A dynamic innovation model for managing capabilities of continuous innovation

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Abstract: The primary objective of this study is to investigate the required capabilities for continuous innovation through analysis of the existing literature and examination of empirical cases. A dynamic innovation model (DIM) is proposed to accelerate enterprise capabilities in building continuous innovation in a dynamic business environment. The DIM combines the concept of entrepreneurship and resource management and highlights the importance of co-evolving relationships among these capabilities. Findings of a comparative analysis of the DIM for two PC manufacturers, Atech and Bymove, illustrate how business leaders combined foresight and insight with cyclical processes of resource integration, learning and transformation in delivering continuous innovation. We argue that the foresight of business leaders must be accompanied by insights about the development of the required capability for innovation, whereas the cycle of the building of dynamic capabilities must be linked with the business foresight for effective innovation.

Keywords: continuous innovation; dynamic capability; business foresight; entrepreneurship.

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1 Introduction

With the increased demands of customers and the rapid development of information and communication technologies (ICT), businesses confront intense competition in globalisation, customisation and service transformation. Continuous innovation has become increasingly critical in surviving keen competition, satisfying demanding customers and leveraging technological advancement. To achieve this, organisations need to combine the capabilities of strategic flexibility and operational effectiveness (Boer and Gertsen, 2003). Strategic flexibility involves ongoing exploration to develop new products to satisfy current and potential clients and operational effectiveness requires improving the exploitation capabilities embedded in an organisation's products, processes, technologies, systems and competencies (Boer and Gertsen, 2003). To enhance our understanding of the interrelationships among the strategic and operational capabilities necessary for continuous innovation, this study seeks to answer the following questions:

1 What are the capabilities required for the implementation of continuous innovation?

2 What are the capabilities required for sustaining continuous innovation?

3 Is there a model for building a generic concept of the management of the continuous innovation capabilities?

The primary objective of this study is to identify the capabilities needed for continuous innovation through analysis of the existing literature and examination of empirical data. Based on the literature of innovation and dynamic capabilities, the study analyses the concept and process of continuous innovation. We then provide an analysis of the content of leadership, entrepreneurship, resource management and dynamic capabilities and their relationships with continuous innovation. Subsequently, we propose a model to demonstrate how these capabilities are weaved together to form a dynamic cycle for continuous innovation in the enterprise. Then, we present the case analysis results with the dynamic innovation model (DIM). Finally, we discuss our findings and draw conclusions from the study.

2 Constructing and implementing continuous innovation

2.1 Continuous innovation

The concept of continuous innovation is a process by which organisations continuously apply new methods and ideas in improving products, internal processes, technology, systems and operations to build strategic flexibility in satisfying current and future customers (Boer and Gertsen, 2003; Soosay, 2005). Continuous innovation involves the interactions among learning, operations, processes, people and technologies (Davison and Hyland, 2006). Enterprises need to integrate technological and organisational innovation to create sustainable competitive advantage (Lu et al., 2007). In many cases, such as those of FedEx, Wal-Mart and Toyota (Appelbaum and Lichtenstein, 2006; Bhardwaj and Momaya, 2006; Dyer and Nobeoka, 2000), enterprises develop and introduce products, processes or services into the marketplace based on new technologies (Betz, 1993). Technological innovations are reflected in both products and processes (Lin and Lu, 2007; Subrahmanya, 2005). Product innovation provides new products or services to meet customer requirements and process innovation takes place when firms launch new components for production or service operations.

A global innovation management model, focused on product innovation and based on the continuous improvement literature, was developed by Soosay and Chapman (2006). Constructs of this model, including drivers, behaviours, competencies, contingencies and performance measures, were examined using distribution centers in the logistics industry (Soosay, 2005). The model provides a sequential framework for the inputs and outputs of the innovation process. Continuous innovation, however, involves a cyclical interaction between incremental and radical changes among organisational tangibles and intangibles (Davison and Hyland, 2006). Hence, to maintain sustained competitive advantage firms must continuously improve processes and products, build innovation capabilities and dynamically align operations with strategic intentions (Smeds and Boer, 2004). A model with interactive relationships among strategic and operational capabilities is needed to clearly demonstrate the dynamics of innovation management.

2.2 Leadership and entrepreneurship for continuous innovation

The concept of continuous innovation emphasises the importance of a continuous cycle of generating and implementing innovative ideas throughout the life of the enterprise. A given firm's leadership in continuous innovation is reflected in its ability to lead established or newly formed teams in entering new markets, obtaining new customers and combining existing resources using new methods (Ireland et al., 2001). Although, entrepreneurship has been defined as the establishment of the initial idea for a product or service, firms that compete through continuous innovation need to maintain the attitude and behaviour of entrepreneurship to produce a continuous wave of innovative movements (Ireland et al., 2001). One of the key characteristics of entrepreneurship is risk taking – active, positive and innovative (Covin and Slevin, 1986) – and entrepreneurial corporations are thus, able to respond to dynamic environments flexibly, adroitly and quickly (Naman and Slevin, 1993) and combine external and internal resources to accomplish new tasks (Lumpkin and Dess, 1996; McAdam and Galloway, 2005).

The capabilities of entrepreneurship include two complementary views: foresight and insight (Sambamurthy et al., 2003). Foresight is the ability to identify future issues, integrate all of the information available and make decisions in advance whenever possible (Grant, 1989). It also involves characteristics such as the ability of firms to expand old markets, explore new markets, detect chances in the business environment, respond flexibly and design competitive actions. Insight is the capability to integrate diverse abilities and opportunities to respond to the changing market effectively and efficiently (Sambamurthy et al., 2003). It involves management of the firm's ability to acquire and deploy resources to adapt to planned strategic goals. The ability of business leaders to manage the complimentarity between foresight and insight sets up organisation's strategic intent (Hamel and Prahalad, 2005) and guidelines the company will use to plan the advance.

2.3 Critical resources for continuous innovation

Turning foresight of innovative ideas into insight on the organisation's operational capabilities and organisational resources thus, becomes a critical component of the development of innovations. In order to generate competitive advantage relative to competing organisations, firms need to construct resources that are valuable, rare, imperfectly imitable and non-substitutable (Barney, 1991). Resources are company-specific and involve all tangible and intangible assets (Wernerfelt, 1984); including physical assets, organisation processes, knowledge and human capital (Barney, 1991). These resources, which are held or governed by the firm, are critical in transforming inputs into the production process (Amit and Schoemaker, 1993; Grant, 1991). The dominant organisational capabilities required to achieve innovation are technology, knowledge, market, human resources and operations (Danneels, 2002; Nelson, 1991). In this study, we consider three major resources that are vital to achieving continuous innovation: knowledge, processes and technology.

Knowledge is the collective learning of the organisation and the basis to achieve competitive advantage and make profit (Prahalad and Hamel, 1990). Enterprises must integrate diverse knowledge to develop products and services to satisfy customers quickly and alertly in this changing environment (De Boer et al., 1999). Aligned with the motivation for continuity (Drucker, 1993) organisations establish and carefully manage the mobile aggregation of experiences, values, ideas, thoughts, opinions and instincts (Davenport and Prusak, 1997; Pasmore and Woodman, 2005). The characteristics of knowledge are, therefore, transferability, appropriability and specialisation (Grant, 1996).

Processes are the dynamic view of how the organisations provide value (Davenport, 1993). A process transforms input into valuable output with a specific objective. It includes many structured activities that must be carried out in order to provide a product or service and emphasises how the work is done within the organisation (Davenport, 1993). Moreover, it enables the organisation to implement new strategies or make existing strategies more efficient and effective (Barney, 1991). Innovations in processes include implementation of a new or significantly improved production or delivery methodology to achieve competitive advantage (Schroeder, 1990).

ICT inspire and enable changes in knowledge and process of organisation (Karimi et al., 2001; Miozzo and Ramirez, 2003). Information technologies can play an important role in the knowledge-based view of the firm in that information systems can be used to

synthesise, enhance and expedite large-scale intra- and inter-firm knowledge management (Alavi and Leidner, 2001). Through technological innovation, firms can provide customers new or improved products, processes or services (Abernathy and Utterback, 1975; Damanpour and Evan, 1984).

2.4 Dynamic capabilities for continuous innovation

Organisational resources are the static stock of the firm, but they cannot explain the mechanisms that enable entrepreneurial rents and sustainable competitive advantage (Teece et al., 1997). Resources need to be managed in response to environmental and contextual changes. Capabilities, though invisible, are dynamic assets that allow firms to utilise resources (Amit and Schoemaker, 1993) and make them work together to accomplish the task of innovation (Grant, 1991). The ability to sense and respond to changing market needs and the processes of integrating, building and reconfiguring internal and external resources to address these changes, are key organisational intangibles that link strategic intentions with operational execution. These competencies and capabilities are embedded in organisation processes (Nelson and Winter, 1982). According to Teece et al. (1997), three essential processes – integration, learning and reconfiguration – form the cyclical system of innovation implementation.

The integration process includes integrating internal and external resources and coordinating activities and technologies with major business operations (Kaplan and Norton, 2004) to implement innovations effectively and efficiently. Through interactions, involvement, communication, coordination and information sharing companies may enhance cross-functional linkages to achieve organisational goals (Jassawalla and Sashittal, 1998; Kahn, 1996). In addition to integrating activities inside enterprises, companies stress strategic alliance, collaborative agreements and partnerships with suppliers and customers, to enhance the integration of external activities. This involves identifying, creating and acquiring the necessary experience and knowledge to react to changes or deal with problems. Resource collaboration is a learning and interacting process – a means for knowledge creation (Kastelli et al., 2004). Integration of both experience and knowledge can be referred to as a source of new knowledge (Zahra et al., 1999).

Learning is a repetitive and experimental process to accumulate knowledge, know-how, experience and skills (Kale and Singh, 2007; Teece et al., 1997) to develop organisation capabilities and create sustainable competitive advantage (Crossan and Berdrow, 2003; Hatch and Dyer, 2003). In the learning process, a firm first distributes knowledge across organisational units through sharing success and failure experiences on projects or activities and then it learns from these accumulated experiences (Zollo and Winter, 2002). This capability enables the firm to experiment using the captured knowledge that emerges from knowledge integration activities. Such knowledge can also be used as a base to transform organisational resources or create additional new knowledge (Nielsen, 2006). Collaboration and partnership is a means for organisational learning (Sáez et al., 2002; Teece et al., 1997; Wang and Zajac, 2007). Organisational learning includes the creation, processing, transfer, sharing and storage of internal and external knowledge, which is important in achieving the goal of innovation (Corso, 2002; Kondou, 2003; Ronchi et al., 2003). Firms may acquire knowledge through consultants, conferences, journals, benchmarking and competitor information (Lane and Lubatkin, 1998).

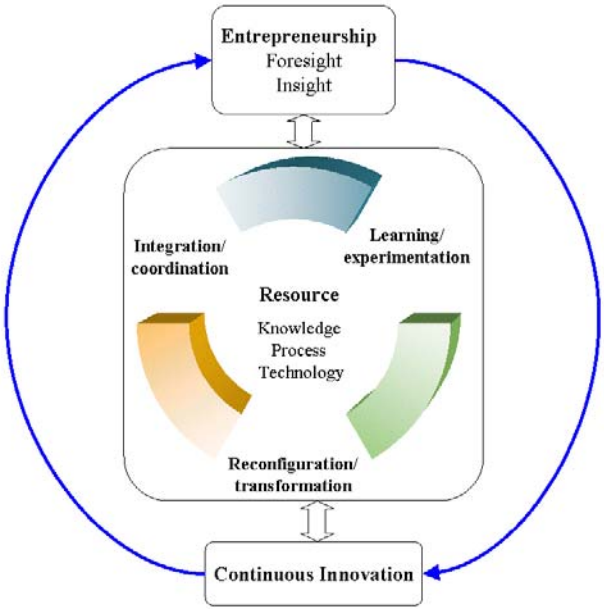
The reconfiguration process involves the capability to sense and evaluate competitors, markets and business environments and to flexibly accomplish internal and external changes (Teece et al., 1997). Reconfiguration means enterprises to change and arrange resources including recombining, retaining, deleting, acquiring resources (Karim, 2006; Karim and Mitchell, 2000). By transforming and reconfiguring aligned resources, firms can create new value-creating processes (Kogut and Zander, 1992) and strengthen organisational learning (Teece et al., 1997). Through reconfiguration, resources or competencies link jointly to achieve the boarder goal or innovation (Galunic and Rodan, 1998). Enterprises with flexibility and agility have the capabilities to sense environmental change and respond rapidly (Bessant et al., 2002; Kianto, 2008).

There is a cyclic relationship among these processes and in this co-evolutionary cycle organisational agility is built. This agility becomes crucial to innovation and firm performance in a dynamic society (Sambamurthy et al., 2003).

2.5 The dynamic innovation model

Based on the business innovation literature, which includes the logic of the continuity of innovation and the concepts of entrepreneurship, resource management and dynamic capabilities, a model of dynamic innovation (Figure 1) is proposed in order to demonstrate the cyclical relationship among different capabilities for continuous innovation.

Figure 1 Dynamic innovation model (see online version for colours)



To build strong capabilities for continuous innovation, firms need to have leadership with both the attitude and behaviour of entrepreneurship, combining the foresight to capture opportunities and the insight to guide and manage internal resources to achieve innovation. To complement the leaders' foresight and insight organisations also need to

establish an iterative process of integrating new information and reconfiguring critical resources, including organisational knowledge, processes and technology, to successfully carry out each cycle of innovation. During this process of integration, learning and reconfiguration, enterprises receive feedback from their organisational processes and are thus inspired to take new innovative actions. The cycle of initiating, constructing and implementing innovations allows organisations to establish a unique capability for continuous innovation in their dynamic business environments.

3 Research method

In order to examine the criticality of the capabilities proposed in the DIM, a comparative analysis was performed on two major personal computer enterprises in Taiwan. The information industry was developed in Taiwan in the 1980s in response to the appearance of personal computers. Since, the first personal computer appeared on the market (the Apple computer in 1977), computer manufacturing has become an innovative trend for entrepreneurs in Taiwan due to the accumulated technology integration capability. The industry's output value in 2006 was US$89.6 billion and the sector has become one of the top three in the worldwide hardware industry (Market Intelligence Center, 2007). However, the industry is constantly faced with intensive global market competition and with pressures from demanding customers. Enterprises in the information and electronics industry are widely considered the most innovative.

In order to draw valid conclusions about the dynamic innovative capabilities in the studied cases, it is important to assure that the selected cases are competing in the same market and have similar environmental contexts. The two selected cases, Atech and Bymove, were established in the late 1970s by founders of the same age and with similar college educations and started with similar organisational structures, utilising the same talent pool and competing in the same domestic and international markets. Over the subsequent three decades, the two enterprises have faced various pressures to reinvent products and business models. Atech responded with multiple waves of innovation in products, services and organisational structures, resulting in a competitive global position in the ICT market. Bymove replied with various strategic intents but evinced a lack of support from its competitive capabilities for the visionary moves. As a result, the company is only a mid-sized competitor in the ICT market.

The case study approach is appropriate for providing insights and answers to the 'how' and 'why' questions (Yin, 1994). This study also focused on gaining knowledge of reality through the study of social construction (Klein and Myers, 1999), which gives us an interpretive and explorative view. With this in mind, based on the framework of the DIM, a longitudinal analysis was conducted on the two enterprises. The aim of the in-depth longitudinal case analysis was to build and test logical support for understanding the management of capabilities for continuous innovation. Due to their leading positions in the market, a rich variety of studies and documents were available for public access. A chronological analysis focused on the innovations, foresight and insight of the entrepreneurship and the development processes of the supporting resources and capabilities. Under the same timeline, each innovation event was analysed and compared, with the results presented in Table 1. Details of the two cases are described in the following section.

Table 1 A comparison of two cases

		Atech				
Year	*Innovation*	*Entrepreneurship*		*Dynamic capabilities*		
		Foresight	*Insight*	*Integration*	*Learning*	*Reconfiguration*
1981	Launched self-built microcomputer, Micro Professor I to domestic and overseas markets	Realisation that home computers are the trend	To build capabilities of manufacturing handheld computer	• Sought to acquire microcomputer- manufacturing technology (from Apple II and others) • Collaborated with professors to acquire software technology • Integrated domestic and international market resources	• Microcomputer manufacturing technology • Experience from domestic market and international market • Importance of component compatibility • Importance of market opportune moment	• Refined manufacturing processes and technology • Considered to connect Micro Professor I with monitor
1982	Launched Micro Professor II as Taiwan's first 8-bit home computer	Realization that compatible PC is the future	To build capabilities of manufacturing IBM compatible computers	• Integrated knowledge and skill of microcomputer and IBM compatible PC • Other electronic firms helped with manufacturing • Coordinated intellectual property rights issues with Apple	• IBM PC compatible architecture • PC research and development skills • Critical technology legal issues • Experience from domestic market and international market	• Enhanced technological research and development capabilities • Set up legislation department
1983	Launched 8-bit IBM compatible computer (XT PC) in Taiwan	Realization of PC-users market and self-owned brand	In addition to capabilities of IBM compatible computer, brand management capabilities is needed	• R&D collaboration with Taiwan Industrial Technology Research Institute • Integration with suppliers • Alliance with world PC marketing and sales channels	• PC manufacturing processes and technologies • Customer requirement • Global channels • Global market management	• Strengthened the capabilities to manufacture IBM compatible computer • Provide16-bit and 32-bit personal computers
1987	New brand name to international market	Confirmed own-brand operating model and internationalization strategy	Need to build focused business practice, overseas manufacturing and marketing strongholds	• Integrated internal and overseas businesses • Integrate diverse and advanced technologies (IC design, internet and telecommunications)	• Management of brand marketing • Technological integration skills • Global market channels and sales	Established corporate transformation project – metamorphosis to refocus on the global market
1990	Entered minicomputer market through merging with Altos	Saw emerging market in mini computers	To leverage capabilities of mini computers	• Integrated resources with merged firm • Integrate customer knowledge • Coordinate administration with merged firm	• Learned from the failure of merging with Altos • Learned mini computer market and PC market • Traditional business model cannot suit future development	Initiated first corporate reengineering project to reallocate resources and restructure for global PC market

Table 1 A comparison of two cases (continued)

	Atech					
Year	*Innovation*	*Entrepreneurship*		*Dynamic capabilities*		
		Foresight	*Insight*	*Integration*	*Learning*	*Reconfiguration*
1992	Launched 64-bit personal computers	Refocused on PC market and shift on to multimedia home computers	Refocused on capabilities of PC manufacturing and supply chain	Integrated technology of computer and consumer electronics	Multimedia technological and R&D capabilities	Continuously enhanced PC skills
1993	Launched multimedia home computers	Emergency of service market	Recognized need to build customer-service capability	• Integrated technologies • Coordinated businesses of five major sub-groups • Strategic alliance with a semiconductor company (TSMC)	• Integration and consolidation of different business resources • Technological and design capabilities	Second corporate reengineering project to change from manufacturing company to brand service company
2001	Entered marketing service industry	• Sought opportunities in service industry • Strengthened customer value	Built firm's capability in the development of enhancing human life through technology	Streamlined international practice	Global market strategies, resources and customer demands	Transformed from product-oriented firm to market-oriented firm
2002	Established a customer value centre	Understood customer needs to build superior service	Realization of need to build integrated processes with flexibility	Integrated knowledge about customers value	Built customer-knowledge tank for research and development in customer service	Shifted focus on customer needs and service innovation
2003	Provided easy-to-use technology to consumer	Satisfied customer needs with more customized services	Realization of need to leverage more external resources for building the supply network	Integrated hardware, software and services to provide end-to-end technologies	• Enhanced skill in product and service integration • Learned more about customer behaviour	• Customer-oriented corporate culture • Enhanced skill in user-empowered solution development
2006/2007	Unveiled a series of user-empowered multimedia home computers (Aspire series)	Diversified and localized strategy for different global regions	Built capabilities of managing complementarity product-and market position in different local markets	• Acquired Gateway computer • Coordinated with employees and resource/service providers in streamline services	• Technological, design and R&D capabilities • Fulfilment of customer services of different regions	Solidified position in different regional PC markets

Table 1 A comparison of two cases (continued)

		Bymove				
		Entrepreneurship		*Dynamic capabilities*		
Year	*Innovation*	*Foresight*	*Insight*	*Integration*	*Learning*	*Reconfiguration*
1981	Self-developed MIS800 microcomputer	Microcomputer is the trend	Need to build technology in manufacturing compact computers	Collaborated with Taiwan Industrial Technology Research Institute in R&D	Skills of microcomputer systems	• Enhanced skill in microcomputers • Built up factories in the Hsinchu Science Park • Increased capital and set up the branch in USA • Move of important employee moved from Bymove to other companies
1982	Launched self-built microcomputer – micro Mitac in the domestic market	Tested opportunities in software market	Built capabilities in software development		• Manufacturing capabilities • Technological R&D capabilities	• Enhanced PC manufacturing capability • Tried to avoid invading Apple's patents
1983		Opportunities in automatic traffic surveillance system, slab handling facility control system	Diversified capabilities in system integration management	Coordinate internal processes	Capabilities of system integration	Enhanced PC compatible capability
1987	Gained manufacturing order from global brand	Discovered changes in domestic military and government market	Diversified capabilities in different areas	• Integrated manufacturing processes and supply management • Consolidated Chinese PC technology	• Manufacturing capabilities • Technological and R&D capabilities • System integration	• Enhanced Chinese PC capability • Diversified capability in system integration
1990	Launch Chinese series personal computer	Sought opportunities in alliances with Informix software Sun Micro system workstation	Diversified capabilities in different areas	Coordinated internal activities	• Manufacturing capabilities • Technological and R&D capabilities	

Table 1 A comparison of two cases (continued)

	Bymove					
Year	*Innovation*	*Entrepreneurship*		*Dynamic capabilities*		
		Foresight	*Insight*	*Integration*	*Learning*	*Reconfiguration*
1992	Launched industrial computing products	Shifted interest in island-wide high-speed optical networking system	Diversified capabilities in different areas	Integrated internal processes	• Capabilities of developing industrial computing • Capabilities of system integration	
1993		Joined large government projects – auction system, logistic system, gas supply monitoring and control system		Separated projects with different skills	Capabilities of system integration	
2001	Established information technological service business	Sought opportunities in the media market		Joined projects of national defence with overseas companies	Skills of various types of system integration	
2002						
2003		Sought opportunities in electronic business and internet services		Integrated internal business units for providing e-services	Internet services	
2006/2007		Sought opportunities in health industry		• Coordinate with Hitachi • Coordinated with Juniper Networks • Created alliance with hospitals and universities	• Capabilities of system integration • Knowledge of information safety	

4 Atech

Atech was established in 1976 with a start-up capital of US$28,000, focusing on the design and trading of electronics products (Atech global website, 2008). In the past 30 years, Atech has generated multiple waves of innovation in its products, processes and business model. Some of its innovative projects have succeeded and others have failed. However, it continues the journey of exploration and exploitation of its business resources.

Driven by the vision of building the first microcomputer in Taiwan, Atech founded a Microprocessor Training Center in 1978 that trained 3,000 engineers for the industry. It also acquired technological knowledge from various global corporation projects. Atech's branded microcomputer, Micro Professor I, was launched in 1981. With the strong intention of moving into the global microcomputer market, the founder of Atech, Stan Shih, developed capabilities in integrating technological resources, including knowledge learned from the Apple II and reconfigured the model with a new version, the Micro Professor II, which was the first national 8-bit home computer. This project also provided valuable experience in developing capabilities in manufacturing personal computers for the global market. With the objective of building its own personal computer, Atech continued the cycle of acquiring and integrating knowledge, learning about and experimenting with new features and reconfiguring and upgrading the product model. Through the experience of promoting Micro Professor models, Mr. Shih considered developing an IBM-compatible PC that would be in the market mainstream. Meanwhile, Apple considered a tort case against Micro Professor II, which made Atech more cognisant of intellectual property (IP) rights issues. To enhance its PC technology capabilities, Atech initiated collaborative R&D with the Taiwan Industrial Technology Research Institute (ITRI) to learn PC-compatible technology and in 1983 Atech launched its IBM-compatible computer, the XT PC. A 16-bit personal computer came out in 1984 and accelerated Atech's capability to manufacture and promote PCs.

Atech elaborated on its technological capabilities to develop 32-bit personal computers in 1986 and from 1987 onward the company moved in the direction of own-brand operation and globalisation. In addition to internal organisational restructuring, it set up overseas manufacturing and marketing strongholds. Atech planned on integrating domestic and overseas businesses and coordinating diverse technological fields such as IC design, the internet and telecommunications. The company initiated a business transformation program called 'metamorphosis' in the hope of tightening up its business control over global resources and increasing efficiency. This helped Atech to build capabilities to manage self-brand and improve technological capabilities to satisfy changing market needs.

In the next year, due to another IP rights issue, Atech paid US$200 million to IBM in 1989 (Shih, 1996). The company's profit was only US$2 million that year. In the meantime, triggered by the IP problems, Atech considered entering the minicomputer market. In 1990, Atech merged with Altos to integrate its technological capabilities in minicomputers and to increase its internationalisation strength. However, this move was not a positive one, due to inconsistencies in implementation and the failure of the market to appear. Atech suffered a loss of US$17 million in its overseas markets. Learning from failure, Atech discovered flaws in its existing strategy and business model. Its problems lay in overflowing capital, organisational bureaucracy and slow responsiveness. In 1992,

Mr. Shih initiated an organisational reengineering project designed to transform the company into a federated global firm in which global support fitted local needs. It implemented a flattened structure and re-allocated global resources while continuing technological capability development for 64-bit personal computers.

In 1995, the company integrated the technologies of computers and consumer electronics to develop the multimedia home computer Aspire. Learning from customer needs and motivated by industry trends such as IBM's service transformation, the executive group started the preparation for a service market (Shih, 2004). In 2001, Atech provided a new trademark to build identity symbolising the firm's commitment to enhancing people's lives through technology. This change was enabled by the business reengineering project of previous years. The business was divided into two independent business entities: manufacturing and brand management. Moreover, Atech enacted cultural change within the firm, moving from the culture of the manufacturing industry to that of the marketing service industry.

With its vision of providing easy-to-use services for home consumers, Atech integrated the technologies of household electronics and personal computers to launch its second-generation multimedia home computers in 2002. In order to enhance its customer-centric focus, Atech set-up a 'value centre' to investigate customer needs and to develop market-oriented services and products. To get customers to appreciate the technology, Atech launched the next-generation, user-empowered technology platform that integrated hardware, software and service to provide all-in-one, end-to-end technologies for consumers. The new version of their multimedia home computers (Aspire series) was launched in 2007. In the meantime, cyclical processes of integrating resources, learning from projects and small- and large-scale transformation continued to build a customer-centric culture and globally controlled, locally supported practices in different regions. The recent merger project with the number five worldwide PC brand Gateway is another planned move in building global economies of scale. In 2006, Atech had revenues of US$192 million in the global PC market and it was the number three notebook and number four desktop brand worldwide (Atech global website, 2008).

5 Bymove

Bymove, in the same business area as Atech, was established in 1974 with US$57 thousand (Bymove website, 2008). Bymove entered in the computer business in 1974 with the introduction of its Q1 commercial microcomputer. It brought Intel microprocessors to the Taiwan PC industry in 1975 and it built the first super-mini-computer (Perkin-Elmer, 32-bit) in 1976. In 1977, Bymove started to develop a Chinese commercial terminal machine to build R&D and technological capabilities and in 1981, Bymove developed the MIS800 microcomputer information system in conjunction with the Taiwan ITRI in order to expand the capabilities of its microcomputers (Bymove website, 2008). The following year Bymove launched a Chinese terminal (Han-Tun), producing its personal computer Micro Mitac I in 1982. Bymove profits reached US$57 million (at the same time, Atech made only US$40 million) (Book Zone compilation, 1997). Unfortunately, the Micro Mitac I encroached on Apple's patent rights. Bymove gave up on personal computers and initiated a few other investments in software development projects. However, no specific skill development or resource configuration was planned to support these initiatives. During these years, not

much profit was generated from these different initiatives. By 1985, Atech's profits exceeded Bymove's.

In the next few years, Bymove diversified into different businesses. It became involved in commercial microcomputers, super minicomputers, Telecom products, defence projects, logistics systems, auction systems and Chinese commercial terminals. Bymove then opted for supercomputers and developed the slab handling facility control system in 1986. In addition, the company received original equipment manufacturing (OEM) orders from MEMOREX in 1987. It launched its P9 microprocessor and developed information systems for the military and police. In 1990, Bymove launched a Chinese series personal computer using Informix software and Sun Microsystem workstations. It next participated in several system integration projects in 1991 and launched industrial computing products in 1992. It also developed and installed computer systems, island-wide networking systems and high-speed optical networking systems beginning in 1992. In 1993, the company developed an auction system and joined several computer projects and in 1995 it designed and installed a gas supply monitoring and control system. Due to the diversity of its business directions, Bymove did not plan tight capability development programs to organise resources, knowledge, accumulated experience and lessons learned. Although, the business founder had a vision that involved entering global markets, the company had not built the concrete capability to do so.

In 2000, Bymove saw opportunities in the electronics business and internet services and established an internet data centre and a software business centre. In the development of internal capability, Bymove started R&D and marketing collaboration with Hitachi in 2001. During this period, the company still invested in several system development projects. In 2006, Bymove selected Juniper Networks to provide internet products. Bits and pieces of capability development were conducted, with little apparent association with a particular business direction, while the business direction itself was not clearly elaborated. The company seems to have interests in both network technology and the system integration business. In 2006, Bymove had revenues of US$4 million. Gradually withdrawing from the PC market, it becomes a leading system integration enterprise in the domestic market.

6 Discussion

From the comparative analysis of the two cases, we have drawn the following four lessons learned: To begin with, the foresight of business leaders must be accompanied by insights about the development of the required capability for innovation. The case analysis has demonstrated the need for a close link between business foresight and insight. In Atech's case, a business vision was always accompanied by an insightful progress of resource configuration and reconfiguration. For example, the vision of a PC-compatible computer was built through the process of acquiring technology, accumulating experience through self-developed microcomputer and transforming the delivery structure of domestic and global market implementation. The vision of a global brand was achieved through a series of preparations in global market practices, customer knowledge accumulation and learning from failed projects. In the same time and under the same market and IP issues, the other case, Bymove, reacted with a variety of foresight but lacked insights supporting the realisation of differing business intents. Although, each

foresight seemed to be innovative, they ended as piecemeal steps with only partial effect on organisational performance. Entrepreneurship of initiation and commercialisation is very much necessary in enterprises that pursue sustained innovative capabilities.

In addition, the cycle of the building of the dynamic capabilities would have to be linked with the business foresight for effective innovation. In regard to the iterative process among integration, learning and transformation, the two cases have demonstrated distinct patterns in the management of business capabilities. At Atech, we see a continuous cycle of reviewing situations, acquiring knowledge, technology and experience, modifying processes, studying and experimenting with different technologies, feedback into the decision-making loop and several transformations. These cycles were centred around the business intent. On the other hand, the Bymove case demonstrates a pattern where disconnections were found between processes. For instance, the foresights of building personal computer was realised at Atech but was dropped at Bymove due to difficulties encountered. The accumulated skills were then dissipated. The different system integration projects were not found to be highly applicable to new situations since the internal resources did not seem to be reallocated to learn and to accumulate experience from the new projects. Therefore, there were lower levels of innovation at the company and key links were missing in the Bymove case. It is clear from both the Atech and Bymove cases that from entrepreneurs to sustained enterprise innovation, the institutionalisation of the cyclical process of capability development seems to be the essential practice.

Furthermore, business innovations may not always be successful and failure must be learned from and transformed into new capabilities for the next innovative move. In both the Atech and Bymove cases there were failures in innovative moves. Failure to entering into the minicomputer market through merger was a lesson learned by Atech. These lessons learned have led to changes in business foresight and in refocusing in personal computers and reengineering of the company's business structure for efficient global practice. However, it is important to connect the cycle with the next wave of innovation to mitigate the risk of innovation failure.

Finally, the time it takes to develop innovation capabilities varies and the key is to have a continuous link between the entrepreneurial and capability-development processes. In the Atech case, the time it took for the development of the innovation capability varied. For the development of the PC-compatible computer, Atech and Bymove both took more than five years. Their products were developed through deconstructing the model computer, knowledge acquisition from different sources and practice on self-developed microcomputers. Similarly, in developing a global market Atech learned for more than ten years before succeeding. In contrast, Bymove did not connect capability building with the various innovative projects and ended up developing under-utilised capabilities in various projects. It is important to build a tight linkage between the strategic intent and operations practice.

Enterprises may emphasise different components of the DIM in organisation life cycle. Companies facing resource constraints in the initial stage may focus on accumulating capabilities. For instance, Atech collaborated with Taiwan ITRI, academics and other companies to acquire and develop technological capabilities. In the mature stage, capabilities of coordination and integration seem to be more important. In 1998, Atech implemented corporate reengineering to coordinate five sub-groups, in order to avoid disproportionate resource allocations. It would be interesting to examine how to accelerate the cycle of the DIM in different industries. Future research will proceed by

construction of a questionnaire for the DIM. More empirical research on DIM is necessary and should be encouraged.

7 Conclusions

The primary objective of this study is to identify the capabilities needed for continuous innovation through analysis of the existing literature and examination of empirical data. Based on the existing knowledge of innovation and continuous improvement, we have built a model for analysing the capabilities required for sustained competitive innovation. In contrast to existing studies which focus mainly on the state of business innovation, this study has provides a holistic view of the inputs and outputs of the innovation process and highlighted the dynamic processes of leveraging resources, learning from experiments and generating innovations. The aim is to emphasise the interrelationships among these capabilities and the critical points for managing the initiation and implementation of innovative ideas throughout the business life cycle. Through interpretive and explorative enhancement, with longitudinal analysis of two comparative cases, we argue that a dynamic entrepreneurship with both foresight of the market and insight into internal capabilities tightly linked with cyclical processes of resource integration, experience, learning and transformation, may accelerate enterprise capabilities in building continuous innovation in a dynamic business environment.

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