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**Innovating Global Value Chains:
Creation of the Netbook Market by
Taiwanese Firms**

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Abstract

This paper explores the process of creation of the netbook market by Taiwanese firms as an example of a disruptive innovation by latecomer firms. As an analytical framework, I employ the global value chain perspective to capture the dynamics of vertical inter-firm relationships that drive some firms in the chain to change the status quo of the industry. I then divide the process of the emergence of the netbook market into three consecutive stages, i.e. (1) the launch of the first-generation netbook by a Taiwanese firm named ASUSTeK, (2) the response of the two powerful platform leaders of the industry, Intel and Microsoft Intel, to ASUSTeK's innovation, and (3) the market entry by another powerful Taiwanese firm, Acer, and explain how Taiwanese firms broke the Intel-centric market and tapped into the market-creating innovation opportunities that had been suppressed by the two powerful platform leaders. I also show that the creation of the netbook industry was an evolutionary process in which a series of responses by different industry players led to changes in the status quo of the industry.

Keywords: disruptive innovation, latecomer firms, global value chains, the PC industry

JEL classification: L63, O51, O53

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Introduction*

Since the early 1990s, the disintegration of large multinational manufacturers and the rise of cross-border production networks in the electronics industry have brought about huge growth opportunities for local manufacturers from East Asia (Dedrick & Kraemer (1998); Borrus (1997, 2000)). Among them, Taiwanese manufacturers are by far the biggest winners to gain from the deverticalization of the industry and the expansion of the outsourcing market. After two decades of rapid growth, they now dominate global production of various IT products, mainly acting as original design manufacturing (ODM) firms: designing and manufacturing products sold under the outsourcer's brand.

While some scholars are pessimistic about the upgrading prospects of ODM-oriented strategies pursued by these firms (Fuller (2005); Chu (2009)), Taiwanese electronics manufacturers show clear signs of breaking through the "glass ceiling" that prevents them from further industrial upgrading. Among a number of such developments identified by Sturgeon and Kawakami (2010), the rise of Taiwanese brand-carrying firms and their growing presence in the market deserve particular attention. Some of them have even started to launch innovative products and eat into the market dominated by powerful firms from developed economies.

In this paper, I focus on the case of a disruptive innovation by Taiwanese brand-carrying firms: the creation of the netbook market. "Netbook" computers are a newly-invented category of internet device that grew out of the notebook PC industry and became a tough competitor of traditional portable PCs within a few years of their launch. In this new market, two Taiwanese firms, namely ASUSTeK Computer and Acer, have been extremely successful. ASUSTeK first developed the idea of simple-to-use and ultra-low-cost portable PCs and launched its first product in 2007. Acer entered the market in 2008 and soon became the world's largest seller of netbooks.

As Taiwan has been the dominant producer of notebook PCs, accounting for 95% of total world shipments in 2010, one might assume the emergence of Taiwanese netbook firms is

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a natural extension of their achievements in the notebook PC industry. However, the strategies and positions of Taiwanese firms in these two markets are strikingly different. Firstly, Taiwanese notebook PC manufacturers grew mainly as competitive ODM suppliers, whereas ASUSTeK and Acer are selling their netbooks under their own brands. Secondly and more importantly, Taiwanese notebook PC firms grew by enhancing their complementarities with their brand-carrying customers (Kawakami (2009), thereby embracing the existing market order of the notebook PC industry. In contrast, the creation of the netbook market by Taiwanese firms involved creative destruction of the status quo in the notebook PC market which was tightly controlled by powerful platform leaders (i.e. Intel and Microsoft). Clearly, the rise of Taiwanese brand firms in the netbook industry illustrates the shifting position of latecomer firms in the industry's value chains and marks a milestone in the industrial development in Taiwan.

In this paper, I investigate the process of market creation by Taiwanese brand firms, the impact of this innovative product on the established firms in the notebook PC industry, and the underlying dynamics that unfolded along with the disruptive innovation by these firms. By so doing, I will explain how firms from Taiwan—the homeland of international subcontracting production—broke the Intel-centric industrial regime and exploited the opportunities for market-creating innovation that had been suppressed by existing players in the industry¹. I also show that the creation of the netbook industry was an evolutionary process in which a series of responses by different players overturned the collusive co-prosperity among existing players in the notebook PC industry.

The paper is organized as follows: Section I presents the analytical framework of the study, Section II explores the status quo in the notebook PC industry prior to the emergence of netbooks, and Section III describes the process of creation of netbooks by Taiwanese firms and the responses of other players to this innovation. The final section draws some conclusions.

¹ The companies I interviewed for this study during 2010-2011 include ASUSTeK, Acer, Toshiba, Sony, Quanta, and Intel. I also used the results of the interviews I conducted with Japanese and American notebook PC brand firms, Intel, and Taiwanese ODMs during 2006-2011, and discussions with industry analysts as information sources for this research.

I. Analytical Framework

Innovation Literature

In this study, I define innovation as the series of a firm's intentional activities that creates new value-added for customers/users and changes the rivalry among firms by disrupting or making obsolete the established competence of firms in terms of technology and/or linkages to customers and markets². The first step in exploring the emergence of Taiwanese netbook firms is to clarify the impact that netbooks had on the notebook PC market and to identify their innovativeness and disruptiveness.

Abernathy and Clark (1984) developed an analytical framework that classifies innovation into four types using two scales: the degree of disruptiveness or consecutiveness of the existing competence of firms in terms of technology, and market linkages (Figure 1). In this model, we can map netbooks in the “niche creation innovation” quadrant, as the core concept of the product was to create new linkages to customers by using existing technology developed in the PC industry.

Similarly, Henderson and Clark (1990) and Christensen (1997) provide a useful categorization of innovation that helps us understand why some innovations that look apparently minor—as was the case for netbooks in the eyes of established notebook PC firms—could destroy the competitive advantages of established firms and cause disruptive impacts to the market. In identifying four types of innovation, Henderson and Clark (1990) distinguish between the product as a system and the product as a set of components, and define innovation that changes the way in which the components of a product are linked together, while leaving the core components unchanged, as “architectural innovation” (Figure 2). This type of innovation often turns out to be disruptive for established firms and difficult to respond to, as the communication channels and information filters that these firms have developed over time hinder them recognizing and adapting to the new patterns of linkages among components. Christensen (1997) explains why some innovations that result in products that underperform established products precipitate the failure of excellent leading companies. He attributes the failure of existing firms to respond to these types of “disruptive” technologies to the

² This definition is partially based on the view of innovations presented by Abernathy and Clark (1984).

difficulties in investing in technologies with lower-margin opportunities and small markets.

Obviously, the studies cited above are helpful in identifying the idiosyncrasy of netbooks as an innovation. The product was a “niche creating” innovation (Abernathy & Clark (1984)) that created new linkages to consumers through the usage of existing technologies. It also innovated the combination of existing components (“architectural innovation” (Henderson & Clark (1990)), as the innovator used existing component knowledge to launch an ultra-low-cost internet device. The product is a typical example of “disruptive technology” (Christensen (1997)), as established firms had structural difficulties in responding to it, due to their information filters and motivations.

However, these studies suffer from one common limitation inherent in their analytical scope: all these analyses focus narrowly on the rivalry among firms competing in the specific product market where the innovative product emerges. In other words, the existing studies on innovation focus only on the horizontal dimension of inter-firm competition in the market, and tend to neglect the critical relevance of vertical inter-firm relationships that drive some firms in the chain to innovate and disrupt the status quo of the industry³.

This study attempts to capture the vertical inter-firm dynamics of competition and collaboration among firms in the chain that unfolded along with the emergence of netbooks.

Value Chain Perspectives: Identifying Major Players

To fill the analytical gap stated above, I introduce the global value chain (GVC) perspective (Gereffi and Kaplinsky eds (2001), Gereffi, Humphrey and Sturgeon (2005)) to capture the vertical inter-firm relationships in the notebook PC industry. The GVC perspective explores how a vertical sequence of value-adding activities is typically organized by “lead firms,” largely from developed economies, that set and enforce parameters for specifications related to product production to which other firms in the chain—“suppliers” from developed and developing countries—must adhere (Humphrey and Schmitz (2004), pp. 96–98). It also

³Christensen developed the idea of “value network,” the nested network of producers and markets through which the components at each level are made and sold to integrators at the next layers in the system (Christensen (1997), Ch. 2). However, Christensen’s main focus is on the way value networks structure firms’ responses to disruptive innovations, and not on the way interactions among network players affect the process of innovation. The present study shows the necessity of properly incorporating the perspective on vertical inter-firm relationships in analyzing innovations.

focuses on the power asymmetry between powerful lead firms and suppliers. Arrangements in notebook PC GVCs clearly fit the basic patterns found in these studies: lead firms from developed countries such as HP, Dell, and Toshiba coordinate value-adding activities by setting and enforcing parameters for Taiwanese contracting suppliers such as Quanta and Compal.

While the GVC perspective helps us highlight sequences of bilateral relationships between powerful lead firms and less powerful suppliers, a simple application of the GVC framework to the notebook PC industry would fail to capture a critical dimension of the industry: the emergence of powerful “platform leaders” and their pivotal role in driving the value chain dynamics. Here, the term platform leader refers to companies that provide the core components and technologies on which other companies build products or offer services (Gawer and Cusumano (2002), p. 6). As Gawer and Cusumano argue, the PC industry has two powerful platform leaders, Intel and Microsoft (pp. 15–16). Intel, in particular, has been extremely effective in this regard. Borrus (2000) identified a new form of competition in which powerful firms from developed countries exercise strong market power over disintegrated value chains through development of *de facto* market standards, and called it “Wintelism” after the most successful firms and their products in this new system—Intel and Microsoft’s Windows (“Wintel”).

In this industry we can identify three major players that drive the dynamics of notebook PC value chains: (1) Intel, a powerful component vendor and platform leader which governs the core technology of the product, (2) brand-carrying firms in the U.S. and Japan which control access to final markets, and (3) Taiwanese ODM firms which control detailed design, production and the coordination of delivery. In the following sections, I will explore the value chain dynamics before and after the rise of the fourth player—(4) Taiwanese brand-carrying netbook firms—and elucidate how they changed the landscape of the collusive co-prosperity among the three existing players in the mainstream notebook PC industry.

II. Status Quo Ante Netbooks: The Intel-centric Market of the Notebook PC Industry⁴

⁴ This sub-section is partially based on Kawakami (2011).

Prior to the emergence of netbooks, the notebook PC market was tightly controlled and governed by Intel and its strategic partner, Microsoft. In this section, I will discuss how Intel, a mere supplier of key components, came to govern the final product market, and how other value chain players responded and embraced its predominance.

Historical Background of “Wintelism”

The first notebook PCs were developed and mass-produced by Japanese firms (i.e. Toshiba and NEC) in 1989. In developing the new product, both companies used their intimate knowledge of component and sub-system technologies to miniaturize the product through the integration of in-house technologies. Their superior capabilities in product development and production proved to be a continuous source of competitive advantage in the market and effective barriers to entry by latecomer firms. Japanese brand-carrying PC manufacturers dominated the notebook PC industry both in terms of core technology and the final market until the mid-1990s.

Starting in the mid-1990s, however, this situation started to change. Following the successful strategy it had employed to dominate the desktop PC industry, Intel started to pursue platform leadership in the notebook PC industry. After 1997–98, the company began to promote its own notebook PC chipsets, launched “mobile modules”⁵ that eliminated technological difficulties of electrical engineering design and provided PC manufacturers with reference designs, while keeping the internal structure of its products as a proprietary black box (Tatsumoto, Ogawa and Fujimoto (2009); Ogawa (2007)). By so doing, Intel was able to internalize more functions, knowledge and value by encapsulating and integrating proprietary technical knowledge within its chipsets.

The emergence of ready-made technological solutions with a well-defined external interface negated the originally scarce and valuable engineering know-how that branded notebook PC firms, especially those from Japan, had accumulated in early years⁶. In this way,

⁵ Mobile modules integrated Pentium CPUs, coupled chips and second-level cache memory on a single board as a turn-key solution for latecomer firms.

⁶ In addition, the rapid spread of 3D-CAD systems for developing molds and dies and the launch of thermal modules as heat treatment solutions by Japanese parts suppliers removed technological difficulties facing latecomer producers.

Intel's strategic move lowered the entry barriers for developing and mass-producing notebook PCs by latecomer firms.

These technological changes led to intensified price competition among notebook PC makers and triggered a rapid expansion of outsourcing by global brand firms, opening the way for Taiwanese firms to enter the industry as ODM suppliers. The launch of the Centrino platform in 2003 further boosted the encapsulation of value-added by Intel products, intensified price competition among branded firms, and spurred subcontracting to Taiwanese firms. As their shipment swelled drastically (see Figure 3)⁷, Taiwanese manufacturers upgraded functionally and started to assume a wide range of value-adding activities, including product development, logistics and after-service functions. Their rapid emergence as "turn-key producers" (Sturgeon (2001)) was the combined outcome of two forces.

First, the strategy of American and Japanese brand firms to cut costs and increase flexibility by outsourcing product development and production has created opportunities for Taiwanese suppliers. Second and more important, Taiwanese manufacturers absorbed technologies transferred from their customers and continuously learned and invested to vertically integrate various value-adding activities to serve the needs of customers (Kawakami (2009)). Starting in the mid-2000s, brand firms have even started to rely on prototypes developed by Taiwanese suppliers when they plan their product line-up. This was made possible as Taiwanese top-tier ODMs such as Quanta and Compal came to trade with a large number of the world's leading brand firms and developed a rich pool of market-related information and knowledge about the tastes and product strategies of individual customers. In this way, brand-carrying firms came to partially rely on ODM suppliers for the function most critical to their role in the value chain: creating the concept of products.

All these developments led to the shrinking role that brand firms play in the value chain (Figure 4). On the one hand, the grip on the core technology shifted to Intel. On the other hand, Taiwanese firms constantly upgraded their capabilities and started to play an active role

⁷ Another critical factor behind the dramatic rise in the share of Taiwanese firms' global notebook PC production was the successful relocation of production sites to Shanghai and adjacent areas in China after the turn of the 21st century. The share of production in China to total shipments by Taiwanese firms rose from 5% in 2001 to 99% in 2008, showing a nearly complete relocation of the industry in seven years (MIC, various years).

in the process of product development by their customers.

Intel-centered Ecosystem and Collusive Co-prosperity under Wintelism

The thoroughness of Intel's platform leadership and the declining role of brand firms in the notebook PC industry are typically reflected in the process of product development, as illustrated in Figure 5.

In the early years, Intel selected as partners a small number of first-tier brand firms with superior R&D capabilities and high market share, such as Toshiba, IBM, and Compaq, and collaborated with them closely to develop a new chip. In conceptualizing a new product, Intel would hold a series of intensive discussions with these firms about the basic functions of a new chip, develop an engineering sample, and ask them to verify and report bugs to Intel. Intel and their partners would then go through several rounds of modification-verification cycles before launching the chip.

In this process, brand-carrying firms were indispensable partners for Intel that helped them develop attractive platforms upon which brand firms and their Taiwanese subcontractors developed products. For brand firms, the time-consuming process of debugging was worth the effort, as it allowed them an "early touch" of new core chips and secured first-mover advantages in the product development process. From the late-1990s, brand firms started to outsource product development to Taiwanese ODMs, but first-tier brand firms kept working with Intel, and Intel shared critical information about new chips only with brand firms. The interactions between Intel and Taiwanese ODMs were very limited both in frequency and significance.

After the mid-2000s, however, this division of labor started to change. Firstly, brand firms started to retreat from the time-consuming process of debugging. As they had started outsourcing product development to Taiwanese ODMs, brand firms started to let their ODM suppliers help Intel debug sample chips. Secondly, Intel started to treat Taiwanese ODMs on the same terms as brand firms. Nowadays, Intel releases chip-related technological information to Taiwanese ODMs almost at the same time as they do to brand-carrying firms. Taiwanese firms then develop a number of prototypes using new chips and present them to their customers for selection. This new pattern of information-sharing benefits both Intel and brand

firms, as involving Taiwanese ODMs in the process reduces the lead time for new product development and reduces the human resources required by brand firms.

Despite the changes in the roles of the three major value chain players, the essence of this Intel-centric ecosystem has remained unchanged. Intel periodically launches ever more powerful, high-performance chips. By so doing it continuously stimulates demand and drives up-market migration (Christensen (1997)) in terms of computing power and functionality of the product. In cooperation with Intel, Microsoft periodically launches ever larger operating systems (OSs), which require the huge CPU power supplied by Intel. Brand firms launch “Intel-inside” products based on the prototypes developed by ODM suppliers. In this way, Wintel has constantly stimulated the product market, led the collective up-market migration, and allowed brand firms and Taiwanese ODM firms to co-prosper in the Intel-centric market.

But this co-prosperity has been maintained at the expense of consumers, who are forced to purchase products with arithmetic capacity often beyond their needs. Christensen (1997) argues that the pace of technological progress often exceeds the rate of improvement that customers can absorb, and this oversupply in product performance creates a vacuum at the low end of the market which innovators can enter. This was exactly the case in the PC industry: ASUSTeK tapped into this vacuum that appeared in the low end under the collusive structure in the notebook PC market.

III. The netbook revolution and disruption of the Intel-centered regime by latecomer firms

In this section, I divide the process of the emergence of the netbook market into three consecutive stages: (1) the invention of the first netbook by ASUSTeK, (2) the response of Intel and Microsoft to the innovation by ASUSTeK, and (3) the entry by Acer into the netbook market, and describe the industry dynamics in each phase.

ASUSTeK as an innovator⁸

ASUSTeK, the world’s largest seller of motherboards and the inventor of the netbook,

⁸ This subsection is based on Shih et al. (2008), annual report of ASUSTeK Computer Inc., and the author’s interviews with ASUSTeK (October 2010, January 2011).

was founded in 1990 by four engineers, all of whom were former employees of Acer. From the early days, the company was famous for its superior R&D capabilities and the deep trust it won from Intel. By the late 1990s, the company had become the world's largest manufacturer of motherboards. As part of its product diversification strategy, it started to manufacture notebook PCs in 1997 and mobile phones in 2003. ASUSTeK's product line now covers a wide range of IT products, semi-finished products and components, but notebook PCs and motherboards continue to be the two main pillars of its revenue.

In the autumn of 2006, the CEO of ASUSTeK and an admired engineer, Jonny Shih, came up with the idea of an easy-to-use and ultra-low-cost portable PC. Shih thought that the notebook PCs at the time were too complicated and expensive, and ASUSTeK could tap into a new market opportunity with a simple and low-cost PC (Shih et al. 2008). Shih envisioned a completely new type of portable device that would be "easy to learn, work and play"⁹ for such potential consumers as children, teenagers, the elderly and homemakers in developed countries, and that would help them enjoy the world of the internet. The target price was set at under \$399 (US). Based on this blueprint, Shih and his right-hand man, Jerry Shen, organized a project team¹⁰ to focus on developing the product that was later named "EeePC".

For many years, the pursuit of small, thin and light notebook PC products had been a laborious project that required extensive R&D and substantial costs, as it was difficult to create a compact product using the latest CPUs and OSs. For instance, Panasonic and Toshiba have devoted huge resources to developing proprietary mechanical components for their leading-edge ultra-thin notebook PCs (Interviews with Panasonic (June 2005) and Toshiba (June 2007)).

In contrast, ASUSTeK took a revolutionary approach: it did not premise Wintel's product roadmap as a starting point when it began developing the product that was later named "EeePC" (Nikkei Business (2008)). Instead, it adhered to the core concept of the product and selected low-cost, low-function components to meet the target price and product specifications. It tried to make the product as simple and economical as possible. In contrast with established

⁹ "Eee" PC is an acronym for "Easy to learn, work and play, Excellent Internet experience, Excellence-on-to-go."

¹⁰ Most of the team members came from the motherboard business unit, as the project's target was to develop a machine totally different from a traditional notebook PC.

brand firms, ASUSTeK was a newcomer and outsider with a global share of 3.4% in 2006, and this made ASUSTeK less concerned about the negative impacts of launching low-price products on their lucrative products.

As the world's largest motherboard producer with the prominent "ASUS" brand, ASUSTeK worked closely with Intel from its early days, and it naturally sought support from Intel on the project. However, Intel was negative towards ASUSTeK's idea: although it had promoted the development of low-price PCs for educational purposes in developing countries, it had not envisioned or encouraged low-price PC product space in *developed* countries. ASUSTeK had no choice but to collaborate with Intel's minor competitor, AMD, to develop the first prototype of EeePC.

By the end of 2006, ASUSTeK had developed a working sample based on AMD's processor, but it did not give up involving Intel in the project, and continued to seek collaboration. Eventually, Intel started to show interest, and after closely studying the prototype, it decided to support the project by providing ASUSTeK with Dothan Celeron M—a CPU that was out of phase at the time—at a special price. As for the OS, ASUSTeK chose to develop an original Linux-based OS in cooperation with a Canadian software company. This was one of the most challenging parts of the project, as it had no previous experience in developing OSs (Shih et al. (2008)).

The first EeePC was launched in the autumn of 2007 and was a great success. Shipments in 2008 reached 4.2 million. The main demand came not from the type of consumers ASUSTeK had anticipated, but from mainstream notebook PC users looking for second machines¹¹. The great success of EeePC demonstrated the existence of underserved demand for low-cost, low-function products. The voice of the consumer, long suppressed under the Intel-centric regime, was now finally heard.

Down-Market Migration by Platform Leaders

The quick success of EeePC disrupted the Intel-centric market order, and triggered reactions from the platform leaders. In this regard, Intel was more active and strategic than

¹¹ Another impetus came from the wireless communication market, where service providers promoted their telecom service by offering bundled internet devices at a special price.

Microsoft. In supporting the EeePC project, it recognized its potential and the growing pressure for down-market migration, and decided to embrace the emerging market. Its main strategy was to go down-market itself, compartmentalize the market and contain the possible cannibalization effects of netbooks on the mainstream notebook PC market.

While working with ASUSTeK on the EeePC project, Intel started to develop a completely new type of processor that was much cheaper than existing products, consumed far less power and required less mounting space, a CPU later named “Atom”, and released it in April 2008. Intel also defined a low-price portable PC mainly focused on internet access as a “netbook,” and highlighted it to be the most promising application of the Atom CPU. More importantly, Intel designated the upper limit for the panel size of products that adopt an Atom-based platform as under 10.2 inches, and by so doing tried to compartmentalize the netbook sector from mainstream products.

The response of Microsoft was more passive and less successful. When EeePC hit the market, Microsoft had just released its latest flagship product, the “Vista” OS, and announced the termination of support for Windows XP. But the success of EeePC with a Linux-based OS disrupted this plan. Vista was too expensive and large to implement in netbooks and this left Microsoft disadvantaged in comparison with the Linux-based OS in the netbook sphere. Thus, Microsoft had no choice but to extend the support period for Windows XP. It encouraged the use of Windows XP on netbooks by offering a special rate in order to prevent the shift to the Linux-based OS in the netbook sector. In common with Intel, Microsoft tried to contain the netbook sector to stop it cannibalizing the mainstream market by specifying upper limits for the display size and memory size to qualify for support for Windows XP.

As is clear from the above discussion, the launch of EeePC seriously disrupted the product strategies of Intel and Microsoft, and led to their down-market migration. In response to EeePC’s success, they tried to compartmentalize the market and contain the netbook sector in the lowest-end, small niche. But their strategy was only partially effective, as the down-market migration by platform leaders paved the way for new dynamics in the final market.

Acer Follows Suit

Prior to the emergence of netbooks, traditional branded PC firms like HP, Dell and Toshiba were not developing ultra-low-cost notebook PCs, as the price decline and erosion of demand in the lucrative mainstream sectors were their primary concern. However, the EeePC's quick success highlighted the growing demand in the low-end market, and the sluggish IT product market after Lehman's collapse in 2008 boosted the momentum of netbooks. Thus, the established firms had no choice but to go down-market: HP released its first netbook in May 2008, followed by Acer (July), Dell (September), Toshiba (October) and other top-tier brand firms. The shipment of netbooks and their share of total shipments of portable PCs swelled dramatically from 11.6 million units (8%) in 2008 to 34.5 million units (20%) in 2009. The intensified competition drove some brand firms to launch Atom-based netbooks with panels larger than the upper limit specified by Intel as the definition of a netbook¹². Clearly, the strategies of Intel and Microsoft to contain netbooks in the lowest-end niche were only partially effective.

Among the new entrants, Acer was by far the most successful follower; its shipments of netbooks surpassed ASUSTeK and reached 9 million units in 2009. A sharp increase in netbook shipments helped them become the world's second-largest selling PC brand by the third quarter of 2009.

Acer's success in the netbook market is primarily attributable to two factors. Firstly, its entry to the mainstream market only after the mid-2000s was the key. In contrast with established brand firms that were reluctant to enter the sector, Acer saw the emergence of the netbook market as a chance to strengthen its market position. For Acer, the possible cannibalization of mainstream products by netbooks was expected to be smaller in comparison with other top-tier firms, as the firm had focused more on the mid- to low-end market, and had enjoyed a lower premium of excessive performance. The ambition to surpass the position of competitors motivated the entry by Acer into the netbook market.

Secondly and more importantly, Acer's business model turned out to be highly competitive in the netbook sector. The evolution of the division of labor among the three players in the last decade, with the shrinking role of brand firms and the enhanced role of

¹² For example, Dell and Lenovo developed netbooks with 12-inch LCD panels using Atom in 2008 and 2009, respectively.

Taiwanese ODMs, has changed the key factors for success for brand firms. Nowadays, Taiwanese ODMs undertake an ever-wider range of value-adding activities for customers: they even develop prototypes for selection by brand firms. In this new pattern of division of labor, the bargaining power over ODMs and ability to exploit the resources of suppliers are the critical success factors for brand firms. In this regard, Acer was extremely competitive.

As a Taiwan-based brand firm, Acer is well positioned to leverage ODM's high level of expertise in product definition and design. Acer separated its branded PC business from its ODM contract manufacturing (Wistron)¹³ and PC peripherals (BenQ) businesses in the early 2000s¹⁴. At the same time, Acer transformed itself into a pure-play brand firm that fully exploits the supply-base capabilities of Taiwanese ODMs. In contrast with top-tier brand firms, especially those from Japan which tend to keep product planning and development in-house, Acer relies heavily on the ideas and prototypes developed by ODMs when it launches new products. It focuses on making the right decision and selecting the best proposals presented by suppliers.

Acer's competitiveness partially stems from its embeddedness in the Taiwanese economy, which enables it to effectively monitor ODMs, correctly select from their proposals, and reduce overhead costs as a result of this business model. Proximity, both in terms of space and culture, makes Acer the toughest negotiator for ODM firms. Partly due to the high mobility of employees among firms and the dense information network in the Taiwanese IT industry, Acer has good intelligence about the current business conditions and cost structures of individual ODMs, and this makes it difficult for ODMs to hide profits from Acer (Otsuki, 2009). Acer's business model was particularly effective in the netbook market, in which the elasticity of demand to product price is high.

In the process of Acer's entry into the netbook market, Quanta played a pivotal role. When EeePC emerged, Quanta quickly developed a number of prototype netbooks for its customers, and this made Acer's quick entry based on the prepared proposals possible. Also, Quanta used to be a member of the "OLPC (one laptop per child)" project¹⁵ and had collected

¹³ By doing so, the company successfully enabled Wistron to compete with pure-play ODMs such as Quanta and Compal.

¹⁴ ASUSTeK followed suit and spun off its ODM business as Pegatron in 2008.

¹⁵ OLPC is a US-based non-profit organization that offers an inexpensive portable computer for

information about the availability of low-cost components for building ultra-low-cost products¹⁶. After 2009, Compal replaced Quanta as the ODM partner for Acer, but the strong support from ODMs continues to be the main driver of Acer's sustained growth.

Commoditization of Netbooks and Vanishing Innovativeness

As can be seen from Table 1, Acer and ASUSTeK have been the two leading brand firms in the netbook sector, with a combined market share of 47% in 2010. This achievement deserves special recognition, as it indicates that Taiwan, the home of international subcontracting, now produces outstanding brand-carrying firms.

However, along with the rapid expansion of the netbook industry, the innovativeness of the product, clearly observable in the product concept of EeePC, disappeared. The down-market migration by Intel and Microsoft paved the way for the quick launch of netbooks, negated the first-mover advantage of ASUSTeK, which had developed a proprietary OS and manufactured the first batch of EeePC in-house, triggered another round of severe price competition among brand-carrying firms, and spurred the commoditization of the product. In this process, Acer's business model of fully exploiting the supply-base capabilities of Taiwanese ODMs prevailed, and ASUSTeK, the innovator which had struck a blow against Wintel's hegemony, became a secondary player. All these developments are eroding the uniqueness and innovativeness of netbooks, and are leading to the convergence of netbooks with low-end notebook PCs.

Conclusion

In this paper, I have explored the process of creation of the netbook market by Taiwanese firms as a case of disruptive innovation by latecomer firms. The emergence of the netbook sector was not simply a story of firms launching an innovative product, but was an evolutionary process in which a series of responses by different players in the value chain

children in developing countries. Quanta was chosen as the exclusive production partner (Shih et al., 2008).

¹⁶ Another reason for Acer's competitiveness in the netbook sector stems from its strategy of keeping the number of models to a minimum. This policy proved to be effective as ASUSTeK started to launch a larger number of models as a part of its strategy to compete with new entrants and sacrificed the economy of scale after 2008.

changed the collusive co-prosperity of existing players in the notebook PC value chain.

The process of creation of the netbook industry studied in this paper consisted of three consecutive stages. The first step was made by ASUSTeK, the newcomer and outsider in the mainstream notebook PC market, which broke the Intel-centric market order. This led to the second step, the down-market migration by Intel and Microsoft, which turned out to be the real driver of the growth of the netbook sector. The third stage began when other brand-carrying firms entered the market, leading to the rapid commoditization of netbooks. The collective down-market migration triggered by Taiwanese firms disrupted the established market order governed by Wintel. But along with the arrival of easy solutions (i.e. Atom CPUs and extended support for Windows XP), the true innovativeness of the first generation of EeePC became blurred. Partly due to this, the netbook market became threatened only a few years after its launch by the emergence of other types of IT products, including tablet PCs and smart-phones, and lost momentum¹⁷.

In conclusion, we can derive some theoretical and empirical implications from the present study. Theoretically, this study illustrates the necessity of combining the value-chain perspective with innovation analysis to understand the innovations dynamics. Existing studies on innovations have tended to focus on inter-firm rivalry within the market for a specific product or component. In contrast, this study highlighted the critical relevance of vertical inter-firm dynamics as a driver of innovation in the notebook PC market. The vertical dimension is especially relevant in the IT hardware industry, in which control over core technology, the market, and mass production is dispersed among various players in the value chain. The process of the rapid expansion of the netbook market can be understood only by tracing the dynamic interactions among value-chain players in the notebook PC industry.

Empirically, this study reveals the growth potential of Taiwan-based brand firms in the IT hardware industry. As was typically observed in the notebook PC industry, the encapsulation of value-adding functions in core chips by platform leaders on the one hand, and the enhanced capabilities and enlarged value-chain functions of Taiwanese ODMs on the other, will cause the role of brand firms to decline. In turn, this will change the key success factors

¹⁷ In 2010, however, total shipments of netbooks declined by 8% (see Table 1) due to the rise of Apple's iPad and smart-phones.

for brand firms and increase the potential of brand firms that achieve powerful competitiveness based on their strong ties and good intelligence about ODM firms based in developing economies. Thus, contrary to Chu (2009), who emphasizes the path dependency of firm growth and predicts a prolonged phase of ODM-oriented development of Taiwanese firms, I argue that the same dynamics that played out in the notebook PC industry will naturally lead to the emergence of Taiwanese brand-carrying firms in a growing number of IT hardware sub-sectors in the near future.

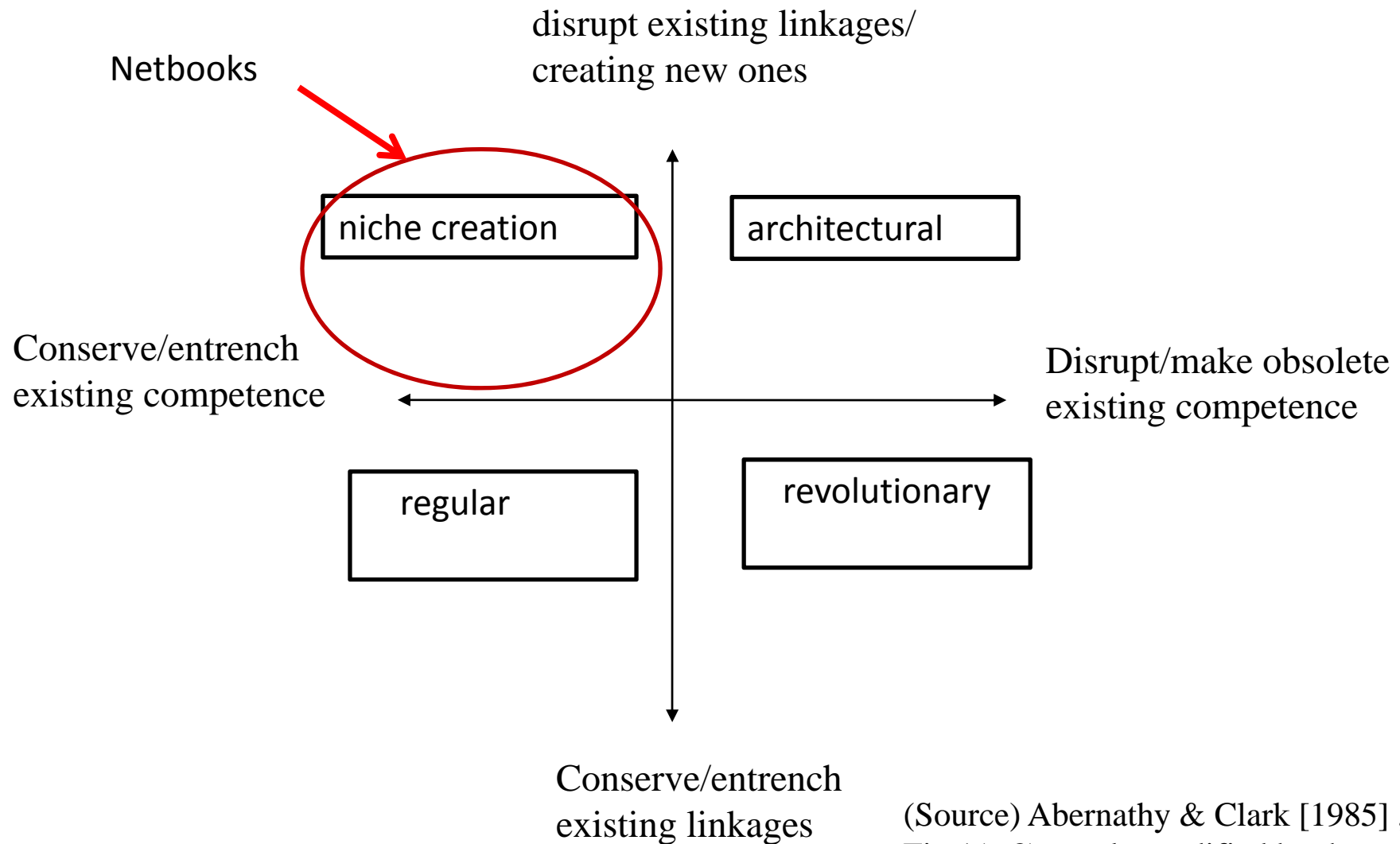
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Figure 1. Four categories of innovation by Abernathy & Clark [1985]



(Source) Abernathy & Clark [1985], Fig.1(p.8), partly modified by the author.

Figure 2. Four categories of innovation presented by Clark & Henderson [1990]

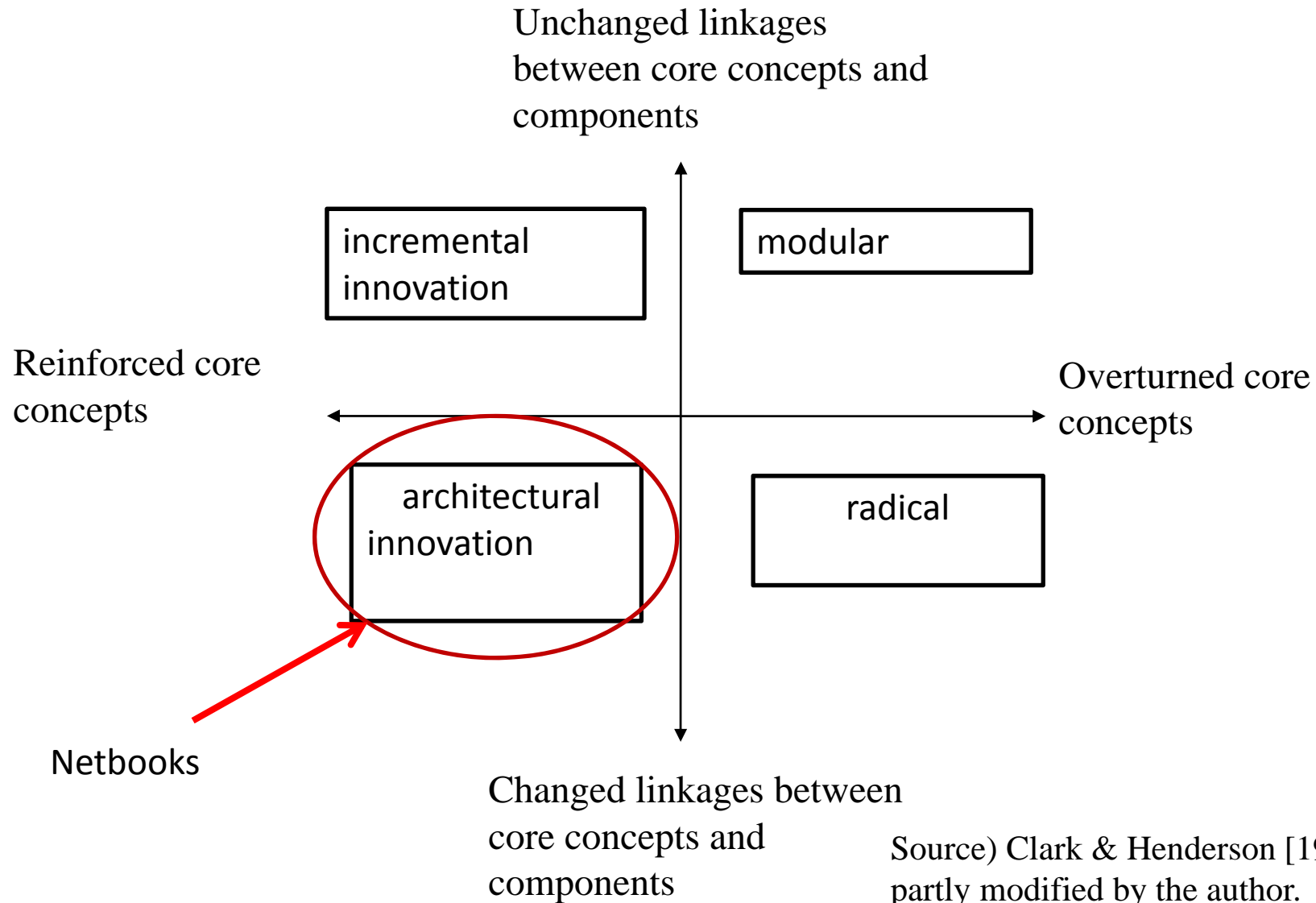


Figure 3. Change in shipments, OEM/ODM ratio, ratio of production in China, and world share of Taiwanese notebook PC manufacturers

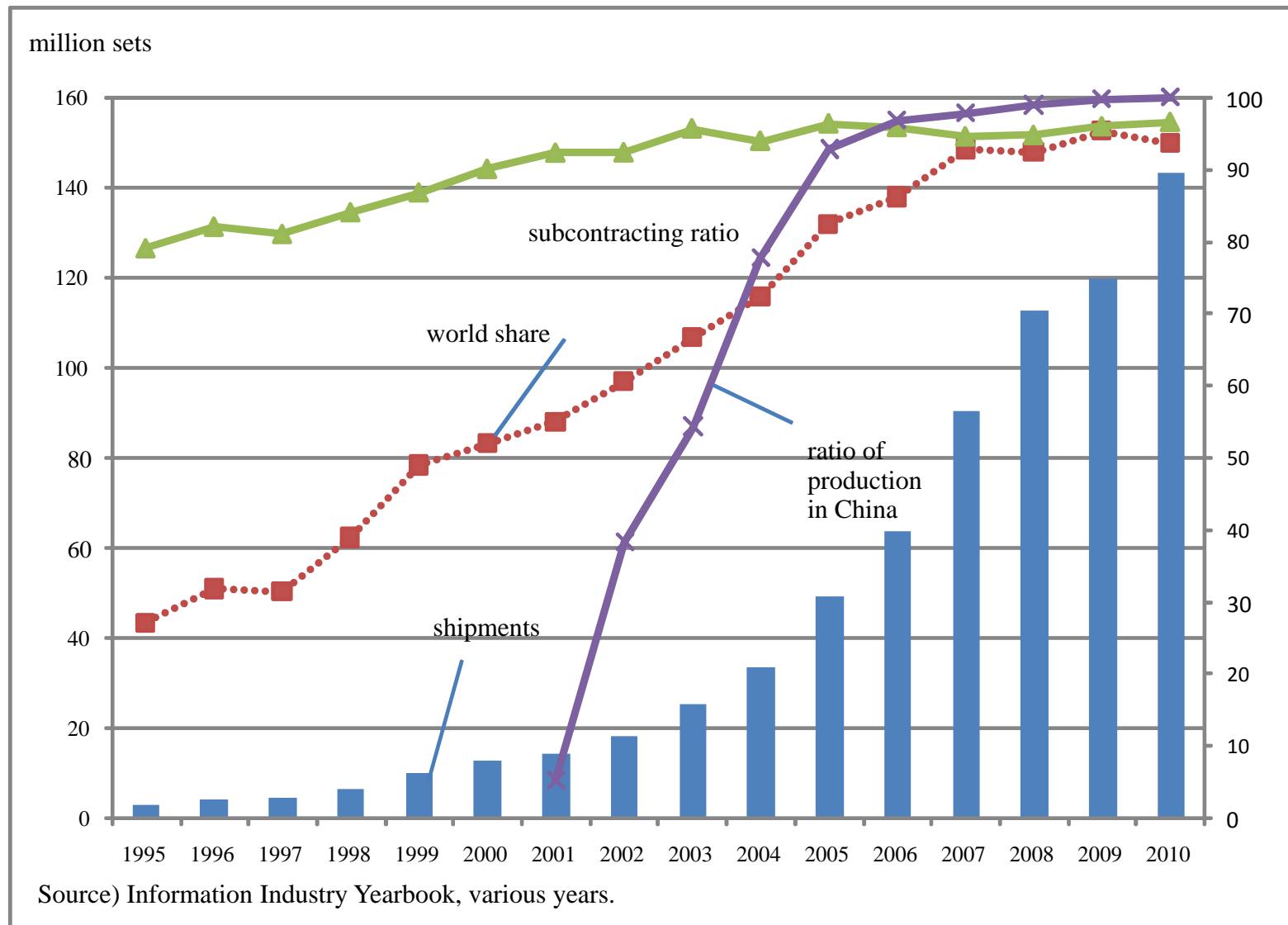
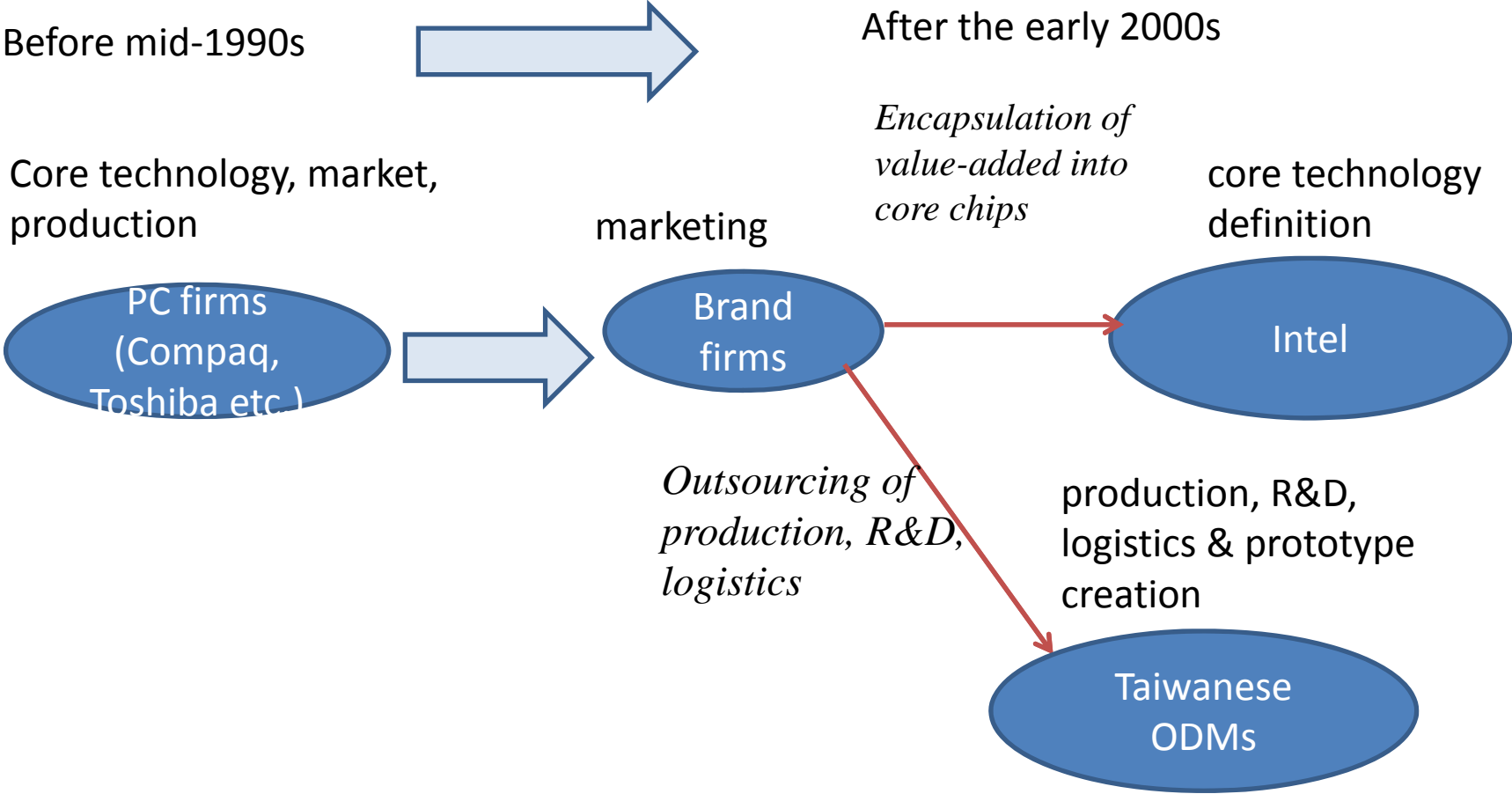


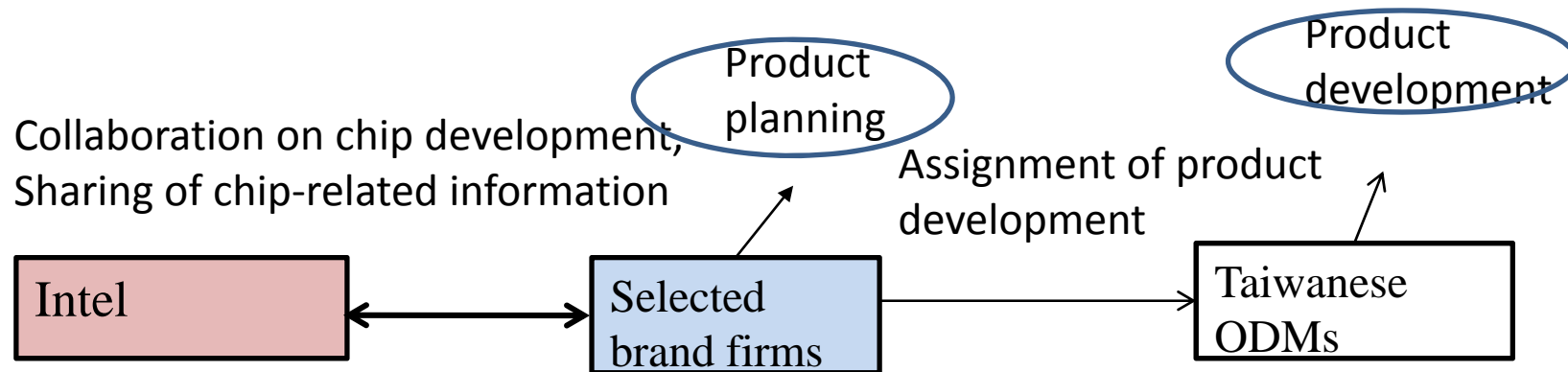
Figure 4. Emergence of three main players and the decline in the role of brand firms in the notebook PC value chain



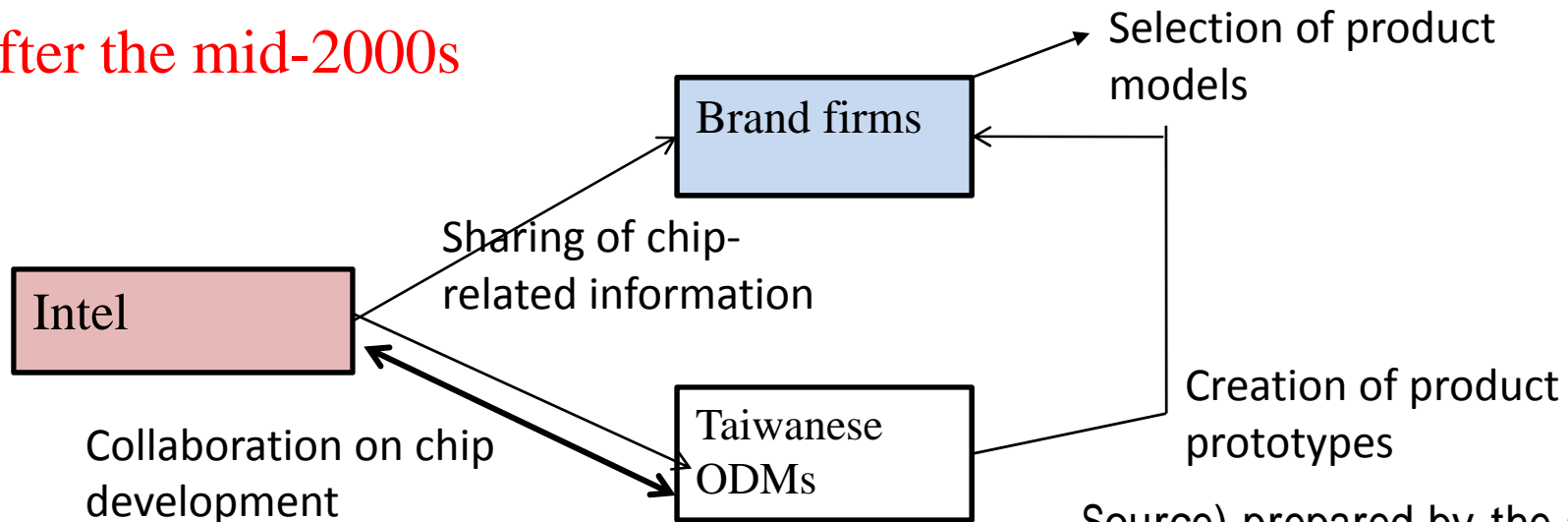
Source) prepared by the author.

Figure 5. Division of labor among three actors in the development of a new chip and PC product

Before the mid-2000s



After the mid-2000s



Source) prepared by the author.

Table 1 Shipments of netbooks by selected PC brand firms

company/name	2007		2008		2009		2010	
	shipments	share	shipments	share	shipments	share	shipments	share
ASUSTeK	123	93	4,183	36	5,552	16	5,891	17
Acer	-	-	3,354	29	9,055	26	9,166	26
HP	-	-	761	7	4,855	14	5,696	16
Dell	-	-	360	3	2,866	8	2,322	7
Lenovo	-	-	366	3	1,688	5	1,358	4
Samusung	-	-	321	3	2,646	8	3,931	11
Others	9	7	2,204	19	7,731	22	7,266	20
Total	132	100	11,549	100	34,393	100	35,630	100

Source) IDC Corp.

Note) Data for mini notebook PCs.