Linking business ecosystem lifecycle with platform strategy: a triple view of technology, application and organisation

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Linking Business Ecosystem Lifecycle with Platform Strategy: A Triple View of Technology, Application and Organisation

Abstract

This paper explores platform strategies along the business ecosystem lifecycle (BELC), based on a multiple-case study. Developing observations on platform strategies from a firm level to a business ecosystem level, the study investigates the issue of platform strategy through three views, respectively technology, application and organisation. As a result, a general evolutional pattern of platform strategy along the BELC is identified, where an open strategy emerges at the Birth and Expansion phases, then a dominating strategy rises at the Authority phase, and finally the opportunistic strategy takes over at the Renewal phase. This paper connects the core firms in the business ecosystem with the evolutionary platform strategies.

Keywords – Business ecosystem, Platform strategy, Lifecycle, Technology, Application, Organisation, Mobile computing industry

1 Introduction and Industrial Background

The concept of business ecosystem, first proposed in 1993, sought to describe a loosely connected business community composed of different levels of organisations such as industrial players, associations, governments and other relevant stakeholders, who share a common goal and co-evolve, with the purpose of dealing with uncertain business environments (Moore, 1993). This concept could equip companies with a bigger view of cross-industry collaboration, rather than directly linked partners in the supply chain, as seen through a traditional lens. Furthermore, the concept inspires the industrial players at their birth.

The mobile computing industry has recently emerged from the mobile phone and PC industry to improve the level of convenience for users when dealing with portable devices (Kenney and Pon, 2011). However, typical products within the mobile computing industry are not finalized, as they need to maintain the advantages of both devices, such as easy Internet access, user-friendly interface, and portability with a long stand-by time. Players from both industries have therefore also adopted the business ecosystem concept to address these uncertainties.

With regards to this issue, platform development is a key way to organise partners within a business ecosystem (Moore, 1996) to deal with market uncertainty. A platform is identified as an interface to facilitate external companies to work with technology owners

(Iansiti and Levien, 2004). ‘Who wins and who loses these competitions is not simply a matter of who has the best technology or the first product. It is often who has the best platform strategy and the best ecosystem to back it up’ (Cusumano, 2010, p. 34). Besides this, Moore pointed out that in each phase (Birth, Expansion, Authority and Renewal), the platform would vary and adapt to each phase’s essential factors (Moore, 1996).

However, there are very few studies on platform strategy and its dynamic changes along the BELC. To bridge this gap, this paper aims to analyse the evolution process of firms’ platform strategies along their BELC. The main research question of this paper is defined as:

How does the platform strategy evolve along the lifecycle of a business ecosystem?

This paper contains the following sections: after the introduction, a literature review on the current research on business ecosystems and platform strategy follows, and a conceptual research framework is developed based on the literature review. The methodology will address the research method, and specify the data collection and data analysis methods. Then, case studies to investigate different platform strategies using the proposed conceptual framework are explored. Three platform strategies are summarized using the results from the case studies. Finally, the conclusion and future research are discussed.

2 Literature Review

2.1 Business ecosystems and their lifecycle

There are four main groups that contribute to the body of knowledge of business ecosystems. The first is Moore, who proposed the concepts of the business ecosystem, and the business ecosystem lifecycle (Moore, 1993, 1996). In terms of lifecycle study, Moore developed an S-curve lifecycle consisting of four phases, namely Birth, Expansion, Authority and Renewal (Moore, 1996). At the Birth phase, firms watch carefully for new opportunities to set up value chains and create value for customers. At the Expansion phase, business ideas will capture value for a large number of customers and make it possible to scale up the concept to a broad market. At the Authority phase, the value-adding components and processes are stable and leaders set a direction to encourage partners to work together. At the Renewal phase, a new business ecosystem will emerge from the mature business communities by giving birth to new ideas and innovations.

The second group further developed the business ecosystem idea based on Moore’s concept, and enriched the model by introducing different role types and their platform strategies, as well as the concept of ecosystem health (Iansiti and Levien, 2004; Den Hartigh et al., 2006). The third group proposed the four key features of a business ecosystem and

suggested a key governance framework by adopting system complexity and evolutionary theory (Peltoniemi, 2006). The fourth group worked on the innovation strategy and risk in an ecosystem (Adner, 2006).

To summarize, although Moore highlights the importance of the BELC, very few studies are currently available for further exploration into issues relating to the lifecycle of a business ecosystem.

2.2 Platform in the business ecosystem

As platform strategy and business ecosystems play increasingly important roles in competition (Cusumano, 2010), research in this field is attracting more and more attention from both academia and practitioners. However, Moore did not develop the platform strategy of the business ecosystem. Instead, he proposed the concept of the 'offer' as a component of a business ecosystem, which connects companies in the network (Iansiti and Levien, 2004). This could be regarded as the draft image of a platform that operates among the business ecosystem partners.

In 2004, the concept of platform was introduced into the business ecosystem, and was defined as 'a set of solutions to problems that is made available to the members of the ecosystem through a set of access points or interfaces' (Iansiti and Levien 2004, p. 148*)*. As a result, the ecosystem partners could use the platform as a basic functional component and build up their own products based on that platform. Hence, the platform concept also reflects Moore's core idea of the 'offer'; it also facilitates and shapes the manner of partners' interactions (Li, 2009). To summarize, the platform is regarded as the interaction interface of a business ecosystem.

Moreover, adopting the platform could be regarded as the starting point of the value creation process, which is also one of the key characteristics of the business ecosystem. The platform is able to shift value from the firm to the network level (Li, 2009). Li also expands the platform category, which contains services, tools, or technologies shared by other members of the ecosystem to co-create and deliver value (Iansiti and Levien, 2004). Therefore, the platform contributes to the value creation process from this point of view.

Furthermore, the platform also enables a better structure of the partner network in a business ecosystem in order to harness creative individuals to co-create new value and take it to market globally. Hence, current business competition takes place more at the ecosystem than the firm level (Iansiti and Levien, 2004). The value created by the platform is not only captured by the core firm, but also shared by the network partners (Li, 2009).

In conclusion, the concept of ’platform’ in the business ecosystem includes three main functions: namely interaction interface, value creation, and network formulation. Interaction interface means ecosystem members could leverage the interface as a kind of toolkit to build their own products. Value creation means the platform enables ecosystem partners to work together to co-create the value. Network formulation means that since the platform makes the partners work together to co-create value, they will formulate specific network patterns to compete against their competitors’ ecosystems.

To our knowledge, previous studies are limited to covering the evolution of these platforms along with the change of their BELC. Therefore, this paper puts more focus on identifying the types of platform strategies and their evolution within a business ecosystem.

2.3 Three views of platform

Although research on the evolution of platform strategies in a business ecosystem is rare, we can still summarize three views by which to analyse platform strategy based on current literature.

Platform strategy reflects a firm’s ***technology*** policy, in particular towards its new product development activities. In general, a platform is regarded as a collection of the underlying technology or knowledge (Gawer and Cusumano, 2002) that is implemented across a range of products. In the fast-evolving high-technology industry, certain technologies serve as a platform to facilitate market expansion. For example, the Windows operating system acted as a technology platform for the PC market (Kenney and Pon, 2011), and the iOS served as a global platform for Apple’s iPod, iPhone, iPad, and its integrated services. Moreover, platform leaders normally have a foundation technology that is sufficiently open to allow outside firms to provide complementary products and services. Furthermore, platform leadership allows a company to drive innovation around a particular platform technology at a broad industry level (Gawer and Cusumano, 2008). However, platform development is also a technical issue because it needs know-how or specific problem-solving procedures (Muffatto and Roveda, 2002). Obviously, it is essential to better understand how the platform strategy will confront the technological innovation within the BELC.

Based on the technology platform, various products/services (which we define here as ***applications***) are delivered to customers. Among them, some products/services themselves could be developed as a product/service (application) platform. For example, based on the iOS platform, Apple provides customers with products like iPods, iPhones and iPads, and also services such as the iTunes Store, App Store, and iBooks Store (Cusumano, 2010). Take the iTunes Store as an example: this has become a platform for publishers and

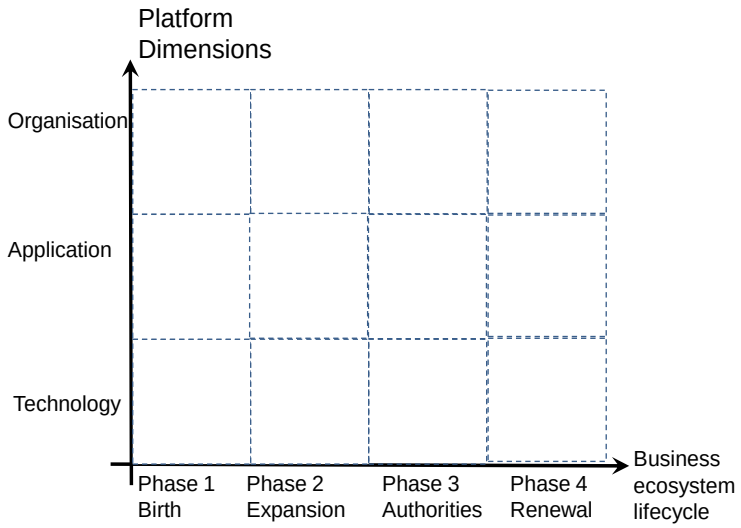
other ecosystem players to distribute their video and audio products. This product platform has been widely studied and applied in the field of product design, and is regarded as a group of common components, modules, or parts from which various products could be created efficiently (Iansiti and Levien, 2004). Furthermore, the platform is also regarded as a combination of two parts: the external product platform deals with the market requirements, and the internal product platform relates to the internal product development. It is important to study platform strategy, considering the relationship between product lifecycle, product design lifecycle and product platform lifecycle (Wortmann and Alblas, 2009).

The implementation of a platform strategy not only affects product development but also has significant ***organisation*** implications (Pasche et al., 2011). 'Leaders of leaders' play critical roles in creating a platform or platforms that set the rules, behavioural expectations, quality control, tone, work and customer service ethic, as well as the overall identity of the organisation (Rubenstein, 2005). In addition to the relations among different technologies, organisational issues such as people and relationships are critical to the platform strategy, including the teams, relationships among team members, relationships between the team and the larger organisation, and also relations with the supplier network. From an organisational view, platform means developing a cross-functional team within technology and application development (Muffatto and Roveda, 2002). Furthermore, the development of the platform leads to organisation boundary challenges when the development covers several different companies in different countries (Burström, 2011).

2.4 Conceptual research framework

Based on the literature review, it is necessary to investigate the platform strategy with reference to views of technology, application, and organisation. The conceptual research framework is developed as shown in Figure 1. The main purpose of this research is to analyse the platform strategy from perspectives of organisation, application, and technology, as described in the vertical axis, and to compare its differences at different BELC stages (Birth, Expansion, Authority, and Renewal), as presented in the horizontal axis.

Figure 1 Conceptual framework



3 Research Methodology

3.1 Case study methods

To address the contemporary research question defined above, the multiple-case-study methodology is appropriate to address those areas with limited research (Yin, 2008). Three case companies (ARM, Intel and MTK) are selected for this research. Table 1 summarizes the chosen three cases considering six criteria, and each company has a different rationale for being chosen as a typical case in this field. The case companies acted the same concerning the first three criteria as 1) centric firms, which are involved in 2) emerging industries and 3) developing future products in the mobile computing industry. These considerations aim to demonstrate a rich database of ecosystem cases with a similar background, while on the other hand setting a context against which those ecosystem partners engage. The other three criteria aim to reflect the variations of the cases' business ecosystems in terms of 4) type, 5) platform strategy and 6) interaction frequency. Variations in the business ecosystem type, for example the level of dominance, including various, less dominant and dominant, indicate the different phases of the BELC experienced by these three cases. The variations in platform strategy also represent the different responses made by the three case companies to the different phases of the BELC. Last, across different platform strategies, the interaction frequency also varies. The latter three criteria are designed to demonstrate the evolution of the ecosystem partners' platform strategy along the BELC, as well as to make the case data more comprehensive.

Furthermore, these three typical cases are embodied by nine sub-cases, to demonstrate a rich case base and provide a comprehensive view. Other companies in the business

ecosystem are also interviewed in order to comprehensively understand how the case companies implement their platform strategies.

Table 1 Selective criteria for main cases studies

Criteria Cases	ARM	Intel	MTK
1.Centric firm	Yes	Yes	Yes
2.High tech emerging industry	Yes	Yes	Yes
3.Future product	Mobile computing	Mobile computing	Mobile computing
4.Business ecosystem	Various	Less dominant	Dominant
5.Platform strategy	Open	Half	Highly integrated
6.Interaction	Frequent	Often	Less

3.2 Data collection

According to the proposed research questions and research framework, in-depth interviews were used in this research to collect the required data. The positions of the interviewees varied from CEO and project manager, to product manager. A total of 77 interviews were conducted in 40 companies within three business ecosystems, taking 208 hours. The list of interviewees is shown in the Appendix Table. Other data from websites and documentation are used as secondary data sources to cross-verify the collected data, which also ensures the reliability of the collected data.

3.3 Data analysis

Data are analysed following the development of the conceptual research framework, as outlined in Figure 1, which ensures construct validity in this research (Gibbert et al., 2008; Yin, 2008). Firstly, regarding typical platform strategies, three dimensions were initiated, namely technology, application and organisation. Secondly, series projects in each case were compared internally and analysed with the purpose of demonstrating each pattern's typical platform evolutionary strategy in terms of technology, application and organisation. Thirdly, a generalized platform evolution model was developed by cross-case analysis and synthesizing each case's platform strategies along the BELC.

4 Case Studies

4.1 ARM

ARM is the world's leading semiconductor intellectual property (IP) supplier. IP acts as the technology foundation for nearly every electronic device in the world today (www.arm.com). ARM's position is at the very starting point of a supply chain for the end-user of electronic products; hence, persuading downstream partners to adopt ARM's IP is a big challenge for ARM. In order to convince downstream partners, ARM has a very open attitude to nurturing its ecosystem. Three projects were highlighted to demonstrate ARM's platform strategy along the BELC: 1) mobile phone 2) leader partners strategy 3) IP categorization.

ARM believed that they had the ability to develop the common parts of integrated circuit (IC) chips, and license them to IC design firms. This business model would help IC firms save costs, shorten the lead time and differentiate their own products based on ARM's IP. However, at the early development stage, ARM was a small firm and not able to persuade the direct customer, IC design firm TI, to adopt their IPs. ARM reconsidered its new product development strategy, and began to approach the downstream company instead of direct customers. They hoped that downstream partners, especially original equipment manufacturers (OEM), could help build up supply chain connections for ARM's IP commercialization. At that time, Nokia, as an OEM, also hoped to develop the next generation of mobile devices that had low power, were small in size and were easy to upgrade. ARM's architecture exactly matched their aims, and Nokia agreed to develop the new phone based on the IP-ARM7 architecture. TI was just one of Nokia's suppliers, so Nokia suggested that TI adopt ARM's IPs. ARM finally leveraged the supply chain players for mobile phone products with the help of the OEM. From this case, ARM began to understand the power of its ecosystem partners rather than only focusing on their own direct partners. As a result, they started to nurture their own business ecosystem.

ARM then categorized their ecosystem partners into three groups: silicon partners; design support partners; and software, training and consortia partners. They aimed to provide specific support to those different group partners and enable them to promote ARM's IP together to IC design firms. In addition, ARM launched a leader partners strategy (LPS) to approach specific IC design firms like TI in the mobile phone project. This phase was the key period to enable the ecosystem's growth and sustainability. ARM firstly chose the top chip design firm in the targeted market, and then got their marketing team, architecture team, design team and modelling team involved with this leader partner in order to realize co-designing and co-marketing the future platforms. As a result, they combined their partners and promoted the new IP products. Moreover, in some specific markets they also selected as the leader partners players who were small but with strong design capability.

ARM discovered that if they followed their previous strategy to develop new IPs, their IPs would be very luxurious and not suitable for specialized markets. Therefore, they began to categorize IP markets into three streams with the help of leader partners: mobile computing with high processing capability, industry control with real-time-response capability, and low-level embedded market. In each market, they worked with specific leader partners and got a lot of feedback to help them finalize IPs into those three streams.

4.2 Intel

Intel is an integrated device manufacturer (IDM), and the top player in the semiconductor industry. Their products mostly focus on computer processors (CPUs), but also include motherboard chipsets, network interface controllers, flash memory, graphic chips, embedded processors and so on (www.intel.com). Three projects were highlighted to demonstrate their platform strategies: 1) PC processor 2) Xscale 3) Atom.

Intel's first successful product was the PC processor. Initially, they joined hands with IBM to initiate a network pattern of manufacturing, which surpassed vertical integrated manufacturing systems like those offered by Apple. After winning the competitive advantage, IBM began to charge an IP fee when other companies wanted to produce PCs meeting IBM standards. This set an industrial entry barrier and dramatically slowed the industrial innovation rate. Intel took this issue into account and intended to provide free industrial standards to facilitate partners' innovations in the PC industry. Unfortunately, the PC OEMs used different chipsets, and Intel therefore had to use different chip platforms to maintain connection with them. With these two concerns, Intel finally introduced peripheral component interface (PCI) standards to connect partners' peripherals chips with its processors, which enabled partners to take part in new product development based on Intel's chip, generation by generation (Gawer and Cusumano, 2002). This strategy not only destroyed IBM's dominating control, but also encouraged more partners to contribute to the PC industry based on Intel's free PCI standard, which resulted in Intel's huge success. Later, they continued to introduce industry standards and to form a close alliance with Microsoft. Finally, Intel and Microsoft together dominated the PC industry.

While the PC industry became saturated, the mobile phone industry grew dramatically. Intel began to enter the mobile phone industry by using Xscale chips to renew the PC industry. Intel owned this chip based on ARM's platform through an acquisition in 2002. This became a dilemma in 2006, when Intel faced intense competition with top IC design firms such as Qualcomm and TI, who used the same platform as ARM and had their own mobile ecosystems support. However, Intel was fresher and could not afford to manufacture the chips with ARM's IP. To make matters worse, they got even less support from the software side. Thus, they decided to abandon the Xscale project in the hope of taking the opportunity to launch a new chip based on their own platform. After selling the Xscale, however, they started to think about how to re-enter this market.

Intel then developed, generation by generation, a chip called Atom, which had low power that was customized for the mobile computing industry. Learning from Xscale's failure, Intel became aware of the importance of the business ecosystem. They used several steps

to build up their business ecosystem in the mobile computing industry. They firstly initiated the Atom-based Netbook, which was a frugal version of the notebook. The idea for this came from EeePC – a low-cost and basic version of a notebook. This approach helped increase the sales of Atom chips and build up the business ecosystem around Atom chips as well. Instead of directly entering the mobile market, they intended to enter the mobile computing industry first and nurture the business ecosystem for Atom chips. In addition, in order to highlight the performance of Atom chips, they set up an open-source Moblin ecosystem to facilitate software development. They encouraged many players to develop both operating systems and application software that were compatible with Atom chips. Furthermore, they proposed a new device concept, the mobile Internet device (MID), and encouraged partners' contributions to its development within the mobile market.

Intel faced a dilemma on its pathway to the mobile market: it started to design its roadmap by contributing to the software side for new devices, and encouraging partners' contributions as well, which represented a more open attitude compared to before. However, they did not open their core chip technology.

4.3 MTK

MTK was a leading IC design company for wireless communications and digital multimedia solutions (www.mediatek.com). The company was a market leader and well known for its single-chip solutions for mobile chips, digital TV, DVD and VCD products (Zhu and Shi, 2010). Three projects were studied in order to demonstrate their platform strategies along the BELC: 1) VCD/DVD 2) mobile 2G 3) smartphone.

MTK's platform strategy was very different from those of ARM and Intel. MTK focused on how to increase industrial efficiency in the mature market, while ARM and Intel aimed to give the industry variety and sustainability in the early market. For example, MTK firstly penetrated the mature VCD market with a single-chip solution that beat down all other competitors. The single-chip solution cut through the technology barrier at a low price. In the meantime, the single-chip solution enhanced players' innovation on the downstream supply chain. They triggered the manufacturing network in mainland China, with less R&D capability. This network could easily transfer products from VCD/DVD to mobile via its flexible manufacturing capability. In conclusion, MTK's strategy was to find a good and large market, offer a single-chip solution, and penetrate at the right time with the help of this manufacturing network.

However, MTK faced challenges in the mobile 2G project: at first, the single-chip mobile solution was not well accepted by Western and local Taiwanese OEMs. The mobile phone network was controlled by a small number of multinational companies who formulated

a very close alliance. MTK had no opportunity to join that close alliance. However, they copied what they had done in the VCD market, coming to mainland China and finally triggering the close manufacturing network formed by thousands of small and fragmented firms, which were strong at manufacturing but weak at design. This complementary combination created a new, thriving market. In 2008, 20% of the mobile phone shipment was based on MTK's chip platform (Rong et al., 2011).

Furthermore, by learning from the mature mobile 2G industries, MTK began to penetrate the early markets of the smartphone industry in order to win an early competitive advantage. In the smartphone industry, many more new types of companies, such as telecommunication operators, independent software vendors (ISV), content providers and other relevant stakeholders, became involved in new product development, which made the supply chain system even more complicated. Rather than only triggering the manufacturing network with its single-chip solution, they also interacted with local partners and adopted their requirements into the solution. Furthermore, MTK joined the open-source software community Android in order to make their chips compatible with many other partners' product platforms. Finally, MTK provided training sessions to help local partners to design their platform.

4.4 Summary of the case study findings

The main cases are positioned differently in the BELC, as shown in Figure 2 regarding their projects' implementation process. Taking ARM's first project as an example, it started at the Birth phase since ARM had to commercialize its new IP. Following this, ARM continued to improve its IP performance with leader partners in the second phase. In the third phase, industrial players regarded ARM's solution as the dominant design. In the Renewal phase, they began to categorize IPs and upgrade the original ones. In terms of MTK's mobile 2G project, ARM penetrated the mobile phone market when it was very mature and its business ecosystem was at the Authority phase. In addition, other projects and their platform strategies are also placed along the BELC, depending on their characteristics. All case data follows the three-dimensional view. In the following section, the data analysis will focus on two aspects: first, identifying the typical pattern from a single, main-case perspective following the BELC, and second, conducting cross-case analysis to generalize the platform strategies.

Figure 2 Platform strategy from a three-dimensional view (Note: P1-P4 the phases of the BELC)

		Technology				Application				Organisation			
		P1	**P2**	**P3**	**P4**	**P1**	**P2**	**P3**	**P4**	**P1**	**P2**	**P3**	**P4**
ARM	**1a-Mobile**	Low power IP	Cooperate with IC design firm	Finalized with IC design firm and OEM	Upgraded into embedded IP	The first mobile	Platform with different chip firms	Finalized by the mobile OEM	Embedded application	Persuade OEM and IC firm	Various partners along value chain	Mobile phone small alliance	leveraged partners in other market
	1b- LPS	Embedded IP	Co-design platform	Leader partners' platform		Embedded market	New Embedded platform	ARM based embedded chips		Alliance with leader partners	Diversified relationship based on solution	Selected platform partners	
	1c- IP Categorize		Leader partner	IP categorize d			Leader partner chips	ARM based platform			Diversified relationship	Selected platform partners	
Intel	**2a-PC**	PC processor	Processor compatible to different platform	PCI industry standards	ARM based architecture	IBM PC	Different OEM's PC	Win-Tel based PC	ARM based Mobile	Close with IBM	Supplier to various OEMs	Close alliance with Microsoft, and connect with other chip suppliers	Encourage PC partners penetrate into mobile market
	2b-Xscale	Xscale chip	Outsource manufacturing to TSMC	Motorola platform		Xscale based Mobile	TSMC manufacturing platform	Motorola A1200 Mobile		Close with OEM	Alliance with TSMC, OEM, software	Close relationship with Motorola	
	2c-Atom	Atom chip	Moblin OS; MID and netbook platform	Netbook standards		EeePC	MID; operating system	Finalized standard netbook		Succeed from notebook network	Encourage notebook partner involvement	Selected partners	
MTK	**3a-VCD/DVD**			One chip solution	DVD chip to renew			VCD	DVD			science park, mainland China partners,	Mainland China partners
	3b-Mobile 2G			One-chip solution				Shanzhai mobile phone				Succeed from VCD partners	
	3c-Smart-Mobile	MTK solution	Android platform; platform interaction			MTK based smartphone	Smartphone co-designed with local Partners			Succeed from previous partners	Shenzhen manufacturing network		

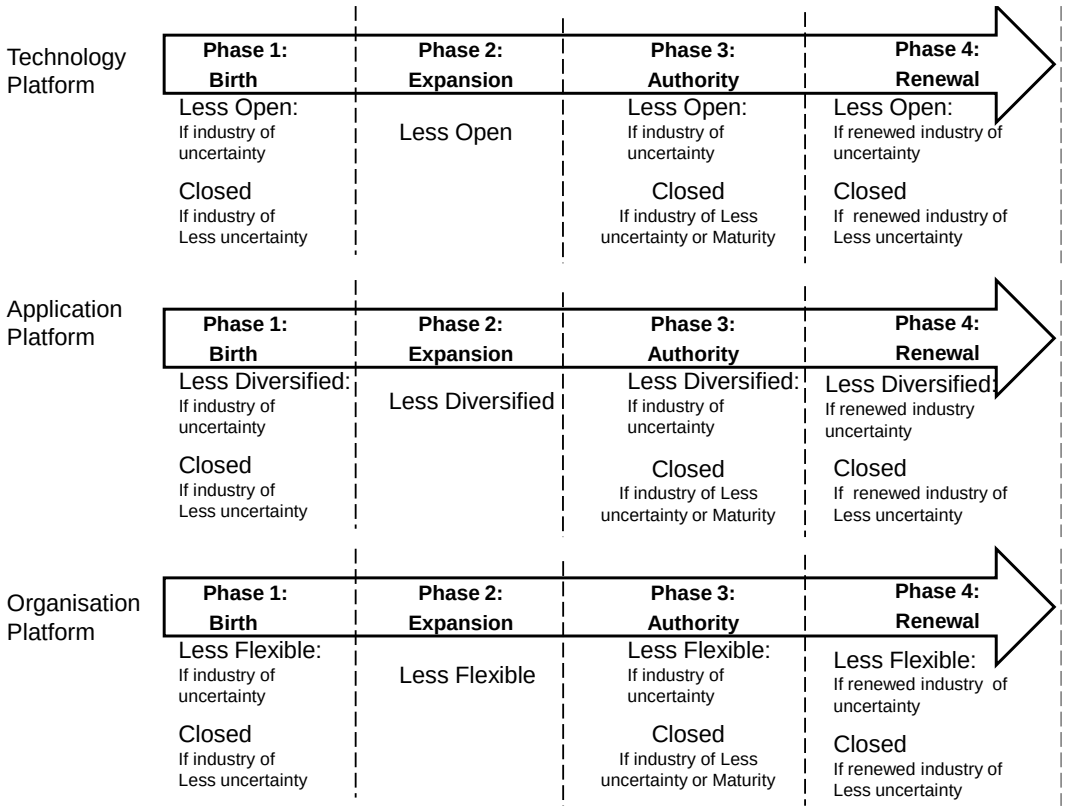
5 Discussion and Findings

5.1 Platform strategy along the lifecycle

The platform strategy along the BELC can be determined from Figure 2. Two principles have been selected. Firstly, we adopt the platform strategy from successful projects; secondly, we adopt platform strategies used at higher frequencies. Figure 3 is the key result of this paper, and summarizes the integration of three levels of platform strategies along the BELC. In the following sections, a description of the detailed process further explains the platform strategies along the BELC.

In general, the key platform strategies, as shown in Figure 3, are varied in terms of two industry status levels – uncertainty and less uncertainty. Firstly, if the industry is very uncertain, firms prefer to encourage partners to contribute to the platform. As a result, instead of a close strategy, firms implement the less open (less diversified, less flexible) strategy through the four phases. Secondly, if the industry is at a level of less uncertainty, firms are willing to improve industry productivity and achieve quick response. Hence, firms implement closed, less open (or less diversified, less flexible), closed and closed strategies along the sequential four phases respectively. Finally, as shown in Figure 3, firms implement the same platform strategy at all technology, application or organisation levels.

Figure 3 Platform strategy along the business ecosystem lifecycle



5.2 Three dimensions of the platform strategy

Technology is regarded as the key offer from the main cases. MTK's single-chip solution is totally closed to partners in the VCD market, while ARM's leader partner strategy only allows leader partners to co-design their IPs. Furthermore, Intel adopts the Linux community as the core of the Moblin ecosystem. Linux is totally open to everyone. As a result, closed (1), less open (2), and open (3) could be three degrees of openness to clarify the technology platform as self-design, few firms' co-design and everyone's design.

Application is developed through collaboration between the main case firms' technology platform and their partners' contribution. For example, ARM's first project proposed a very closed mobile phone product, while the leader partner strategy resulted in a less open application. Only the application based on an open source framework, like Linux, could be totally diversified. Therefore, the application platform could be divided into three degrees: closed (1), less diversified (2) and diversified (3), corresponding to applications that are self-designed, designed by a few firms, and designed by everyone.

Organisation is described as how firms interact around the technology and application platforms. In the first mobile phone project, the partners were selected by the mobile OEM player and the organisation was closed. Regarding the Moblin ecosystem, firms were encouraged to contribute their parts to the Atom platform. The network organisation seemed to be not closed, but less flexible. In the open-source community, organisations are free to enter or quit very flexibly. Therefore, closed (1), less flexible (2) and flexible (3) could be used to categorize the degree of flexibility of an organisation platform, which echo with the networks controlled by a single firm, very few firms and many firms – without dominators. As a result, Figure 4 demonstrates the typical pattern of each platform strategy based on the raw data of Figure 2, which will be further discussed in the following section.

Figure 4 Summary of the platform strategy

		Technology				Application				Organisation			
		P1	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4
ARM	1a	1	2	2	2	2	2	2	2	2	2	2	2
	1b	2	2	2		2	2	2		2	2	2	
	1c		2	2			2	2			2	2	
	conclusion	1,2	2	2	2	2	2	2	2	2	2	2	2
Intel	2a	1	2	1	2	1	2	1	2	2	2	1	2
	2b	1	2	1		1	2	1		2	2	1	
	2c	1	2	2		1	2	2		2	2	2	
	conclusion	1	2	1,2	2	1	2	1,2	2	2	2	1,2	2
MTK	3a			1	1			1	1			1	1
	3b			1				1				1	
	3c	1	2			1	2			2	2		
	conclusion	1	2	1	1	1	2	1	1	2	2	1	1

5.3 Three types of platform strategy

1) Open platform strategy Open platform strategy is used to co-evolve with partners and seek significant support from them. Normally, it is used in the early stage of nurturing a business ecosystem. ARM prefers to use open strategy, as their target market is not that mature or is still at an early stage. The key platform strategy for their ecosystem nurturing process is very open and encourages partners' contributions. By learning from the first mobile phone project, they began to open their IP architecture. Thus, the leader partners strategy is the key way by which to involve leading players and their ecosystem partners to develop applications based on ARM's IPs. In order to scale up volume, they are very open to supporting different application platforms, even at the Authority phase of their BELC.

More specifically, open platform strategy features the following characteristics: 1) Technology is co-developed with partners, and their supporting tools are open to third-party partners. The application remains diversified when the industry is at a high level of maturity, and the organisation network is always flexible for latecomers. 2) Normally, firms use this strategy when the industry is not that mature, for instance when firms are in the Birth and Expansion phases.

2) Dominating platform strategy

Dominating platform strategy aims to control the ecosystem development direction and scale up the product volumes as well. Intel used this strategy to win market advantage in the PC industry. Firstly, they proposed chip solutions and supported many OEM application platforms. Secondly, they finalized product design by introducing industry standards. However, they failed at the Xscale project due to a lack of openness and external support. Learning from the unsuccessful Xscale project, Intel began to open their door and stimulate the partners' innovation and contributions. Thus, they tried to trigger innovation of the software side to support the core technology of Atom. However, they never opened the core technology of Atom chips.

Some key characteristics have been identified in the dominating platform strategy: 1) at technology level, case firms always make their platform closed to partners. However, they open the supplementary part of their core technology and encourage partners' participation. In terms of application development, firms initiate new devices with partners but always lead a closed partner alliance. As a result, the organisation platform is not very flexible. 2) This strategy is used to dominate the market when the lifecycle reaches the Authority phase and product design is finalized. 3) However, if the industry is not very mature, at the Authority phase a firm might adopt an open platform strategy, as Intel did.

3) Opportunistic platform strategy

Opportunistic platform strategy aims to find the right substitute to renew the business ecosystem. MTK adopts the opportunistic platform strategy. They penetrate the new market by considering three factors: 1) the market has a big volume; 2) they succeed in 70% of their original technology and design the other 30% for the new product development; 3) the overall industry has reached a mature stage. VCD was MTK's first try with their one-chip solution. They continued their success in the DVD and mobile markets. In summary, they are looking for that kind of opportunity with these three factors. However, in order to enlarge the scope of their products, they also began to adopt the local partners' feedback and embed it into their single-chip solution.

Some key characteristics of the opportunistic platform strategies are highlighted: 1) At the technology level, substitute products are provided in order to penetrate the existing market, and the same strategy is also followed at the application level. In order to scale up their volume, firms begin to support networking partners and demonstrate a different extent of openness. 2) Normally, firms use this strategy when the business ecosystem has reached the Renewal phase.

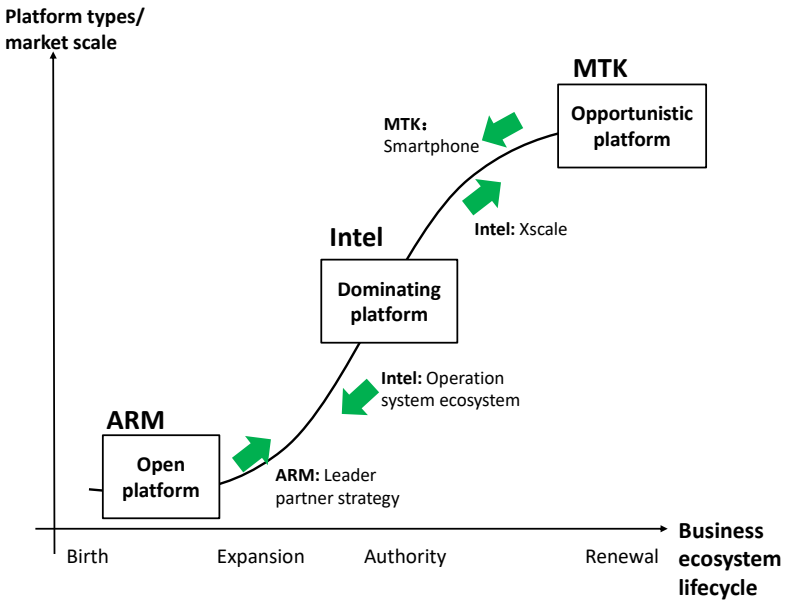
5.4 Synthesized platform strategy

Following the analysis, ARM's platform strategy fits the phases of Birth and Expansion, Intel's strategy is suitable for the Authority phase, and MTK's strategy can be adapted to the Renewal phase, as shown in Figure 5. The general platform strategy should be delivered by synthesizing each case's typical strategy of nurturing the business ecosystem.

At the Birth and Expansion phases, markets experience a high degree of uncertainty. Product designs also vary. As a small firm, ARM not only quickly set up a supply chain to commercialize its technology platform, but also triggered innovation activities around its platforms so as to adapt to the dynamic business environment. This strategy enabled more partners to join in and contribute to the industries emerging around its platforms. Also, ecosystem partners organised themselves and sustained this kind of interaction.

At the Authority phase, the degree of uncertainty is reduced while the product design is sharpened. Firms begin to formulate small alliances and enhance their bargaining power in order to control the direction of the industry's development. Intel dominated the PC industry using a similar strategy. After entering the mobile computing industry, despite the openness on the software side, they never opened their core technology platform. Hence, once the industry has already reached the Authority phase, their strategy will generate a great effect.

Figure 5 Platform strategies along the business ecosystem lifecycle



At the Renewal phase, the ecosystem has reached a stable status. At this moment, brand-new ideas or solutions are to be introduced to bring significant changes to the existing industry or even renew it. MTK's single-chip solution had the potential to turn the mobile phone from a luxury device into an affordable one. In addition, the manufacturing network could be changed from a traditional closed alliance of big firms into a network with thousands of small firms. As a result, at this stage, MTK's niche idea, like an opportunist strategy, would better trigger the transformation of the mature industry.

However, although the three cases had their own clear platforms, they also alter their platform strategies according to the changing industry environment, as indicated by the arrows in Figure 5. On the one hand, firms started to open their platform strategies in order to penetrate the mobile computing industry. Intel began to support open source projects, while MTK embedded local partners' feedback into its mobile single-chip solution in the Smartphone market. On the other hand, firms also began to integrate their platform to dominate the mobile computing industry. Intel began to integrate their chipset into a one-chip solution aimed at cutting down chip power consumption and cost. ARM's leader partners also integrated their own platforms and selected the partners to work with.

6 Conclusion

6.1 Theoretical contribution

The research results contribute to the theory of business ecosystems in relation to platform strategy. In detail, this paper provides a matrix framework to describe platform strategy with

reference to three dimensions (technology, application and organisation) along the BELC, which enriches the meaning of the product platform (Wortmann and Alblas, 2009) by combining technology, application and organisation. Further, this paper links the expanded platform to the whole business community lifecycle, instead of only focusing on the product platform lifecycle.

In addition, three typical platform strategy patterns are identified in this research: open platform strategy to increase product design and sustain the process; dominating platform strategy to control the industry development and scale up volume; and opportunistic platform strategy to use the niche idea to renew a business ecosystem.

The synthesized platform strategy along the BELC has been delivered by integrating different platform strategies. The open platform strategy is suitable for the Birth and Expansion phases of the BELC, while the dominating and opportunistic platform strategies work at the Authority and Renewal phases. In all, the results contribute to the fields of business ecosystems and technology innovation.

6.2 Practical contribution

This paper provides a 'best-practice' roadmap along the BELC to practitioners, especially for those industries in a dynamic business environment. The detailed description is based on three dimensions – technology, application and organisation platform – in relation to 1) starting a business ecosystem with an open strategy, 2) scaling up and finalizing the business ecosystem with a dominating strategy, and 3) finally renewing the business ecosystem with an opportunistic strategy.

In addition, the platform strategy is always changing. In response to the different status of the business environments, companies will adjust and develop their specific platform strategies along the BELC. The research results could also help practitioners to nurture their business ecosystems by adjusting their platform strategies in a triple view involving technology, application and organisation along the BELC.

6.3 Limitations and future direction

As the case scope included three main cases consisting of nine sub-cases, further study of other cases in the same industry is required so as to further verify the patterns of platform strategy along the BELC. Furthermore, this research focused only on the mobile computing industry; more industries should be tested in order to further generalize the findings. In addition, tools should be developed for platform strategies for practical use.

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Appendix Table Interviewee list

	Business Ecosystem		
Leading Firm	ARM	Intel	MTK
Location	UK, China, USA	UK, China, USA	UK, China
Interview Participants	ARM (9*) – IP provider** Synopsys (1) – EDA ST (3) – IC design Hisilicon (1) – IC design Spreadtrum (1) – IC design Datang (1) – IC design Symbian (2) – OSV Montavista (1) – OSV Google (2) – OSV Microsoft (1) – OSV Tecent (2) – ISV eBay (1) – Service provider TSMC (3) – Foundry provider Huahong-NEC (2) – Foundry provider Wistron (3) – ODM Samsung (2) – OEM ZTE (2) – OEM Aigo (1) – OEM Aiside (1) – Agency	Intel (6) – IDM Marvell (1) – IC design Montavista (1) – OSV Tecent (2) – ISV TSMC (3) – Foundry provider Wistron (3) – ODM Compal (3) – ODM Asus (1) – OEM Aigo (1) – OEM Lenovo (2) – OEM	MTK (3) – IC design VIA (1) – Processor provider Sanmu (1) – Independent design house Tecent (2) – ISV vendor Tanqi (1) – OEM Coolpad (1) – OEM Zhang's (1) – OEM NEO (1) – Industrial and mechanism design firm Caixin Plastic (1) – Casing provider Global & Source (1) – Media Triones (1) – Media Shenzhen government (1) – Regulatory Authority
	18 organisations, 39 interviewees, 87 hours	10 organisations, 23 interviewees, 60 hours	12 organisations, 15 interviewees, 61 hours
Total	40 organisations, 77 interviewees, 208 hours		

Note: *number of interviewees, ** firm type, OEM- original equipment manufacturer, OSV- operating system vendor, ISV- independent system vendor, ODM- original design manufacturer, IC- integrated circuit, IP- intellectual property, EDA- electronic design assistant, IDM- integrated device manufacturer