Practices of Innovation in Mobile Computing Alliances

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Abstract and Key Results

- Global technology alliances (GTAs) and innovation capabilities are the two main themes in this chapter. Drawing on innovation concepts and the resource-based view, this chapter explains how firms gain access to complementary resources, dispersed in the international realm, and incorporate these within their organizations through GTAs.

Key Words

Global technology alliances; capabilities; innovation; strategic alliances; resource externalization; resource internalization

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Practices of innovation in mobile computing alliances

Yong Kyu Lew and Rudolf R. Sinkovics

Introduction

Global technology alliances (GTAs) and innovation capabilities are the two main themes in this chapter. Drawing on innovation concepts and the resource-based view, this chapter explains how firms gain access to complementary resources, dispersed in the international realm, and incorporate these within their organizations through GTAs. This emergent form of international resource-seeking and network collaboration across borders can be seen as a new phenomenon in international business (IB) (Kogut and Zander 1992; Rugman and D'Cruz 2000; Yamin 2011). Innovation capabilities can be attained by combining a firm's technology resources with those of overseas alliance partners and thus progress towards enhancement of competitive advantage. From a theoretical aspect, we combine the resource-based view with innovation concepts and comprehensively examine the dynamics of resources and innovation at both a firm and a network level.

Foreignness provides firms with innovation-creating opportunities in terms of a wider range of resource availability and accessibility (Glaister and Buckley 1996; Kafouros et al. 2008; Kotabe, Srinivasan, and Aulakh 2002). However, due to bounded rationality and heterogeneity, firms cannot keep their entire set of resources in-house and at the same time capture all of the market opportunities available in global high-velocity environments (Johanson and Vahlne 2009; Ohmae 1989). From technology and market development perspectives, GTAs permit firms to explore and exploit technological partnership opportunities in order to develop and sustain their competitive advantage (Eisenhardt and Schoonhoven 1996; Podolny 1994). Thus, firms utilize resources from external actors to

increase their technological capabilities, thereby achieving product innovation and market competence (Danneels 2002; Hagedoorn 1993; Hill and Rothaermel 2003; Narula and Hagedoorn 1999; Osborn and Baughn 1990; Song et al. 2005; Stuart 2000).

There is a growing interest in the business activities of high-tech firms in upstream value chains; yet, little international business (IB) research has looked at GTAs and innovation. Despite the fact that a large amount of value is generated through the research and development (R&D) activities of firms in the upstream value chain (Hamel and Prahalad 1991; Mudambi 2007), the majority of global strategic alliance studies to date have focused on downstream segments of the value chain (e.g. manufacturer-distributor relationships). Empirical GTA studies in the IB literature mostly focus on a macro-level unit of analysis, based on secondary data sources, thus failing to explain the firm-level innovation capabilities attributable to GTAs in specific industry contexts. This leads to the following questions: Are GTAs critical to the innovation capabilities of firms in high-tech industries? If so, how do firms create idiosyncratic innovation through GTAs? Accordingly, the aim of this chapter is to explain the innovation capabilities that can be gained through GTAs. It also aims to explore the validity of the conceptual arguments, by illustrating the use of GTAs in a specific high-tech market, from the perspective of a focal firm.

The remainder of the chapter is structured as follows. In the next section, we examine GTAs and resource complementarity in high-tech industries. After this, innovation landscapes and the resource-based view are reviewed from a theoretical perspective. Integrating these elements conceptually, we discuss innovation capabilities from the aspects of new product development and market development. The subsequent sections illustrate a software firm's innovation through GTAs in the mobile computing market, and the final section provides conclusions to the chapter.

GTAs in high-tech industries

The rationale for GTAs in high-tech industries

As a firm cannot internalize all of the resources available in the market, technology alliances are a good strategic option for firms seeking specific technology resources. GTAs allow a firm to access required resources which do not exist in its own local market, thus enabling it to bring the acquired complementary external resources within its own boundaries (Doz 1988; Kotabe and Swan 1995; Mathews 2006). By forging non-equity based organizational arrangements, a firm can efficiently anchor its technological position in global high-tech markets (Cantwell and Narula 2001; Osborn and Baughn 1990). For this reason, there are a growing number of GTAs worldwide in high-tech industries (Hagedoorn and Narula 1996; Narula and Hagedoorn 1999). GTAs encompass governance structures, such as joint R&D agreements, R&D contracts, co-production or co-development contracts, technology licensing, and technology sharing (Narula and Hagedoorn 1999); generally, market-related alliances which are accompanied by GTAs can also be included in this list (Oxley and Sampson 2004; Swaminathan and Moorman 2009). In this respect, GTAs are not only oriented towards technology development (e.g. technology complementarities, a reduction in the innovation time span), but also market access, market expansion, and influencing market structures (Glaister and Buckley 1996; Hagedoorn 1993; Jaworski, Kohli, and Sahay 2000; Varadarajan and Cunningham 1995).

One result of internal and external R&D investment in high-tech industries is that a firm's absorptive capacity, upon which its resource allocation for innovation rests, is increased (Cohen and Levinthal 1990; Dyer and Singh 1998; Miozzo and Grimshaw 2005; Rothaermel and Deeds 2006). There is a propensity for firms in technology-intensive industries (e.g. software, computers, semiconductors, and pharmaceuticals) to spend more R&D expenditure on sales (Cantwell and Fai 1999; Kafouros et al. 2008; Kotabe, Srinivasan,

and Aulakh 2002; Osborn and Baughn 1990). As technology investment can be taken as a proxy for innovation (Ahuja and Katila 2001; Teece 1996), valuable technology resource acquisitions, through external linkages, guarantee a firm's innovation. Therefore, taking into account the notion that innovation equates to technological invention and market competence, it can be seen that GTAs contribute to a firm's innovation capability which gives it a competitive advantage (Chesbrough 2003; Cooper 2001; Danneels 2002; Teece 1996).

GTAs and resource complementarity

Firms ought to identify their core technologies and strategically obtain new external technology resources in order to gain a competitive advantage in high-velocity industry environments (Porter 2004; Prahalad and Hamel 1990). As GTAs deal with complex relationships between different legal entities, partnering firms should identify how much resource complementarity exists prior to entering GTAs and then develop resource exchange governance mechanisms in the GTA structures (Gulati and Singh 1998; McCutchen, Swamidass, and Teng 2008). Proper governance of the exchange of technology resources in GTAs is critical to generating mutually beneficial outcomes (Hoetker and Mellewigt 2009). Owing to knowledge tacitness (Inkpen 2000; Kogut and Zander 1993), the more high-tech and knowledge-intensive the industry, the more complex the technology knowledge transfers between the partnering firms are. A firm can benefit from valuable external resources that can help it to overcome technological difficulties and the risks involved in complex product development in high-tech industries (Mitchell and Singh 1996). Thus, whether potential partners are capable of complementing their own technological innovation is critically important (Shapiro and Varian 1999).

A firm, as a repository of knowledge, has unique technological capabilities which differentiate it from other firms (Kogut and Zander 1992). The firm can create technological opportunities and successfully implement new technologies when it appropriately adapts

technology resources to environments (Leonard-Barton 1988). As such, resource complementarity between partnering firms leads to technology dependence on partners in that the focal firm makes an effort to appropriate complementary resources from its partners in order to attain competitive heterogeneity (Lambe, Spekman, and Hunt 2002; Richey, Daugherty, and Roath 2007). Thus, the presence of complementary resources is an important criterion for selecting partners, and technology alliances provide partnering firms with the resources they need to create value (Harrison et al. 2001; Hitt et al. 2000). From a focal firm's perspective on GTAs, how to obtain complementary resources from external actors and achieve innovation is of crucial importance. To elaborate on this, the following sections discuss the theoretical foundations of this chapter, integrating the resource-based view with innovation concepts.

Innovation and resource-based view

Innovation landscapes

There is a large volume of innovation literature, ranging from sociology and economics to management. This chapter limits the scope of the discussion to product innovation perspectives, whilst taking into account resource acquisition through GTAs (Eisenhardt and Martin 2000; Powell, Koput, and Smith-Doerr 1996; Srinivasan, Lilien, and Rangaswamy 2002). Teece (1996) defines innovation as a quest into the unknown that includes examining and exploring technological and market opportunities. Similarly, Chesbrough (2003) distinguishes innovation from invention, stating that innovation has market-orientation. By processing the development and application of new ideas, a firm is able to create a new product, process, or business model (Galbraith 1982). As such, product innovation is one of the key dimensions of innovation, as technology resources encourage firms to innovate new products (Cooper 2001; Goffin and Mitchell 2005). Exploration and

exploitation, in relation to radical and incremental innovation, are frequently recurring topics in the literature (see e.g. Eisenhardt and Martin 2000; Hill and Rothaermel 2003; McGrath 2001; Rothaermel and Deeds 2004; Zahra, Ireland, and Hitt 2000). This group of studies refers to March's work (1991, 71):

“Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution.”

Recent product innovation studies show that a firm's innovation capability is related to its level of radical or incremental innovation attributes (see e.g. Atuahene-Gima 2005; Atuahene-Gima and Murray 2007; Yalcinkaya, Calantone, and Griffith 2007). This being the case, how can firms in high-tech industries successfully acquire and coordinate technology resources for product invention and then successfully commercialize these combined resources? Technology management and innovation scholars seek an answer in the concept of open innovation (see e.g. Chesbrough 2003, 2007; Dahlander and Gann 2010; Laursen and Salter 2006; Lichtenthaler 2008).

The idea of open innovation is that a firm's innovation activities can go beyond its internal R&D boundary in pursuit of open inbound (e.g. acquiring or sourcing resources) and outbound innovation (e.g. selling or revealing resources) (Chesbrough 2003; Dahlander and Gann 2010; Lichtenthaler 2005). In other words, the use of internal and external technology resources and paths to the market help a firm to develop new ideas and accomplish innovation. Taking open strategic initiatives, a firm can create and capture new value from the contributions of outside institutions, such as communities, partners, volunteers, and its own business ecosystem, thereby achieving innovation quickly and economically (Broughton 2010; Chesbrough 2007; Chesbrough and Appleyard 2007). The concept of open innovation

fits well with recent new business phenomena in high-tech industries, such as open-source software and community-based web businesses. In this respect, GTAs allow greater access to complementary resources, thus offering appropriated relational rent and inbound spillover rent (Lavie 2006).

Resource-based view

According to the resource-based view, a firm's valuable, inimitable, rare, and non-substitutable (VIRN) resources contribute to its competitive advantage (Barney 1991; Dyer and Singh 1998; Oliver 1997). From a focal firm's perspective on GTAs, the resource-based view complements the concept of innovation, in that it fundamentally assumes resource ownership and the heterogeneity of the firm. A commonality in the resource based view literature is that salient resources enable a firm to sustain a competitive advantage through its intentional firm-specific investments and use of resources (Barney 1991; Barney and Clark 2007; Cockburn, Henderson, and Stern 2000; Ethiraj et al. 2005). Accordingly, a firm attains competitive heterogeneity by exchanging complementary technology knowledge with external firms (Cantwell and Narula 2001; Choi and Lee 1997). Resources acquired through exchange relationships, that is, GTAs, ought to inwardly contribute to a firm's capability to gain successful relationship outcomes and create a competitive advantage (Hitt et al. 2000; Oliver 1997; Powell, Koput, and Smith-Doerr 1996; Rothaermel and Deeds 2006). As such, explicit and tacit technological knowledge is embedded in resource exchange relationships (Grant and Baden-Fuller 2004; Kogut and Zander 1996; Nonaka and Takeuchi 1995). Tacit knowledge exists in firms in the form of rare and imperfectly-imitable resources embedded in the organizational routines (Makhija 2003; Verbeke 2003). In this regard, a firm seeks to obtain requisite complementary resources by forming relationships with external firms (Hitt et al. 2000; Lorange and Roos 1993). From the resource-based view, it is critical for a firm to identify the resources it needs in order to build up its innovation capabilities. Thus, the

resource-based view can be effective in explaining GTAs as it regards a firm as a bundle of resources, made up of both skills and knowledge (Eisenhardt and Schoonhoven 1996; Madhok 2002).

Integrating the resource-based view with the concept of innovation

Following the innovation concept of technological invention leading to market commercialization, a two-by-two matrix has been developed and is presented in Table 1. The matrix shows that the resource-based view can be encapsulated using innovation concepts. The horizontal line shows two different sources of technology resources that can be used for technology development: internal and external; the vertical axis represents levels of value-capturing actors involved in the commercialization of technological developments, given the two groups of resources. The resource-based view explains cells A and B at the bottom of the matrix, as the view looks upon a firm as the owner of VIRN resources which give it heterogeneity and a competitive advantage. These cells allow for technology development through the use of internal and external resources and also for their value-capturing commercialization by an economic actor at the firm level. By following this logic, firstly, firms in cell A (closed innovation) create and capture innovation, based on internal R&D; in the Chandlerian innovation system, the traditional hierarchy (a firm) would be an example (Hedlund and Rolander 1990; Kristensen 2010; Williamson 1971; 1979).

Secondly, external resources contribute to a firm's technology development and commercial success through resource exchange governance mechanisms between economic actors (Gulati and Singh 1998; Sinkovics et al. 2011). With respect to this, an organizational form of quasi-hierarchy or quasi-market (e.g. a joint venture, or non-equity based technology alliance) exemplifies cell B, inbound innovation. Thus, the bottom cells (A and B) illustrate resource internalization at the firm level.

By employing the open innovation concept, the level at which value is gained can be further extended from the firm to the network (Chesbrough 2007; Henkel 2006; Johanson and Mattsson 1987). Herein, network is taken to mean a group of value-capturing economic actors outside a resource-contributing firm; for instance, a network could be a focal firm's partners or ecosystem, an unspecified constellation of firms, or a community.

Cell C is termed 'inside-out innovation' not only to highlight resource externalization, but also to distinguish the term from pecuniary outbound innovation in the literature (e.g. selling internal resources, or outsourcing). Good examples of inside-out innovation, are OpenJDK (free Java software), developed by Sun Microsystems, and Google's Android operating system. OpenJDK is freely available as a part of Linux operating systems, such as Debian and Ubuntu. Even multi-national enterprises (e.g. Motorola, Samsung, LG, Motorola, Huawei, and HTC) have recently begun to adopt Google's free Android platform as their operating system, thereby producing commercially successful Smartphones. These firms have saved on resource-acquisition costs as well as internal technology development time by using free OpenSource software (Stallman 1999). Google on the other hand, as a resource contributor, gains value by directing the numerous customers of such devices, through the Android platform, to its internet site.

Finally, cell D is termed 'open network innovation' because networks of actors can benefit from the technology developments contributed by networks of actors (e.g. volunteer communities or a business ecosystem). The well-known case of the Linux open source kernel, initiated and released by open communities, belongs to cell D. Interestingly, resource contributors to cell C, such as Sun Microsystems and Google, are also beneficiaries of open network innovation, as they use open resources in their products. Thus, the upper cells (C and D) indicate that value can be created through externalizing resources, capturing and commercializing them at the network level. This implies that high-tech firms adopt their

innovation strategies selectively with regard to the level of openness they apply to innovation process. As this chapter deals with firm-level GTAs and innovation capabilities, we highlight phenomena that illustrate cell B in the case study sections.

Table 1: Integrative innovation matrix from resource and openness perspectives

Commercialization		
<i>Network level</i>	C. Inside-out innovation (e.g. Open platform – Google Android operating system)	<i>Resource externalization</i>
	D. Open network innovation (e.g. Open community – Linux open source software)	
<i>Firm level</i>	A. Closed innovation (e.g. Internal R&D –hierarchy in Chandlerian innovation system)	<i>Resource internalization</i>
	B. Inbound innovation (e.g. Quasi-hierarchies – strategic technology alliances)	
<i>Firm's internal resources</i>		<i>Resources external to the firm</i>
Source of technology development		

GTAs and product innovation

In the resource-based view, a firm can infuse new technology resources accessed through GTAs into its organizational structure through internal bonding mechanisms, in order to generate capabilities (Amit and Schoemaker 1993). Product innovation and strategic alliances are entwined with firms' capabilities in high-tech industries, in that external linkages such as GTAs feed situation-specific new knowledge into the firm's technological innovation (Eisenhardt and Martin 2000; Teece 1996). Thus, the more innovation-oriented firm is likely to cooperate with external actors regarding technology (Chesbrough 2003; Eisenhardt and Schoonhoven 1996). Reflecting cell B in Figure 1, a firm's technological capability is determined by how it leverages internally-existing and externally-fuelled resources (Chesbrough 2003; Luo 2000; Metcalfe and Boden 1992; Teece, Pisano, and Shuen 1997). A corollary of its improved technological capability is the ability to improve and refine existing products and/or explore unique new product developments (Atuahene-Gima 2005; Grant and Baden-Fuller 2004; March 1991). Nevertheless, technologically advanced

and innovative products will be unable to permeate the market unless the firm is capable of commercializing its ideas and technologies (Chesbrough 2004; Day 1994; Gittelman and Kogut 2003; Lichtenthaler 2008). When it comes to product innovation, therefore, the firm must have market development capabilities to complement its new product development capabilities.

An illustration: a software company's GTAs and innovation capability

Based on the theoretical discussions above, the following sections explore how firms exchange complementary technology resources through GTAs and use these to augment their innovation capabilities, in the context of the mobile computing market. Based on interviews with senior managers and secondary sources of information, we will illustrate a GTA between a personal computer (PC) software firm in South Korea and its global hardware and software technology partners. Ranked second in the local software industry, the focal firm used to develop PC software applications and server operating systems in the local market. This single case study will show how the focal firm gains access to overseas complementary resources through GTAs, internalize the resources, develop technologically new products, and commercialize them in the new mobile computing market.

GTAs in the mobile computing market

Wireless technologies (e.g. 3G, Wi-Fi, Bluetooth) have triggered the formation and expansion of the mobile computing market (ABI Research 2008; Ansari and Garud 2009). Market growth has recently accelerated, due to advancements in central processing unit (CPU) technologies (e.g. low battery power consumption, high CPU performance) (ARM 2009; Intel 2009). The upstream value chain of the market consists of software and hardware firms, numerous component suppliers, and device manufacturers. Cross-industry cooperation between IT firms has contributed to some highly innovative and rapid product development

(e.g. high-end smartphones, portable netbooks, and touchbooks). The latest products support mobile communication functionality, a high level of computing power, and internet-supported multimedia data streaming (ARM 2009; Intel 2009; Sharon and Eric 2009). Third-party applications are also embraced. There are growing numbers of GTAs between software (e.g. operating systems, application platforms, and application software) and hardware (e.g. chip design, microcontrollers, system-on-chips, and graphics/video) firms at the end of the upstream value chain, an example of which is shown in Figure 1 (Waters 2011). A firm's strategic decisions as to how it cooperates with other firms determine its success or failure in turbulent markets (Kale, Singh, and Perlumutter 2000; Shapiro and Varian 1999). External linkages allow firms in the upstream value chain to secure complementary technology resources and develop innovative products (Harrison et al. 2001; Jaworski, Kohli, and Sahay 2000; Kotabe and Swan 1995; Teece 1996). As such, technology alliances are an indispensable part of the strategies of software and hardware firms in the mobile computing market. It is unlikely, and certainly not current practice that IT firms would internalize all the technology resources available. As such, a brief case study in the following section illustrates how a software firm based in South Korea has generated innovation capabilities through its GTAs with heterogeneous foreign firms. For readers' better understanding of the context of this case, Figure 1 shows the geographical locations and value chain positions of the case firms; it also shows a simple architecture of the mobile computing device, split logically into their components. Firm 'A' is the focal firm and 'B', 'C', and 'D' are its GTA partners in the case study.

Figure 1: Firms in the case study - product architecture and value chain

* *A focal firm in the case study*

** *ODM (Original Design Manufacturer), OEM (Original Equipment Manufacturer), OBM (Original Brand Manufacturer)*

Building a relationship through a GTA

Originally, most of firm 'A' revenues were generated by PC package software distribution and licensing to companies, the government, and educational institutions. As the PC software market matured and became saturated, the focal firm 'A' invested in mobile software technology development and explored the market opportunities but was commercially unsuccessful until entering into a GTA with a hardware firm in the US. Firm 'C' is a leading fabless semiconductor and telecommunication technology developer specializing in the design and sale of hardware devices and semiconductor chips while outsourcing the fabrication or 'fab' of the devices to a specialized manufacturer called a semiconductor foundry. Both firms 'A' and 'C' required resources from each other in order to develop new products and penetrate the growing mobile computing device market, worldwide. After a negotiation stage, contracts were drawn up and signed, laying down co-development and co-marketing agreements; the scope covered worldwide territories. The vice president of product management in firm 'C' commented on this way of forming and managing strategic partnerships:

“We see ourselves as system architect.... we identify the building blocks of the architecture. Then we identify partners that we want to work with on a building block. By building blocks and then we exchange appropriate information with these partners. We constantly re-define new technologies and new products and bring them successfully to market and they need commit the requirements of customers of the industries all the time, which means all the time we have to assess what are the partners really to work with; and what are the projects that we build with those partners.”

Firm ‘C’ required key software applications (e.g. communication, productivity, multimedia, entertainment) to develop feasible hardware architecture in order to commercialize its hardware product, chipsets. The director of product management in the software firm ‘A’ reflected on the GTA as follows:

“At that time, my company didn’t monetize our technologies on the mobile platform (by partnering with ‘C’), our company management turned to pay attention to this area and allocated more engineering resources... our partner had been prepared for GHz CPU powered chipset for a long time and software partners was very important for them because they needed to show directly working software applications on their new high performance CPU to the market. They wanted to make a partnership with us to effectively develop software stacks on the top of their hardware platform.”

The new mobile software product development environment was different from that of PC hardware, in which software firm ‘A’ was used to working. Also, it was unable to obtain this new type of technology resources from its previous hardware partner in the local market. Thus, the GTA with hardware firm ‘C’ allowed it to complement its own software technology resources with the new hardware resource, and integrate this new resource into its existing operations in order to develop new mobile software products. The vice president of the hardware firm pinpointed partnerships as one of the most critical factors behind successful new product developments:

“First, a very good understanding of the status of the industry. Second, it is a very creative and innovative workforce with attitude toward driving new technologies, new products and new ideas that meet the needs of customers. And, third, an ability to build the relationships within the new industries in order to build a market. Without partnerships, we cannot build the market.”

Through the GTA, firm ‘A’ was provided with the proprietary hardware platform resources and knowledge it needed for its software development, by hardware firm ‘C’. The Chief Technology Officer of firm ‘A’ made the following comment about the resource exchange governance in the GTA:

“At the beginning, we shared development tasks through sorts of workshops and reviewed problems and tasks and discussed development milestones. They (firm ‘C’) continuously provided us with testable environments and engineering units. So, we easily managed project tasks.”

Complementary resources for new product development

Firm ‘A’ confronted technological difficulties in integrating its software prototype with the hardware platform from firm ‘C’ during the new product development stage. In order to resolve this, firm ‘A’ needed technology resources in the form of low-level (kernel) system knowledge and the optimization of software with hardware. Thus, it entered into additional GTAs with firms ‘B’ and ‘D’ to tackle the technological problems it was encountering in its new product development with firm ‘C’; ‘B’ is an operating system development firm in China and ‘D’ a chipset design firm in the UK. Since both firms already had close relationships with firm ‘C’, the focal software firm was able to extend its technology development relationships to include them quite smoothly. The director of firm ‘A’ discussed the difficulties of new product development, as shown below:

“Developing a new product is not a simple technical task. Many issues are interlinked so that the important point is to know what a problem is and how to solve the problem... There were problems originated from the code optimization of the

hardware system and there were problems with hardware-runtime from operating system issues. During the product development process, we identified further development tasks and issues to resolve. Although the project was initiated by the chipset company (firm 'C') and software application provider (firm 'A'), other cooperative firms were also involved in the product and we resolved problems together. Without the other partners, we couldn't reach the project goals."

By sharing technology knowledge about kernel-level operating systems with firm 'B', firm 'A' was able to optimize its development of mobile application software using firm 'B's different types of kernel-level systems, including Android, on top of firm 'C's hardware architecture (see Figure 1). Subsequently, firm 'A' forged a partnership with firm 'D' by joining that firm's global software ecosystem, after being introduced by its initial hardware partner, 'C'. Firm 'D' was the original intellectual property (IP) designer of the core technologies used in the chipset of firm 'C'. The GTA with firm 'D' provided firm 'A' with greater access to mobile hardware and software technologies (e.g. application platforms, power-saving, audio and graphic technologies). The GTA also enabled the focal firm to gain a better understanding of the whole technology architecture and dynamic market trends. Table 2 summarizes the series of GTAs from the aspect of the focal software firm.

Table 2: Summary of GTAs between the focal firm and its network

Perspectives	GTA partner 'C' (Fabless semiconductor)	GTA partner 'B' (Operating system developer)	GTA partner 'D' (Chipset IP designer)
Key business	- Licensing system-on-chips to OxM* customers	- Engineering service and license solutions to OxM	- Licensing designed blueprints to semiconductor/ OxM
Sequence, relationships			
Motivation from partners' aspects	- Develop new product - Build a feasible product architecture	- Develop a software solution - Build new business model	- Build mobile software ecosystem - Expand its architecture base
Benefit to firm 'A'			
<i>Resource</i>	- Hardware development resources and technical support	- Different types of optimized operating systems	- Prototype development platform
<i>New product development capability</i>	- Knowledge about mobile development environments - Hardware integration skills	- Operating system integration skills - Kernel-level knowledge	- Identify technology development roadmap - Hardware knowledge
<i>Market development capability</i>	- Market sensing - International marketing - New market development	- Customer development - Understand Chinese market	- Industry-wide market trend and dynamics - Customer creating and linking opportunities
<i>Performance</i>	- Increased product launch - Create new business models both B2B and B2C - Relational rent (access to network resources of firm 'B' and 'C') - Increased global reputation	- Include new products in ready-to-use solution of firm 'B' - Increased customer base	- Access to new software and hardware resources - Form new partnerships in the joined ecosystem - Increased global reputation

*OxM: OEM, ODM, OBM

Market development

Besides the co-development that went on between firms 'A' and 'C', they also actively exchanged market development strategies and key market information and engaged in joint pre-marketing by demonstrating their prototype at key IT exhibitions worldwide. Furthermore, the business development teams of both firms carried out co-market development activities geared towards potential customers (e.g. ODM, OBM, and telecommunication firms), in order to quickly introduce their new software and hardware. One of our interviewees commented on the criticality of commercializing new innovative products, as follows:

“The successful factor of a project is to develop a product that we can sell to the market... To develop a product that did not exist in the market, we had to develop a prototype and promote and expose this worldwide. For this, we invested a lot on engineering resources to develop marketable products.”

As a result of the market development activities, the focal software firm was able to successfully launch three new mobile software products in 2009, which were new to the market. The firm’s new products were operationalized on top of firm ‘C’'s hardware platform which used firm ‘D’'s core technology. Also, the software firm created additional B2B and B2C business models, providing mobile software licenses to OxMs and App store distribution to end users. In addition, firm ‘A’ was able to build relationships with other foreign software and hardware firms within the ecosystem of firm ‘D’', thus increasing its product functionality and quality. The management of the software firm expected the new mobile products to account for ten per cent of annual revenues in 2010. Figure 2 encapsulates the illustrated case from the focal software firm’s perspective. Its initial need for mobile hardware technology resources led to sequential GTAs with semiconductor, operating system, and chipset design firms. External resources gained through these relationships invigorated its technological and market development capabilities, giving it a competitive advantage.

Figure 2: Relationships between resources, GTAs, and innovation capabilities in the case study

Conclusion

In this chapter, we have investigated the interrelationships between complementary resources, GTAs, and innovation capabilities, in the context of the high-tech market. To do this, we have attempted to develop an integrative matrix encompassing the resource-based view and innovation concepts, thus typologizing closed, inbound, inside-out and open

network innovation. This approach allows external actors to contribute resources to the technological value of a firm and allows the firm to gain commercial value-capturing rent from the resource-based view and innovation aspects (Chesbrough and Appleyard 2007; Lavie 2006). Particularly, we have focused on the inbound innovation, cell B in Table 1, in order to explain the contribution of external resources from international partners on a firm-level product innovation. As such, we have further explored the conceptual discussion by illustrating how an idiosyncratic firm created innovation capabilities through GTAs in the mobile computing market. This allowed us to identify a sequence of relationships between three dimensions: resources, relationships, and capabilities. Firstly, the resource complementarity of firms inspires them to forge GTAs in high-tech industries; secondly, these GTAs help to increase firms' innovation capabilities.

This work contributes to the IB field on both a theoretical and an empirical level. Firstly, a theoretically-integrated matrix, in terms of the resource-based view and innovation, allows for a dynamic perspective, capturing resource internalization and externalization and encompassing the notion of open innovation. This also explains how GTAs contribute to firm-level product innovation and commercialization. Secondly, this chapter extends the extant IB literature that has primarily focused on interfirm relationships in the downstream value chain, from a marketing perspective, to the upstream value chain, looking at the context of technology. Thirdly, the illustrated case shows how GTAs allow a firm to acquire value-creating complementary resources which are not available and accessible in the local market, thereby creating new business models and penetrating a new market. Thus, company managers engaged in international business activities should be aware that internationalization of a firm in the innovation process can play a critical role in strengthening and reinforcing innovation capabilities in high-tech industries. Also, managers in R&D or product management functions should understand the criticality of value-

capturing market development capability as well as technological product development capability in product innovation.

Finally, the conceptual matrix and explorative case study in this chapter provide a basis for empirical research. An empirically-tested model would be able to explain to what extent complementary resources, obtained through resource bonding mechanisms in GTAs, contribute to the capability to create a competitive advantage through innovation. Although we have endeavoured to provide a rich description of the relationships between the focal firm and its GTA partners, it is difficult to generalize our findings based on this single case. It may be applicable and limited to explaining phenomena in the mobile computing market. In this respect, a large-scale primary survey would be a useful area of future research. We would recommend including the openness construct, and using the context of high-tech industries, which have rarely been investigated in the IB literature. This would enrich the limited discussions provided in this chapter and allow for the capture of dynamic *bona fide* GTA and innovation phenomena.

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