,” said Christensen in (Christensen, 2003). As elaborated in Sec. 4.4.4, in early years, ARM based CPU was only able to deliver limited computing power compared to the then mainstream Intel CPU products. Hence, ARM based CPU were mainly used in embedded systems for their advantage in low energy consumption. Compared to the desktop CPU market, the embedded market was relatively smaller with significantly lower margins as explained in the empirical part of the thesis. However, as presented in Sec. 4.4.4, the semiconductor technologies keep evolving from micrometer to nanometer process, the computing power that can be supplied by ARM based CPU has drastically increased to suffice in many more daily applications especially those in smart phones. Thanks to the fast growth of the number of smart phone users and more frequent upgrade of smart phones, the volume of ARM based CPU has increased to significantly surpass the volume of Intel CPU. Meanwhile, the computing power of today’s Intel CPU has exceeded the need of most daily applications. Intel’s competitive advantage as elaborated in Chapter 4 with its tick/tock model does differ itself to some extent from its competitors. However, for the smart phone chipset industry, so far cost leadership weighs more than this differentiation. This change is similar to the change happened in the disk drive industry as described in (Christensen, 2003). As Christensen (2003, p.xxvii) pointed out, “When the performance of two or more competing products has improved beyond what the market demands, customers can no longer base their choice upon which is the higher performing product. The basis of product choice often evolves from functionality to reliability, then to convenience, and, ultimately, to price.” In other words, as technology supply surpasses the market demand, it is more and more difficult for the incumbents to maintain high margin based on the technical differentiation they used to have.

The rise of MediaTek is a good evidence to support this hypothesis. As elaborated in Sec. 5.1.1, as the technology supply surpasses the need of the mass
market, disruptive technologies with lower margins will emerge to shake the position of high-end market leaders such as Intel and Qualcomm. Disruptive innovation occurs when the technology supply in a certain industry goes beyond the need of the market for majority. MediaTek is a good example in utilizing this principle to challenge the incumbents as it will eventually catch up in technology.

5.3 How Shall Incumbents Prepare for Disruptive Innovation

According to Christensen (2003), disruptive innovation usually changes the base of competition in the market. Therefore, to sustain a firm’s growth and prosperity, the management people of the incumbents need to set up strategies to prepare themselves and the organization better for the disruptive innovations that could happen anytime anywhere.

As presented in Sec. 5.2, there are many reasons that led to the fall of the entrenched ones. Among them are

- Rely too much on customers and investors for short-term interest. The management people intend to seek comfortable life and "secured" career path by pleasing customers and investors without having their own vision. EMP and ST-Ericsson in Sec. 4.2.2 are good examples for this.

- Focus too much on financial growth to please the investors by overlooking potential opportunities which may not bring enough revenue or profit for the time being. Intel’s complete missing of the smart phone boom in Sec. 4.2.4 is a good example.

- Have a too bureaucratic organization that cannot respond quickly to the change in the market. In this case, the companies usually do not have a clear vision or cannot execute it just like ST-Ericsson in Sec. 4.2.2.

- Not investing enough to R&D when the business is running well. TI’s missing of the 3G smart phone boom in Sec. 4.2.1 is a good example.
For the new comers to rise to take over the incumbents, there are also quite a few prerequisites as

- The size of the new comer has to match the size of the market.
- The new comer has to foresee signs of disruptive innovation before it occurs. In case it cannot foresee it like the MediaTek’s case in Sec. 4.1, it has to quickly adjust itself to ride on the new trend.
- The new comer has to operate under low margin for quite some time until the low-end market becomes mainstream.
- The new comer has to keep investing its limited resources to R&D so that it can quickly upgrade as the market grows, so that it is strong enough when the incumbents enter the market.
- The management people have the right vision and it is efficiently executed.

From the outside, people usually consider entrenched companies to fail due to their failures in responding to the tide of technology change. However, as Chrisensen (2003) pointed out, the entrenched ones are the ones with significant more resources including cash, technology and talents. In the author’s opinion, the impact of psychology on innovation inside big organizations can be used to explain the reason.

People usually need courage to take risks. So do executives of well-established organizations. Nowadays everyone is talking about innovation, though most failed. For most management people, innovation is a risky task which takes a lot of resources and time, and still might end up with nothing. In most well-established firms, people are promoted through the ranks step by step among many talented people (Claussen, 2013). When the a few are promoted to senior positions, they are under pressure every day from their superiors and shareholders. As the superiors intend to promote people who have good deals with them. This implies that they might easily share the same opinion and usually team up in the decision making processes, while innovators usually think differently from the majority. As the development of a new concept or product usually takes more than a year or two to implement, the superior under the
pressure of a better financial report might well reject the proposal to keep him "safe" in the game. "Especially in big organizations, excellent welfare system, cozy office environment and social reputation can easily make the management people reluctant to take risk and become soft", according to the interviewee from interview No.1, "ST-Ericsson is a good example of companies which lost their directions due to incapable management not willing to take risks."

Therefore, it is rather for a psychological reason that management people in big organizations are reluctant to do innovation at the price of endangering their established position. Just like Christensen suggested that "only companies that succeeded in addressing disruptive technology were those that created independent organizations whose size matched the size of the opportunity" (Christensen, 2003).

According to the study conducted in this thesis, the author suggests the following strategies for the incumbents to prepare themselves better for disruptive innovation.

![Figure 5.3: Strategies of Incumbents](image)
5.3 How Shall Incumbents Prepare for Disruptive Innovation

5.3.1 Restructure to Fit the Market Size

According to the Principle #2 of disruptive innovation theory, in the early stage of disruptive innovation, the new market usually is not big enough for the entrenched firms to enter. Hence Christensen (2003, p.xxv) suggested that "Those large established firms that have successfully seized strong positions in the new markets enabled by disruptive technologies have done so by giving responsibility to commercialize the disruptive technology to an organization whose size matched the size of the targeted market." MediaTek as a spin-off from UMC, the world’s second largest semiconductor manufacturer, was a successful example of Christensen’s theory. However, restructuring is also a high-risk task. ST-Ericsson which consists of divisions spun off from Ericsson, ST and NXP has been a bad example on the contrary.

By comparing the two, the author recognized one major difference - leadership. Ming-Kai Tsai, the president of MediaTek is publically recognized as a distinguished leader with unique technical vision which has been proven by MediaTek’s success in business model and its technology catch up with industrial leaders such as Qualcomm as elaborated in Chapter 4. In comparison, none of ST-Ericsson’s leaders had the charisma to lead a company out of chaos and none of them had a vision which can be executed as reflected by the interviews conducted in the thesis.

Furthermore, the author also noticed that the two cases are different from another aspect. UMC spun off MediaTek because MediaTek’s business was thriving but formed a conflict of interest to UMC’s clients. The spin-off of EMP to form ST-Ericsson was due to the reason that management people at Ericsson realized that EMP itself being part of Ericsson alone was not competitive enough to thrive in the mobile chipset market as it could not quickly respond to it. Instead of finding the root cause of its incapability, they decided to find a partner to off load the responsibility which turned out to be an even bigger mistake. Now that Ericsson has taken back the thin modem business of ST-Ericsson, it still has not found a solution for that cash-burning division except claiming the thin modem is part of Ericsson’s long-term competence. Therefore, a strong leadership is needed to identify the real problems, e.g. in the case of EMP, it has severe weakness in execution, sales and FAE as the author collected in the
interviews.

When an entrenched firm realized that it cannot cope with the disruptive innovation for various reasons, what is the best way out? A good example of finding an exit strategy is TI and NXP. After realizing the mobile phone chipset business is too dynamic and requires huge investments and risk taking, TI decided to withdraw from the baseband business while NXP sold its wireless department to ST as part of ST-Ericsson. Now looking at TI and NXP, both of them managed to restore their revenue and profit, and continued to grow in areas they are still good at.

5.3.2 Be Prepared for Low Margin

The entrenched firms are used to enjoy high margins while the investors also prefer firms with high margin. The case of Intel’s selling its ARM based business to Marvell was a reflection of such situation. When Intel made the deal, many people thought it was good for Intel to get rid of the then small and low-margin business to focus on its cash cow - x86 CPU business. However, ten years later, Intel suddenly realized that the same deal causes it to miss the great time of smart phone era from 2008 to 2014.

To be better prepared for the consequence of disruptive innovation, the entrenched firms need to sacrifice short-term profitability to accept lower margins at certain point. More important, they have to learn to cope with the low margin by preparing organizational change. Qualcomm’s QRD in Sec. 4.5.1 is a good example of restructuring its organization for lower margins when serving small and middle-sized customers despite its slow progress.

After realizing its mistake in handling the ARM based CPU business, Intel learned a lesson and responded in 2014 to accelerate its penetration in the whitebox tablet market at all cost as described in Sec. 4.5.2.

5.3.3 Stay Hungry, Stay Foolish

To prepare the organization and more importantly the people working for the organization for the disruptive innovation, the author considers it essential for the firm to create an environment which is not too comfortable and encourage
the employees to be hungry.

"We shall draw from the heart of suffering itself the means of inspiration and survival," said Winston Churchill. Many entrenched companies have problems of being too cozy to work for. As the organization is usually huge, the disfunction of a few people would be hard to discover. This impairs an organization's competitive advantage.

Although the entrenched companies have established market leadership and technology advantage, the management people have to understand how vulnerable they are when facing disruptive innovation. As Steve Jobs made his famous words "Stay hungry, stay foolish" at the graduate ceremony of Stanford University, we have to understand how insignificant we are, if we stop chasing the development of science and technology and be satisfied with where we have now, we will soon fall behind in the race. Therefore, management people shall consciously perceive themselves as humble beginners, and stay hungry to embrace new knowledge and new concepts. According to the research conducted in this thesis, one cannot known when disruptive innovation will occur, though one can still adopt strategies to be better prepared for it to come.

As suggested by Christensen (2003) and Chirstensen and Raynor (2003), the entrenched ones can use restructuring or acquisition to form smaller internal organizations and encourage management people to embrace changes and risk taking. Companies such as Google are good examples of creating internal groups to cope with disruptive innovation and created disruptive innovation such as Android.
Chapter 6

Conclusion and Future Work

Disruptive innovation has been a hot topic since it was widely spreaded through Christensen’s Best Seller’s book "The Innovator’s Dilemma" Christensen (2003). In this thesis, taking the mobile phone chipset industry as an example, the author studied the rise of MediaTek, a company from Taiwan specialized in providing turn-key chipset solutions to mobile phone vendors. MediaTek is a fast-growing company who enjoyed the benefit of a series of disruptive innovations such as turn-key, white-box model, Android OS, ARM processors, smart phones and cloud computing.

By conducting the study, the author used deductive approach based on secondary data and qualitative interviews to reexamine the disruptive innovation theory proposed by Christensen and find out the root causes of the rise and fall of different companies in this industry.

The author selected five hypotheses proposed in the theory part in Chapter. 3. In Chapter. 4, the author elaborated on MediaTek’s cost leadership and differentiation together with its competitors using qualitative interviews and quantitative financial data. By studying the financial data of MediaTek and its competitors, the author performed quantitative analysis on the reasons that caused the rise of MediaTek and the fall of several entrenched companies in the mobile phone chipset industry. By conducting analysis of eight interviews with professionals for relevant companies, the author collected qualitative data to reflect the reasons behind the case.

Based on the data collected, the author reexamined the disruptive innovation theory in Chapter. 5 using the empirical data collected, and tried to connect the MediaTek phenomenon to the these hypotheses to prove their validity.
Moreover, the organization competitiveness and business model of MediaTek is studied to disclose the reason behind its huge success. Furthermore, strategies for the incumbents to cope with disruptive innovation and the challenges brought by it are proposed. In the author’s opinion, there is no way to predict or avoid disruptive innovation for the well-established organizations. However, they still can prepare themselves better for the upcoming disruptive innovation, though the procedure might be painful as necessary reforms need to be taken to create pressure internally.

The rise of MediaTek and the Shanzhai phenomenon occurred in the background of globalization and is part of the procedure as economy upgrades from manufacturing-intensive to knowledge-intensive in regions like East Asia. It shows that the imitating firms currently dismissed by established brand leaders may become potent challengers with innovating forces later. As suggested in (Kim, 1997) that imitation seems to be the best weapon for developing countries to catch up with the developed ones. The author is curious on the national strategies of how a society can be transformed from imitation to innovation which will be a suitable topic for further study.
Bibliography


