

Platforms, network effects and small business dynamics in China : case study of the Shanzhai cell phone industry

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**Platforms, Network Effects and
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Phone Industry**

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Abstract

This paper seeks to argue the significance of platforms on emerging markets through a case study of the Shanzhai cell phone industry in Shenzhen, China. In this industry, value chains are being driven by both the technology platforms and the market platforms. The former include MTK baseband chipset, and so-called Shared PCBA and Shared Mould. The latter include the North Huaqiang Market and the Purchasing and Money Platform. Technology platforms greatly reduced the technological barriers to entry for independent design houses and system integrators, while market platforms markedly improved their poor marketing and purchasing abilities. Due to factors such as social networks, supporting industries, informality and platform governance, strong network effects have been exhibited in the two types of platforms, which have not only fostered numerous start-ups, but have also led to effective exploitation of emerging markets.

Keywords: Platform, Network Effect, Shanzhai Cell Phone, Emerging Markets, China

JEL classification: L63, O14, O17

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1. Introduction¹

Platforms can be defined as “building blocks that act as a foundation upon which other firms can develop complimentary products, technologies or services” (Gawer, 2009, p.57). The extensive adoptions of the platform strategy have profoundly changed the model of innovations, the driving forces of value chains, and the basic pattern of the international division of labor. Currently, cutting-edge research on platforms is primarily concentrated on industries in developed countries, in particular the high-tech sectors (Gawer and Cusmano, 2002; Gawer, Eds. 2009). The purpose of this paper is to make the point that various technology platforms and market platforms have been growing rapidly in emerging markets, and are becoming an important impetus for innovation. Industry in developing countries should become an important field of platform study.

Our argument stems from the fact that the socioeconomic system of developing countries has natural linkages with platforms.

First, the majority of consumers in developing countries are in the low income class, whose demand for commodities is extremely large. As previous studies have suggested, accompanying the development of an industry platform, key components such as the Intel chipset has been designed as a black box adopting integral technology, while peripheral products have become highly modular and standardized, with increasingly lower prices (Tatsumoto et al., 2009). The result is that the more the platform advanced in an industry, the more its final products became a commodity, which to a large extent helped to exploit the demand of emerging markets.

More important is that the structure of production and distribution within emerging markets is highly fragmented, lacking huge local industrial or commercial capital capable of driving the whole value chain. The overwhelming majority of the economic actors are countless small merchants, small producers, and their reserve army. These small firms primarily gather in the informal sector (Bennett, 2010), and are not only deficient in production equipment and technological knowledge, but also lack the means of marketing and purchasing. Platforms, in this sense, can precisely complement the poor managerial resources of these firms and reduce the technological and marketing barriers for them.

Because of the two reasons mentioned above, many success stories concerning platforms have emerged in developing countries, particularly in China. The phenomenon by which many assemblers share the same type of key component (platform sharing) has been broadly observed in industries such as automobiles and

¹ This paper is an output of the joint research project on “The Dynamism of the Consumer Electronics Industrial Cluster Development in Pearl River Delta” conducted by Institute of Developing Economies and Shenzhen Semiconductor Industry Association during the period between 2010 and 2011.

home appliances (Marukawa, 2007). By also utilizing the market platform of so-called Specialized Markets, a large number of regions, such as Yiwu (daily necessities), Danyang (eyewear), and Yuyao (moulds), have rapidly grown into the largest industrial clusters in the global or domestic market within the short period of a mere 30 years (Ding, 2010).

The most typical example has appeared in the cell phone industry. After 2005, a so-called “Shanzhai cell phone” rapidly became the main force in the Chinese and other emerging markets. It has become a byword for imitation, inferior goods and the infringement of intellectual property. By the end of 2010, however, shipments of Shanzhai cell phones amounted to more than 400 million units, accounting for about two-thirds of the total volume of China’s local phone makers. The production of the Shanzhai cell phone is based primarily on the MTK baseband chipset (a typical technology platform), and its sales rely heavily on the North Huaqiang Market (a typical market platform). The main producers and distributors of the Shanzhai cell phone are thousands of small firms with only dozens of employees. Most of the producers are located in Shenzhen, forming the world’s largest cell phone industrial cluster.

Little previous study has been conducted on the Shanzhai cell phone. As the only literature in English, Gao (2011) analyzed the Shanzhai cell phone industry from the sociological perspective. Gao pointed out that the nature of the “Shanzhai Regime” is a new form of informal economy which emerged under the background of the information revolution and globalization. This study precisely apprehended a number of key factors which support the Shanzhai regime, including the Wintel system, the long tail market, the industrial cluster and the specialized market, although these factors are not explained within an integrated framework. On the basis of Gao (2011), this paper aims to for the first time, analyze the Shanzhai system through the concept of the platform. By using this powerful tool and a series of related concepts, we were able to gain a deeper insight into the following three aspects of the Shanzhai cell phone.

First, we succeeded in uncovering various platforms that support the Shanzhai system, in addition to the well-known MTK chipset and the North Huaqiang Market.

Second, we laid emphasis on the analysis of network effects, clarifying the conditions under which a platform achieves critical mass.

Third, we paid particular attention to the emerging economies-specific factors that affect the features of the production and distribution system of the Shanzhai cell phone.

Since the majority of firms in the Shanzhai cell phone industry remain in the informal economy, there is no existing statistical data, and the implementation of a large sample questionnaire survey is also difficult. We thus adopted the methodology of fieldwork in

order to grasp the whole picture. Based on fragmentary surveys from the previous four years, we conducted intensive fieldwork in Shenzhen during the period between September, 2010 and February, 2011. In this paper, we only note the source of information when it has been gathered from one specific firm. The sources of information on the general situation synthesized from multiple firms will be omitted.

2. Platform and small firm growth in developing countries

Before proceeding with the case study, we analyze the role of platforms in small firm growth in developing countries in general.

A technology platform is a core technology or core component in a product system (Gawer and Cusmano, 2002). In developing countries, the R&D capabilities of small firms are generally poor. Therefore, the broader the scope of R&D covered by the technology platform, the lower the technological barriers to entry for small firms will become. In the context of the manufacturing sector in developing countries, the technology platform is essentially a one-sided platform.² As users of a one-sided platform are homogeneous, the more producers that make use of a platform, the more knowledge and information concerning the platform will be shared between them. Consequently, an increasing number of new users will be attracted to the platform, thus generating a direct network effect. A stronger direct network effect will cause a technology platform to become more powerful, which can further help small producers in developing countries to conduct technology research and product development, and thus reduce the technological barriers to entry for them.

The market platform is a market intermediary, taking the form of a two-sided or multi-sided platform (Rochet and Tirole, 2003, Hagiu, 2007). A market platform owns two or more heterogeneous user groups, such as buyers and sellers. In the manufacturing sector, sellers refer to producers. The larger the number of producers in a market platform, the more intense the competition, which brings about cheaper prices and more options for buyers. Consequently, an increasing number of buyers will be attracted to the platform. On the other hand, the larger the number of buyers in a platform, the lower the sales risk becomes and the richer will be the market information brought to the producers. As a result, an increasing number of producers will be

² In developed countries, the core component is likely to be a multi-sided platform, as long as peripheral product makers are able to adjust their products to the new modular architecture designed by the component maker. Under this circumstance, both the final goods assemblers and the peripheral products makers are complementors to this core component platform. In developing countries, however, this situation does not necessarily occur. This is because most of the peripheral product makers are small local firms, who not only have no business relationships with the core component maker, and therefore receive no instruction, but are also incapable of transforming their goods to correspond to the new architecture.

attracted to the platform, thus generating an indirect network effect.³ A stronger indirect network effect will cause a market platform to become more powerful, which can help small producers in developing countries to exploit new markets, while lowering the purchasing cost for small buyers.

The technology platform and the market platform can only display network effects by reaching the necessary minimum network size, namely the Critical Mass. The factors that affect achievement of critical mass and the generation of network effects depend heavily on the institutional context. The factors derived from the experience of the cell phone industry in China will be clarified in this paper.

When studying the manufacturing sector of developing countries, the distinction between the technology platform and the market platform is important. In developed countries, the two types of platforms are usually integrated into a single body, such as video game consoles, the Windows operating system, Intel's IC chipset and the Cloud Computing Platform. A platform could be a foundation for complementors to develop new products, while helping its complementors on one side of the platform to transact with complementors from the other side in order to exploit a new market.

In developing countries, however, the technology platform and the market platform are generally separated. This resulted from the comparative advantage of the international division of labor. R&D requires the investment of a large amount of funds and the long-term accumulation of human capital. Hence, even with a technology platform that is targeting an emerging market, the leading firms in developed countries are still the only economic actor capable of carrying out R&D. In contrast, marketing and purchasing requires credits, business networks, and a deep understanding of local consumption behavior. Therefore, it is more likely that a market platform will emerge inside developing countries.

3. General situation in the Shanzhai cell phone industry

A cell phone named *BlockBerry* was developed by the so-called *Harvard Communication Company*. President Barack Obama, whose portrait is being printed in the most eye-catching position of the PR poster, appears to have been appointed as the image character of the phone. This is a model case for the Shanzhai cell phone made in Shenzhen, China. Currently, the Shanzhai cell phone has become a very popular topic in China, with various appellations such as the black cell phone, illegal cell phone, cell

³ Although a pure market platform can also generate a direct network effect, it is not as strong as that of a pure technology platform. This is because the critical information for a market platform user is always disseminated by their trading partners on the other side of the platform.

phone copy-cat, miscellaneous cell phone and the gray handset.⁴ Shanzhai cell phones often evade tax and official quality testing, imitating international brands with exact replicas, but at low prices and with uneven quality. Many Shanzhai producers do not have their own technology, and simply assemble cell phones at workshops or small factories.

These images reflect some of the features of the Shanzhai cell phone, but are incomplete. Shanzhai does not necessarily mean that the cell phone is of poor quality or is an imitation. In recent years, the failure rates of Shanzhai cell phones have been improved to one tenth the level compared to the initial stage.⁵ At the 2011 Mobile World Congress, a solar smart phone developed by Umeox, a Shanzhai producer from Shenzhen, raised broad concerns in the mass media (MyDrivers.COM, 2011). Simcom, an independent design house in the Shanzhai system, has begun to supply to formal phone makers such as Lenovo (China) and Sharp (Japan).

There is always high upward mobility between the small firms in the Shanzhai system and large firms in the formal sector. Many Shanzhai producers have already transformed into formal producers and have begun a branding strategy. The former Shanzhai producers, Tianyu, OPPO, Goinee, Guohong, and BBK ranked number four, six, seven, eight and ten respectively within China's top ten local cell phone companies in terms of shipments in 2010 (iSuppli, 2011).

Due to this high mobility, it is difficult to distinguish precisely between the Shanzhai system and the formal system. Shanzhai cell phones adopt various technologies, such as GSM, CDMA, WCDMA and TD-SCDMA. Of these, the GSM-based phones are in the overwhelming majority. In 2010, 590 million GSM-based baseband IC chipset units were supplied to Chinese manufacturers. Among these, the shipments of IC chipsets for the top ten local brand cell phone manufacturers were 184.3 million units (iSuppli, 2011).⁶ If we define the local phone makers below rank number 11 as Shanzhai makers, then at least 400 million Shanzhai cell phone units were manufactured in China in 2010.

In addition to mainland China, Shanzhai cell phones have also gained considerable market share in most of the developing countries in a short time. For example, in the Indian market, accompanying the increase in the import of Shanzhai cell phones, the share of the top three international brands (Nokia, Samsung and LG) dropped from nearly 100% to 60% in the three recent years up to 2010. Instead, Chinese brands such as G-Five and Lephone gained a total share of 15%. On the other hand, by making use of original design manufacturing firms in the Shanzhai system, nearly 200 Indian

⁴ Gao (2011) gives a detailed explanation of the meaning of Shanzhai in its Chinese context.

⁵ Author interview with the president of the Shenzhen cell phone association (November, 2010).

⁶ This data includes both the GSM-based IC and other technology-based ICs.

companies have transformed from pure distributors into cell phone brand owners. As a result, within the Indian market, the share of local brands (e.g. Micromax, Spice, Karbonn and Lava) have quickly increased to 25%.⁷

4. Nature of the Shanzhai system

4.1 Shanzhai cell phone value chains

Although it is difficult to measure the Shanzhai cell phone industry quantitatively, its qualitative definition is clear-cut. We consider that the nature of the Shanzhai system is nothing but a platform-based distinct production and distribution system which differs greatly from the traditional model.

Cell phone R&D includes five processes, namely chipset design, software and system design, printed circuit board (PCB) hardware design, industrial and manufacturing design (ID/MD), and product project management (including product definition, parts procurement, outsourcing management of industrial design and production, and project control).

Traditionally, the world's leading cell phone companies such as Nokia, Motorola, and Samsung are highly vertically integrated, having all of the above five functions. With the progress in communication technology, most leading cell phone makers have outsourced chipset design to independent chipset manufacturers, and sometimes outsource some ID/MD tasks to independent industrial design companies. They then tended to specialize in project management, software and system design, and PCB hardware design. The cell phone value chains are being driven firmly into the hands of these top makers.

In contrast, within the Shanzhai system, such a closed value chain has completely disintegrated, both vertically and horizontally. In the upstream section of the chain, Media Tek (MTK), the leading chipset maker from Taiwan, and its followers such as Spreadtrum from mainland China, are providing baseband chipsets which have conducted chipset design, software and system design, and PCB hardware reference design with a turnkey solution. Thousands of engineers are employed by these top chip makers.

The chipsets are sold to 500 Independent Design Houses (IDHs) located in Shenzhen or Shanghai, who merely hire dozens or hundreds of staff (Table 1). IDHs are engaging in PCB hardware design and some simple software design. They are also in charge of the production of PCBA (printed circuit board + assembly). IDHs purchase hundreds of parts in dozens of categories from the sales departments of Taiwanese and Shanghai

⁷ Data provided at a technology forum held by Spreadtrum in 2010.

makers in Shenzhen. Since both are complicated, the parts procurement is sometimes outsourced to specialized Purchasing and Money Platforms (see below) and PCBA production is outsourced to specialized Surface Mount Technology (SMT) factories.

PCBAs are then sold to 2000 cell phone System Integrators (SIs) clustered in Shenzhen, usually hiring not more than a few dozen staff (Table 2). Among them, only 350 firms have obtained production permission from the Chinese government. SIs do not necessarily have an R&D department and only partially take charge of the product definition, supply chain management, project management and sales. According to the contents of the PCBA, SIs ask industrial design companies to design various body styles and arrange for mould factories to produce the moulds. Furthermore, they themselves purchase the screen module, camera, electro-acoustic devices, mechanical parts, and other parts, which are generally made in Shenzhen and neighboring areas, and assemble them as a whole cell phone. Assembly is sometimes outsourced to outside assembly plants.

With regard to sales, 600,000 buyers come to the North Huaqiang Market per day. Relying on the distribution networks, composed of the North Huaqiang Market in Shenzhen, the electronic markets in China's local cities, various provincial and city-level sales agents and Mom-and-Pop shops, Shanzhai cell phones are unfailingly circulated to every nook and cranny of China and other emerging markets.

4.2 Technology platforms

Baseband chipset platform

The above-stated highly disintegrated Shanzhai cell phone value chains are being driven by both the technology platforms and the market platforms. Section 4.2 discusses the former, which includes the chipset platform and the so-called "Shared PCBA and Shared Mould."

The baseband chipset is the key component of cell phones. As Table 3 suggests, the Taiwanese firm MTK has outshined all others in the Chinese GSM-based baseband chipset market. This is because MTK succeeded in the platformization of the cell phone chipset and in promoting it with a turnkey solution.

As a multi-media chipset firm, MTK was spun off from United Microelectronics Corporation as its IC design department. After succeeding in developing a controller IC for DVD players, MTK has grown into the largest IC fabless company in Asia. As a part of its diversification strategy, MTK began to develop a cell phone chipset in 2001. The firm integrated the baseband IC and the multimedia application processor into a single chipset, packaging the operating system and various applications such as an MP3 player

and phone camera driver into its chipset software. The MTK platform was a revolutionary simplification in the development of the cell phone (Imai and Hsiu, 2007).

When MTK began to promote the chipset platform to mainland China in 2003, however, it encountered various difficulties. On the one hand, the Chinese cell phone brand makers have adopted the IC chipset and the solution from leading IC manufacturers such as TI and Infineon. They did not have confidence in the functions and quality of the MTK platform. On the other hand, a large number of local small firms lacked the ability to make hardware design and software design on the basis of the MTK platform. In view of this situation, MTK went on to develop a turnkey solution, which contains the phone motherboard hardware reference design, the software source code, and other design notices for a complete cell phone design. As a result, the IDHs that adopted the MTK platform and turnkey solution became able to start mass-production almost immediately. Their workloads have also been greatly reduced.

In order to promote this chipset platform, MTK itself further established an IDH in Taiwan. Although the quality and functions of the MTK chipset was still inferior to those of the leading European and US firms, it was very efficient. In 2003, the IDHs that adopted other baseband chipsets generally took six to nine months, or even a year, to develop a phone, while only three to four months (six months at the most) were required for the Taiwanese IDH created by MTK. As a result, most of the mainland China's IDHs tended to adopt MTK platforms and the Shanzhai cell phone industry has thrived.⁸ While the IDH succeeded in promoting its chipset, however, MTK soon withdrew from this company, as it has decided to specialize in the chipset market.

Gawer and Cusmano (2002) pointed out that in order to achieve platform leadership, four levers are important, namely, the scope of the firm, product technology, relationships with external complementors, and internal organization. To adopt this framework, we can confirm that this company was at least successful with respect to the first and the third lever. Concerning the scope of the firm, MTK has dramatically broadened the scope of its baseband chipset in view of the inferior capabilities of the firm's users in mainland China. With regard to the relationship with its suppliers, what MTK attempted to do was enter the IDH complimentary field in order to tip the market, but withdrew quickly to avoid competing with its complementors.

Shared PCBA and shared mould (SPSM)

SPSM is a variant technology platform in the Shanzhai system. There are various situations under which IDHs and SIs use SPSM. The first situation is a legal case. When

⁸ Author interview with the general manager of the wireless communications division of MTK (December, 2006).

IDH has developed a new type of PCBA, the SI does not necessarily pay a deposit or guarantee to buy out all the PCBAs. In order to avoid these risks, the IDH sometimes sells PCBAs to several SIs simultaneously, so that the PCBA becomes a shared PCBA. Using this shared PCBA, the SIs downstream may make different moulds and design differentiated phone bodies. However, they can also share moulds together in order to distribute the expensive mould-making fees. In this case, the mould becomes a shared mould.

The other situation is to imitate popular brand cell phones and is thus illegal. Once Nokia or Apple have developed a strongly-selling product, some IDHs or SIs, or even mould makers will soon imitate a copycat PCBA and mould with a closely similar design, specification, user interface and user menu. The true functions and performance of the copycat and the normal product may, however, differ greatly.

SPSM is only likely to emerge in developing countries. The SPSM developers do not change the fundamental architecture of the product at all. Neither the PCBA interfaces nor the moulds have been standardized, nor have the related components been modularized. Since there is knowledge spillover between users, the SPSM generates direct network effects. However, it is obvious that products based on SPSM are highly homogeneous, and that their performance is imaginably unstable. Only in emerging markets, where there are large numbers of low-level producers and low-income consumers, can this kind of platform be long-standing.

4.3 Market platforms

North Huaqiang Market

In China, almost every important industrial cluster has a large wholesale market known as the Specialized Market. Not only merchants, but also a large number of small producers operate booths directly in the specialized markets, for the purpose of the sales of local products. The specialized markets are closely linked with traditional marketplaces in cities and rural areas in China and other developing countries. Like most of the successful platforms, the commodities traded in the specialized markets have often gained a dominant share in the domestic or global market (Ding, 2010).

In Shenzhen, there is also a specialized market which is the major market platform driving the Shanzhai cell phone value chain. The market is located in North Huaqiang Avenue, Shenzhen, and consists of 32 sub-markets and 30,000 booths dealing in electronic parts, cell phones and other digital products. North Huaqiang Market was established in 1988 as a small electronic parts market, but has currently grown into a huge market with an annual transaction volume of 120 billion RMB. Most of the

merchants in China's electronic markets are obliged to come to the North Huaqiang market for purchasing. It is said that "If the North Huaqiang Market sneezed, all the electronic markets would catch a cold."

The seven cell phone sub-markets within the North Huaqiang Market had annual cell phone sales amounting to 30 to 40 billion RMB in 2009, which does not include the sales of SIs located around the markets.⁹ These markets have played a central role in the sales of the Shanzhai cell phone. The shipments of Shanzhai cell phones in Shenzhen in 2010 reached about 400 million units, and the price of each phone is about 200 RMB. Therefore, at least half of the Shenzhen cell phones were sold from this market. In general, overseas and domestic buyers visit the market or purchase directly from the SIs in North Huaqiang Avenue. In the case of domestic trade, most of the cell phones are wholesaled to provincial sales agents. With the exception of a small number of brand makers, the territory system of sales is not being adopted in China's cell phone industry. Each province has at least 100 agents, and one provincial agent covers 40-50% of the area of the province. Under the provincial agent, there are further city or county-level agents and distributors.¹⁰

Purchasing and money platform (PMP)¹¹

A PMP is a kind of cell phone parts trading company, and is essentially a matching platform that facilitates IDHs and PCB parts suppliers in trading with each other. PMPs are primarily located in Shenzhen and neighboring areas, as most of the SMT factories are clustered in this area. It is estimated that there are a total of 100 PMPs providing purchasing and finance services for the whole Shanzhai system.

Because most of the IDHs are very small, they do not have the bargaining power for lowering the purchasing price, are unable to pay the license fees to MTK for purchasing chipsets, and neither do they have enough staff to purchase large quantities of parts and materials. PMPs therefore take charge of the parts procurement in their place. Before procurement, the IDH pays a deposit of around 20 to 30% of the total expenses to the PMP. This large amount of money is generally received from the SI in advance. After the procurement is completed, the IDH collects the residual expenses from the SI and pays the PMP, including a commission fee of 2 to 3% of the total expenses. In this sense, the PMP is merely a purchasing agent and does not share in the purchasing risk.

5. Network effects in the Shanzhai system

⁹ Author interview with the director of the North Huaqiang Market managing committee (September, 2010).

¹⁰ Author interview with the sales manager of a large-scale SI in Shenzhen (November, 2011).

¹¹ Author interview with a manager of a PMP (January, 2011).

5.1 The mechanism of network effects

The MTK platform

Of the four platforms in the Shanzhai system, the MTK chipset and the North Huaqiang Market have generated particularly strong network effects and have become platform leaders in each industry. In this section, we discuss the mechanism through which the two platforms generate network effects and the factors that strengthen these effects.

We firstly discuss the case of MTK. The MTK platform owns simultaneously the properties of the hardware platform and the software platform. The direct network effects are particularly observed in the software platform. The users of the MTK platform are IDHs. Based on the MTK software platform, IDHs engage in debugging, the development of various complementary softwares, and the optimization of software performance (in order to improve the hardware functions). The direct network effects are generated precisely during these processes.

Some IDHs obtain licenses from MTK and others do not. Concerning debugging, the licensed IDHs interact actively with MTK. IDHs report on the bugs and solve them with the support of MTK's technical staff. Through the intermediary of MTK, the achievements of debugging are then accumulated on the platform and shared by other IDHs. In China, the protection of intellectual property remains poor, and inter-firm labor markets are very advanced. Un-licensed IDHs are able to share the achievements of debugging quickly through the job-hopping of engineers. Complimentary software developed on the MTK platform cannot be diffused to other IDHs through the intermediary of MTK, but the software can be shared rapidly by all IDHs simply by employing job-hopping engineers.

The more the IDHs adopt the MTK platform, the fewer the bugs and the more sharable complimentary software will accumulate on the platform. As a result, an increasing number of IDHs will be attracted to the platform. This is a typical direct network effect. Many IDH owners are in profound recognition of this point and are very proud of it. One IDH owner commented, "The engineers that engage in R&D on the MTK platform are not merely from a single company. In the whole China, thousands of engineers are carrying out development around this platform."¹²

North Huaqiang Market

As a multi-sided platform, the main users of the North Huaqiang Market include buyers (small cell phone merchants from the domestic and overseas market), sellers (SIs

¹² Author interview with an IDH owner in Shanghai, a former engineer of the Longcheer Group (September, 2009).

and small wholesalers in the market), and service providers.¹³

The indirect network effects between buyers and sellers in the North Huaqiang Market are obvious. The more SIs and small wholesalers clustered in the market, the more intense the competition, the cheaper the price of cell phones, and the broader the options the buyers can choose from. As a result, an increasing number of buyers have been attracted to Shenzhen. On the other hand, the more buyers that come to the North Huaqiang Market, the fewer the risks SIs and small wholesalers need to take on, and the more abundant distant market information that will be brought to the sellers. As a result, an increasing number of sellers will be attracted to the market. This strong indirect network effect can be confirmed by the change in the number of buyers and booths (namely the sellers). When it was established in 1988, there were only 180 booths in the North Huaqiang Market, and the annual number of buyers was 30,000 (SSZYEC, 1989). In 2010, there were 30,000 booths in the market and the number of visitors per day had increased to 600,000. Of these, the number of pure buyers was 10,000.¹⁴ In the case of the Mingtong cell phone market, there were 110,000 to 120,000 buyers per day at the peak.

As Karnani (2007, pp.91-92) has precisely pointed out, demand in developing countries is “geographically dispersed and culturally heterogeneous.” The purchasing power of each consumer is small, and the main actors responding to poor consumers are the numerous small merchants.¹⁵ The North Huaqiang Market, however, can easily deal with the difficulties of distribution and marketing through the indirect network effect. Due to this effect, a large number of buyers, who brought about both the scattered small orders and information about emerging markets, have been attracted to Shenzhen. By trading with these buyers, SIs can easily enter a new market without constructing their own sales networks. On the other hand, simply by communicating with these buyers and watching the salability of the phones in the market, SIs and IDHs can obtain timely market information from any location in the emerging markets. Indeed, this information-gathering advantage has greatly stimulated the designs of the Shanzhai cell phone, matching them with demand in the emerging markets (Table 4).

5.2 Social networks

Not every platform can easily achieve a critical mass and generate network effects (Evans, 2009). There are four factors that affect technology and market platforms in

¹³ SIs do not necessarily operate booths in the market, but their offices or sales departments must be located around North Huaqiang Avenue, and they are able to contact buyers directly.

¹⁴ Author interview with the director of the North Huaqiang Market managing committee (September, 2010).

¹⁵ This point concerning small merchants was mentioned to the authors by Professor Hubert Schmitz at Sussex University.

generating network effects in the Shanzhai system, namely, social networks, supporting industries, informality and platform governance. This sub-section firstly focuses on social networks.

In general, the more closely network members are connected, the stronger the direct network effects generated (Evans 2009, p.105). The rapid spread of the MTK platform clearly proved that this point makes sense. Most of China's IDHs have directly or indirectly spun off from the Zhongxing Telecommunication Equipment (ZTE) Corporation and Motorola China.¹⁶ As a first wave, a number of IDH owners spun off in 1999, but more than 90% went bankrupt. The few survivors, such as the Longcheer Group, became China's leading IDHs. In 2004, the second wave of spinoffs occurred. This time, most of the start-ups survived and thrived. They then cultivated an increasing number of IDHs in Shenzhen and Shanghai.

As they have originated from the same company, the owners of these IDHs are both competitors and partners. They often communicate with each other to share information and managerial resources. Thus, as soon as one IDH adopted the MTK platform, a large number of IDHs belonging to the same network also tended to adopt it. The MTK platform therefore soon reached the critical mass. These IDH owners also maintain frequent communication in order to solve problems that occur during the R&D process of the MTK platform.¹⁷ This further strengthens the direct network effect.

Social networks also affect the market platform to generate indirect network effects. Compared to the MTK platform, on which the users are engineers with a high educational level, the majority of sellers in North Huaqiang Market, especially the owners of Sis, are traditional merchants with similar geographical origins. These regional groups are rarely educated at universities, while their networks extend nationwide, or even worldwide. In North Huaqiang Market, the major regional groups engaging in SIs are from Wenzhou in Zhejiang Province, Chaozhou in Guangdong Province, Hunan Province, and the three Northeast China provinces.

Taking the Wenzhou group as an example, there are more than 100,000 Wenzhou people doing business in Shenzhen. Of these, more than 50,000 are engaged in the electronics industry.¹⁸ It is estimated that among Shenzhen's 2,000 SIs, nearly 1000 are run by people from Wenzhou. At the same time, Wenzhou people may have founded 300 to 500 cell phone-related firms, from parts makers to wholesalers. Of Wenzhou's SIs, 90% are from the same county of Pingyang in Wenzhou.

¹⁶ Author interview with an IDH owner in Shanghai, a former employee of the Longcheer Group (September, 2009).

¹⁷ Of course, the results of complementary software development will not be communicated. The diffusion of this software relies more on job-hopping engineers.

¹⁸ Information on the features of the Wenzhou network was gathered from an interview with an SI opened by people from Wenzhou (November, 2010).

Wenzhou merchants are always sensitive to market conditions and disseminate market information immediately to each other without the least hesitation. As soon as an opportunity is discovered, a large number of Wenzhou people are able to enter the sector first as a group, sometimes even quite blindly. In the case of the cell phone, during the period between 2004 and 2005, rumors in Pingyang suggested that the cell phone would offer great business opportunities. As a result, people from Pingyang who were involved in different kinds of businesses in various places in China moved to Shenzhen, where they tended to set up SI businesses.

A Wenzhou merchant described this feature vividly: “This is like the ‘frog psychology’ of Wenzhou people. You croak, I croak, and everybody croaks. Then, the market will prosper and expand. Any industry that wants to thrive in China must rely on the Wenzhou network.” He also stressed the high speed of the Wenzhou network in entering a market. “We always enter a market right before its expansion. Wenzhou people are very adept at earning the first pot of gold, which makes the most money.” From the phrases “enter a market right before its expansion,” or “earn the first pot of gold,” it is obvious that although Wenzhou merchants do not have knowledge of platforms and network effects, they clearly recognize the advantage of their social networks. It is precisely the immediate information sharing between network members that enables a platform to achieve a critical mass quickly and thus tip the market.

5.3 Supporting Industries

As China’s first special economic zone, Shenzhen has attracted a large amount of investment from foreign companies (in particular from Hong Kong) and central government-owned companies since the 1980s. These firms helped Shenzhen to accumulate ample human and technological resources in the electronics industry.

Taking advantage of these resources, local private firms began to extensively appear in the consumer electronics sectors from the 1990s. The first wave appeared in 1995, when hundreds of VCD player factories were founded in Shenzhen and neighboring areas. The production volume of VCDs amounted to 600,000 units in 1995, and then increased explosively to 6 million units in 1996 and 10 million units in 1997.¹⁹

After VCD players, the production booms of DVD players, telephones, beep pagers, PDAs, and MP3/MP4 players have occurred in succession. The majority of these consumer electronics firms are small assemblers lacking in capital, technology and production skills. In order to supply the necessary materials and parts, many suppliers,

¹⁹ This dramatic growth in the VCD industry also resulted from the introduction of a combination of turnkey solutions and SPSMs, which indeed is the original model for the Shanzhai system.

such as SMT factories, plastic mould factories, and industrial design companies, which previously supplied to the foreign founded or central-government owned companies, began to supply to these small assemblers.

As a result, except for some high-end components, such as some PCB-related parts, screen modules, and cameras, all the peripheral products necessary for cell phone production became clustered in Shenzhen and neighboring areas. Some assembly plants for other consumer electronics goods also tend to receive orders from the cell phone sector. As a result, the number of firms in Shanzhai cell phone's supporting industries in Shenzhen has risen to about 6,000. A similar situation can also to some extent be observed in Shanghai and its neighboring areas. As soon as MTK developed the chipset platform and released the turnkey solution, IDHs and SIs appeared one after another in Shenzhen.

The spatial proximity of these IDHs and SIs greatly stimulated both the direct and indirect network effect. This is because a large part of the knowledge and information exchanged between the IDHs is tacit knowledge (e.g. debugging know-how). Most knowledge and information exchanged between SIs and buyers in the North Huaqiang Market is similarly tacit knowledge (e.g. cell phone user experiences). As it is more efficient to diffuse tacit knowledge in face-to-face communications between firms, the clustering of IDHs and SIs thus strengthened network effects on the MTK platform, and the North Huaqiang Market.

5.4 Informality

As Gao (2011) has argued, the Shanzhai industry is a new form of informal economy. From the perspective of the platform, this unique informality is also a crucial factor in strengthening network effects, and can result in low fixed costs and low sunk costs in the Shanzhai system. Low fixed costs lower the barriers to entry and enable firms to endure fierce price competition. On the other hand, low sunk costs can reduce the risks of entry. Consequently, the whole industry can accommodate numerous un-differentiated small firms in the state of a perfect competitive-like market.²⁰

Low Fixed costs

Platforms can save greatly on fixed costs such as the cost of R&D and the cost of marketing and purchasing. In the Shanzhai system, however, not only the platform itself,

²⁰ Evans (2009, p.116) points out that most of the B2B sites in US market failed as the sellers of these sites have fixed costs and thus cannot survive in the price competition brought about by the B2B auctions. The case of IDHs in the Shanzhai system contrastingly suggests that a platform will generate strong network effects when the fixed costs are extremely low.

but informality can also cause the fixed costs of firms to decrease. As for IDHs, compared to the expensive license fees of leading chipset makers, which amount to millions of dollars, MTK license fees are only 200,000 dollars. Even so, the number of MTK licensed customers (IDHs and some brand phone makers) is a mere 134.²¹ The remaining un-licensed IDHs can either acquire MTK chipsets from PMPs, the North Huaqiang Market, or licensed companies. Without licensing, they cannot obtain direct technology support from MTK. However, they can still get a software development kit indirectly from previous colleagues and friends in licensed IDHs.

The fixed costs of SIs are also low. Among 2000 SIs, a mere 350 firms have obtained production permission from the Chinese government, and need to send their products for quality testing.²² Most SIs only test the quality of cell phones themselves, which not only saves on the testing fees of 250,000 RMB, but also the testing time of 20 days.

Low sunk costs

Another cost characteristic that resulted from the informality of the Shanzhai system is that investment in the Shanzhai system does not easily become a sunk cost. Most cell phone parts are standardized,²³ and IDHs are often running multiple projects with multiple customers. Therefore, even though sluggish stock material appears or SIs do not pay residual expenses, IDHs can flexibly deploy parts and materials to other projects. Moreover, because the PCBA can be shared, an IDH can sell it to multiple SIs such that neither the costs of PCB design nor parts procurement will become sunk costs.

On the other hand, SI investments also do not easily become sunk costs. The largest risk for SIs is the one-shot mould investment, which costs 150,000 to 300,000 RMB. If the project fails midway, or the order is too small, this investment would become a sunk cost. However, since several SIs can share one mould or can purchase popular phone bodies directly from the market, the risk of investments in moulds are also low.

5.5 Platform governance

In this paper, we define platform governance as a combination of platform regulation and platform services. Platform regulation refers to the regulation of the access of complementors and avoiding opportunistic complementor activities on the platform.²⁴ Platform services refer to the provision of customization, maintenance, logistics,

²¹ Data provided by SZSIA.

²² Author interview with the president of the Shenzhen cell phone association (November, 2010).

²³ This standardization of cell phone parts is the result of the modulation of whole electronic industries and is not caused by the platformization of cell phone chipsets.

²⁴ Boudreau and Hagiu (2009) discussed regulations on multi-sided platforms. We consider that regulation is also indispensable for the one-sided platform.

banking and other services that and increase the value of a platform. Services can be provided by the platform owner itself or by independent service providers. In the latter case, indirect network effects will be exhibited between the service providers and the platform users (Suarez and Cusmano 2009, pp.85-86). Appropriate platform governance can greatly reduce transaction costs and help to strengthen network effects.

Platform Regulation

Although it is an informal economy, the efforts of platform governance can still to some extent be confirmed in the Shanzhai system. We focus on platform regulation first. Concerning the MTK platform, the license fee is very low and MTK have taken almost no measures to clamp down the numerous un-licensed firms. MTK prefers to treat this as a marketing strategy than simple inaction.

In the North Huaqiang Market, the actors in charge of platform governance include the managing companies of each sub-market, the managing committee of the North Huaqiang Market, the branches of the Intellectual Property Bureau (IPB) and the Bureau of Market Supervision and Management (BMSM). The last three organizations are public sector organizations.²⁵ As with MTK, these governors basically do not regulate the access of sellers as long as they can pay the booth rent and tax. On the other hand, the buyers do not need to pay any fees.

Concerning regulations on the interactions between buyers and sellers, each cell phone market has established a consumer protection platform to deal with disputes between them.²⁶ Each booth-keeper is obliged to return, exchange or repair goods if quality problems occur. As for public sector regulations, both the IPB and the BMSM strictly clamp down on imitation goods as soon as foreign firms complain about the infringement, while ordinarily they may be turning a blind eye to imitation goods.

Platform Services

MTK generally guarantees good service for licensed users. It ensures the supply of chipsets at a cheaper price, and has set up a technology department to support debugging.

In order to respond to the requirements of its Chinese customers, MTK always acts in

²⁵ In China, the competition for fiscal incomes between local governments is very intense. The behavior of government departments is more like a firm than a public sector organization. This paper, therefore, does not distinguish between private regulation and public regulation, as with Boudreau and Hagiu (2009, p.170). Information on regulations and services implemented by government departments was all gathered in an author interview with the director of the North Huaqiang Market managing committee (September, 2010).

²⁶ All the information on platform regulation and platform services conducted by the managing companies of the cell phone markets was gathered in an interview with the vice director of the managing company of the Mingtong Market (November, 2010).

a more customer-oriented manner than other leading chip makers. Licensed IDHs have numerous opportunities to communicate with MTK staff and feedback various market and technology information. In order to help their customers exploit emerging markets, MTK has established sales and research subsidiaries in mainland China, India and Dubai, in addition to other developed countries. One IDH owner compared MTK and an European chip maker as follows: “The European maker was positioned in the high-end market. It forecasts industry trends and makes decisions, unlike MTK, which changes its policies flexibly according to the requirements of its customers. The European maker’s products are just for demos, far from the requirement of customers.”²⁷

On the other hand, various complimentary services are being provided in the North Huaqiang Market. As for after service, many SIs have established repair and maintenance units in the cell phone markets and in China’s major cities. In medium-sized and small cities, the broken cell phone will be sent to Shenzhen for repair. As the logistics system is very advanced, it takes no longer than a mere 72 hours from the acceptance of a phone to return to the consumer. As for exported phones, as the cost of returning phones to Shenzhen is too expensive, SIs generally price the cell phones more cheaply, and provide extra parts for repair overseas.

In regard to logistics services, there are nearly 100 logistics firms clustered in a street behind North Huaqiang Avenue. As cell phones are light, air cargo is sometimes utilized for their transportation. The banking system is also advanced in North Huaqiang Market. Of cell phone transactions in the market, nearly 70% of the means of payment are through bank transfers and only 30% are by cash.

Lastly, the governors of North Huaqiang Market are actively publicizing and promoting the market. In order to propagate North Huaqiang Avenue as China’s top electronics avenue, the managing committee is releasing a regular Electronics Transaction Index, which reflects changes in prices of commodities traded in the North Huaqiang Market. This has helped to enhance domestic awareness of the market. On the other hand, the managing companies of each sub-market have actively propagated themselves overseas. For example, the Mingtong market has advertised itself in India, the Middle East and Latin America. One cell phone market in Dubai has become almost a branch market in which most of the cell phones are purchased from Mingtong.

6. Implications of the Shanzhai cell phone industry

The story of the Shanzhai cell phone has helped us to gain a more profound understanding of the significance of platforms for developing countries. The situation of

²⁷ Author interview with a medium-sized IDH owner in Shenzhen (November, 2010).

MTK in the Shanzhai cell phone industry is partially similar to the situation of Intel in the PC industry. The MTK platform and turnkey solution has resolved most of the technology problems concerning both the hardware and software design. As a result, the barriers to entry for cell phone design and manufacturing have been heavily reduced, and hundreds of IDHs and SIs have emerged rapidly.

However, there are also significant differences between the two companies. First, as a top-level maker, the Intel platform has not only facilitated the spread of the PC in emerging markets, but also helped its main users, such as the Taiwanese main board and notebook PC manufacturers to enter the high-end market in developed countries rapidly (Tatsumoto et al, p.361). On the contrary, MTK platforms were initially provided to the Shanzhai producers and are still aimed at the middle and low-end market. In order to acquire more emerging market users, MTK had to turn a blind eye to the existence of both the large number of unlicensed IDHs and the widespread SPSM.

Second, combined with the Windows operating system, Intel has continuously occupied a monopolistic position in the PC chipset market. In contrast, there are several competitors in the cell phone chipset market (Table3). Especially Spreadtrum, as the sole chip maker from mainland China, increased its shipments explosively to 110 million units in 2010.²⁸ What factors enabled Spreadtrum to achieve such rapid growth? Does this mean that developing countries are able to foster their own technology platform leaders? Will the international division of labor concerning platforms change? All these questions need to be answered in future studies.

The story of the Shanzhai cell phone also tells us that in addition to technology platforms, market platforms are also indispensable for exploiting emerging markets. In the Shanzhai system, market platforms include the North Huaqiang Market, which improved the marketing abilities of small firms, and the PMP, which helped small firms to purchase parts and materials with lower costs.

Of these, the former is more important. We repeatedly emphasize that the demands of emerging markets are culturally heterogeneous, geographically dispersed, and each consumer has little purchasing power (Karnani, 2007). As the case of the Shanzhai cell phone suggests, only the market platform, taking the form of the traditional marketplace, is able to respond to such a demand. The North Huaqiang Market attracted from emerging markets a large number of small cell phone buyers, who unceasingly carry orders and distant market information to the SIs and IDHs. These small firms are thus able to develop various novel products suited to demands in emerging markets. MTK

²⁸ As a result of the competition, the MTK chipset price dropped from between US\$6 and US\$8 (2007-2009) to between US\$3 and US\$4 in 2010.

then further improved their platform, using the information fed back by these customers. Since MTK did not have the ability to enter the developed countries' markets, it may be easily judged that without the existence of the North Huaqiang Market, this company would never have emerged, let alone become a platform leader in the Chinese market.

The platform leadership of the MTK chipset and the North Huaqiang Market have been achieved through the generation of strong network effects. The interaction between IDHs generates direct network effects on the MTK software platform, and the interaction between SIs and buyers generates indirect network effects on the North Huaqiang Market. There are four factors that have affected the generation of network effects in the Shanzhai system.

The first factor is the social network. In the Shanzhai system, there are two major types of networks, namely, the engineers' network, and the networks of regional merchant groups. As the case of Shanzhai cell phone suggested, social networks have particular significance for developing countries. Because of overpopulation, social networks in most developing countries have more nodal points than networks in developed countries. Once members of a social network have begun to adopt a platform, it is easier for a developing country platform to achieve a critical mass. Moreover, the credit system in developing countries is not as advanced as in developed countries, and thus information and knowledge shared within the same social network will be more accurate, which helps to strengthen network effects.

The second factor is the clustering of supporting industries, which enabled SIs and IDHs to set up business more easily and to agglomerate more closely. Consequently, the diffusion of tacit knowledge between them became increasingly smooth, thus enhancing network effects. In the Shanzhai system, the formation of supporting industries was caused by the development of local private firms, which obtained technology and human resources from foreign-established and central government-owned companies. This suggests that whether a platform can generate network effects smoothly and achieve platform leadership or not in developing countries depends heavily on the effects of the knowledge and technology spillover from the formal sector.

Informality is the third crucial factor. Although platforms can save on firms' R&D or marketing costs, the platform alone is inadequate for enabling a large number of small firms to start up new businesses. In the Shanzhai system, nothing but the unique informality of industries in emerging economies, including the ignorance of intellectual property and the avoidance of regulations, caused the ubiquitous low fixed costs and low sunk costs. Low fixed costs lowered the barriers to entry and enabled small firms to endure fierce price competition, while low sunk costs reduced their risks of entry. It

must be pointed out, however, that low fixed costs and low sunk costs also enables firms to make an easy exit from an industry. Just as we were finalizing this paper, news came in that one third of the Shanzhai cell phone system integrators suddenly withdrew or went bankrupt during the period between the end of 2010 and mid-2011. Does this mean the termination of the Shanzhai system? Or will this system survive along with the evolution of both the technology platforms and the market platforms? Sustained attention will be required to arrive at the correct answers to these questions.

The fourth factor is platform governance, which consists of platform services and platform regulation. In the Shanzhai system, although the provision of platform services is good, platform regulation, including the regulation of user access and the clamp down on imitation goods, remains inadequate. This will not hinder the development of platforms at the initial stage. Since market demand for consumer goods in developing countries is highly stratified, firms producing poor quality goods and high quality goods can entirely avoid competition with each other by entering a different market segment. Therefore, the phenomenon of bad money driving out good money will not occur for the time being.²⁹ In the long run, however, once the Lewisian turning point is reached, the demand for low-end goods in a market will decrease greatly (Lewis, 1954). Under this circumstance, if platform owners do not formulate further regulations, the platforms will no longer be an engine for innovation, but rather will be thoroughly reduced to a breeding ground for counterfeit and shoddy products.³⁰ Coincidentally, China is standing precisely at this very turning point.

²⁹ Contrastingly, in developed country markets, in which demand is more homogeneous and oriented toward high quality goods, the forgiveness of poor quality goods will soon cause the phenomenon whereby bad producers drive out good producers. See the case of Atari in the video-game console market in the US (Boudreau and Hagiu, 2009).

³⁰ In China, the platform regulation in some market platforms has made remarkable progress. As for the case of eyewear, see Ding (2010).

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Table1. General Situation of System Integrators in the Shanzhai Cell Phone Industry

Shipments/month	Number of staff	Number of firms
500,000 ~	300 ~ 1, 000	50
50,000 ~ 500,000	50 ~ 200	300
~ 50000	5 ~ 30	1, 650

Source: Estimated by Shenzhen Semiconductor Industrial Association (SZSIIA)

Table 2 General Situation of Independent Design Houses in the Shanzhai Cell Phone Industry

Shipments/month	Number of staff	Number of firms in Shanghai	Number of firms in Shenzhen
1,000,000 ~	300 ~ 1, 000	10	15
100,000 ~ 1,000,000	50 ~ 200	80	45
~ 100000	5 ~ 30	110	240

Source: Estimated by SZSIA.

Table 3 Market Share of GSM-based Baseband Chipsets in China

(Millions of Units)

Vendor	2007	Market share	2008	Market share	2009	Market share	2010	Market share
MTK	121.4	41.6%	222.2	76.2%	300.3	50.9%	430.0	72.9%
Spreadtrum	25.9	8.9%	18.9	6.5%	35.1	5.9%	110.0	18.6%
Infineon	28.2	9.7%	30.2	10.4%	22.8	3.9%	23.0	3.9%
Qualcomm	6.8	2.3%	5.8	2.0%	6.2	1.1%	13.0	2.2%
ST-Ericsson	14.1	4.8%	8.2	2.8%	5.3	0.9%	2.5	0.4%
TI	19.2	6.6%	6.0	2.1%	0.0	0.0%	0.0	0.0%
Mstar							10.0	1.7%
Others	1.8	0.6%	0.3	0.1%	3.5	0.9%	1.5	0.3%
Total	217.4		291.6		373.2		590.0	

Source: iSuppli(2011)

Table 4 Unique Functions of the Shanzhai Cell Phone

Functions	Emerging market consumer demands	Functions	Emerging markets consumer demands
Multiple SIM cards and multiple standbys	Developing countries often have many cell phone operators. Charge plans differ greatly for each operator	Flashlight	Developing countries have very frequent electric power cuts
Large speaker	Cell phones are often used as music players, while living conditions for the poor are noisy.	Currency detector	To check counterfeit banknotes
Long standby	The poor like to play with the cell phone for a long time, but charging the battery is inconvenient	Buddhism /worship cell phone	To respond to diverse religious beliefs
Large touch panel	The elderly and the poor are not used to using the keyboard	Analog TV	To improve the unexciting leisure life in developing countries
Multiple cameras	The young like to take pictures of themselves	Cell phones shaped like cigarette packs, cars and Fuwa (the Olympic mascot).	Poor people's fashion

Source: Authors.