The relationships between firm's strategy, resources, and innovation performance: Resources-based view perspective

Besides basic competitive priority (quality, cost, delivery, and flexibility), innovation has been recognised as one of the primary sources of competitive advantage for manufacturing industry to compete in global markets. This paper, therefore, presents an empirical study on the relationship between firm strategy, resources, and innovation performance. Drawing from the grounded theory of resource-based view, and using 218 responses from Thai production/operation managers, this paper shows that differentiation strategy had a positive relationship with both *internal capital* or *internal resources* (represented by knowledge and creativity management) and *networks capital* or *external resources* (represented by customer and supplier network). The findings also revealed that only *internal capital* had a positive effect on innovation performance. Finally, contributions to industry practitioner, academia, and national agency in supporting and promoting innovation are presented.

Keywords: Innovation; Strategy; Resources; Performance

1. Introduction

Innovation has been described as a critical asset that is necessary to attain superior performance by both local and off-shore manufacturers (Yeung *et al.* 2007, Childe 2009). Given the contemporary global nature of manufacturing, there is a need to understand the drivers of innovation in multiple contexts. The motivations for a study are threefold. Firstly, this study contributes to knowledge by exploring the joint effect of external and internal resources on a firm's innovation outputs (Vega-Jurado *et al.* 2008). A firm's level of innovation is closely related to its absorptive capacity and its ability to exploit its resources to support knowledge acquisition from internal and external sources (Lee and Wong 2011). Secondly, it is important to fully understand the impact of customer and supplier relationships in developing product and process innovation. It is also important to study the ability of the firm in utilizing knowledge and resources from their external partners to enhance their internal capability leading to an increase in innovation performance (Nieto and Santamaria 2007, Kramer *et al.* 2011). And, thirdly, there are few studies that focus on innovation in less technologically developed countries and with the increasing importance of innovation in such countries, the need for academic research in such countries increases (Intarakumnerd *et al.* 2002, Silveira 2001, Ozcelik and Taymaz 2004).

While there are several studies that have studied innovation performance, the relationships between innovation performance, internal resource, external resource and competitive strategy – particularly within the context of developing countries remains relatively unexplored. This study is based on the manufacturing industry in Thailand, a fast industrializing country in South East Asia. As countries such as Thailand continue to grow their economies, there will be an imperative to advance from outsourcing-based contract

manufacturing to innovation-driven manufacturing leadership. Consequently, it is important to understand the relationship between available resources and innovation performance.

Thailand has been described as a laggard in terms of innovation catch up and it has been suggested that the country has reached a plateau as it faces competition from other emerging economy countries such as China and India (Intarakumnerd *et al.* 2002, Wong 2011). The country also needs to move from cost advantages to either product or process innovation and enhance operational capability in order to compete effectively after regional integration planned for 2015 - "*ASEAN Economic Community (AEC) 2015*". However, innovation is central to international competitiveness in developing countries and industrial innovation should be a key part of a country's National Innovation Strategy (NIS). It is therefore important to understand the key levers of innovation performance for Thai manufacturing organizations (Ozcelik and Taymaz 2004, Sun and Du 2010).

Besides basic competitive priority (quality, cost, delivery, and flexibility), innovation has been recognised as one of the primary sources of competitive advantage and sustainable economic growth (Bullinger *et al.* 2004). In this study, we define innovation as new (or novel) things which are applied (created or adopted) by firms to bring value to customers (Avlonitis et al., 1994; Atuahene-Gima, 1996; Hollenstein, 1996; Kleinschmidt and Cooper, 1991). Innovation, as a concept, has been recognised as multi-dimensional and varied in nature. Among the various ways to categorize the dimensions of innovation, product and process innovation are the foremost dimensions (Abernathy and Utterback, 1988; Huban and Bouhsina, 1998; Kraft, 1990; Tidd *et al*., 2005; Tushman and Nadler, 1986). Product innovation is concerned with the development or use of new components, features and

technologies to produce new products (Carranza, 2010; Danneels, 2002; Kleinschmidt and Cooper, 1991; Page, 1993; Verhees and Meulenberg, 2004). Process innovation is concerned with the improvement of production process technologies required to manufacture a product. Since process innovation typically occurs within the internal operations of a firm, it receives relatively less attention compared to product innovation (Kraft, 1990; Reichstein and Salter, 2006; Weiss, 2003). Both product and process innovation emerge as key, inter-connected issues in innovation studies, and the dividing line seems to be somewhat blurred (Tidd *et al*., 2005). What stems from process innovation could appear to be a new product in the marketplace, and therefore can also easily be construed as product innovation. Thus, we observe that the definitions of product innovation in much of the literature often seem to encompass innovations that can also be characterized as process innovations and vice-versa. Therefore, while product innovation is often seen as the cutting edge of innovation in the marketplace, process innovation also plays an equally important strategic role.

In the complexity and uncertainty of the business environment today, innovation has become increasingly important. The impact of innovation on business performance has been demonstrated in a number of studies (Deshpande *et al.* 1993, Yamin *et al.* 1997, Cho and Pucik 2005). Among several streams of research on innovation, the determinants of innovation performance have been the subject of a large portion of existing research (Wolfe 1994). In identifying the determinants of innovation performance, scholars have focused on two major areas. Originally, the studies of enabling factors of innovation have focused on internal factors, including R&D and technology investment, knowledge and creativity management, organisational structure and culture, and cross-functional teams. By focusing

on these factors, studies suggested that innovation performance is largely dependent on the assets or resources which firms own internally (Cooper and Kleinschmidt 1987, Brown and Eisenhardt 1995, Gumusluoglu and Ilsev 2009, Wagner *et al.* 2011). Other studies on innovation have placed more emphasis on the external factors affecting organisations. Among several external factors, inter-organisational relationships have received considerable attention. These studies were built on a premise that firm's capabilities must be expanded beyond what they can develop and own internally (intra-firm) and must include the firms' interactions with other organizations (inter-firm). These studies found the important contributions of inter-organisational networks and partnerships in innovation performance include shorter development processes and novelty (Prajogo *et al.* 2004, Zeng *et al.* 2010, Kang and Park 2012). Innovation is therefore considered in a wider context than that of an individual company, and studies have examined a number of explanatory variables which are located on the boundary of organisations and in their networks. As such, innovation outcomes can be enhanced by developing collaborations with various partners, including customers, suppliers, and R&D organisations (von Hippel 1986, Carbonell *et al.* 2009, Wynstra *et al.* 2010).

The study reported in this paper examines the contributions of internal and external resources of organisations in enhancing innovation performance. This topic has important implications for companies that wish to determine the relative importance of different resources in developing capacity for innovation, as indicated in previous studies (Tushman and Nadler 1986, Koen and Kohli 1998, Nilsson *et al.* 2003). Furthermore, this study also examines the role of competitive strategy as a driving force of both internal and external resources. The role of innovation in enhancing competitive advantage is particularly

paramount in the context of differentiation strategy (Porter 1985), and this paper will investigate the way that differentiation strategy is translated into different kinds of resources for pursuing innovation. The paper addresses three main research questions:

a) Based on the experience of Thai companies, which resources are effective to achieve innovation success? and,
b) How does a company's competitive strategy drive its use of network and internal resources? And
c) How does the use of network and internal resources drive innovation performance?

The paper is structured as follows. The next section describes the competitiveness of the manufacturing industry in Thailand. Then, the theoretical background is reviewed leading to the formulation of the study's research framework and hypotheses. After that, the research methodology is presented and the analysis and results are described. The paper concludes with the keys findings and suggests directions for future research.

2. Competitiveness of Manufacturing Industry in Thailand: Policy and Blueprint for Innovation

The manufacturing industry has become one of the most important sectors in Thailand. Recently, Thai firms have begun to shift their focus from cost advantage manufacturing to innovation-driven manufacturing (Wonglimpiyarat, 2004). This trend has also been driven by major customers from foreign countries, which require Thai manufacturing firms (particularly the OEMs) to acquire and assimilate their innovative capabilities through

foreign direct investment or joint-ventures. As a result of this trend, the Thailand's National Innovation Agency (NIA) was established to promote innovation and technology.

In the past, Thailand had only the innovation development fund under the administration of the National Science and Technology Development Agency (NSTDA). The government's vision of how Thailand could be transformed into an innovation/technology-driven country led to the establishment of the NIA, which was considered as a change agent (Intarakumnerd, 2005). The NIA, established in 2003, was charged with undertaking and supporting innovation and technology development for firms, especially in the manufacturing sector. Other objectives of the NIA include developing linkages between innovators and financial organisations, introducing conceptualization and definition of innovation (products and process) to industry, and promoting and implementing knowledge and creativity management.

The first activity that was carried out by the NIA was to introduce the concept of innovation to Thai firms. Innovation refers "new things or concepts derived from the exploitation of knowledge and creativity, and leading to enhancement of social and economic value" (www.nia.or.th). As the leading agency for innovation development, the NIA has also defined the National Innovation System (NIS) as "the implementation mechanisms that link all stakeholders to foster and embed innovation widely in the country, at all levels and sectors". Three main strategies (see Figure 1) were initiated by the NIA in order to promote national competitiveness.

Figure 1. NIA's three strategies for technology and innovation promotion.

(*Source*: Laosirihongthong and Techawiboonwong, 2009))

To upgrade incremental and radical innovative capability of firm, especially in manufacturing sector, the NIA has been encouraging and providing both technical and financial support for innovation projects proposed by firms (Intarakumnerd and Virasa, 2004). Although each innovation project might have some risks, the NIA believe that by lowering those risks and also sharing those risks, the process of innovation development will be faster. For technical support, the NIA helps identify and verify the appropriate technology for firms, while for financial support, NIA provides direct investment for firms. The second strategy employed by the NIA is promoting organizational culture to support innovation development. The agency tries to create an atmosphere for innovation development and promote the awareness on how much innovation and technology development is important to the competitiveness of firm. For the third strategy, in order to build up the Innovation System, the NIA developed programs in order to enhance the national innovative capability and the ability to develop new markets. NIA had a budgetary

allocation of about 163 million baht (0.01%) in 2007 (www.nia.or.th) from an approximated total national budget of 1.5 trillion baht.

3. Theoretical background and hypotheses

3.1 Resource-Based View Theory

In strategic management research, RBV theory has emerged as one of the theoretical perspectives used to explain persistency in inter-firm performance differences (Barney and Griffin, 1992). According to RBV theory, firms have collections of unique resources and capabilities that are valuable, rare, inimitable and non-substitutable and which are able to provide them with a sustainable competitive advantage. Hence, resources are tangible and intangible assets that are either owned or controlled by a firm, whereas capabilities refer to its ability to exploit and combine resources through organizational routines in order to achieve its objectives (Amabile *et al*, 1996). For this study, by applying RBV theory, it is important to investigate how internal and external resources can be influenced by competitive strategy and enable an organization's capabilities to enhance innovation performance (Galbreath 2005).

As outlined above, we seek to examine the effects of internal and external resources of organisations on innovation performance as well as the relationship between the two resources. In building the theoretical background of this study, we drew upon the concepts of intellectual capital and social capital suggested by Nahapiet and Ghoshal (1998) as primary resources for organisational innovation. According to Nahapiet and Ghoshal (1998), the term "intellectual capital" refers to the knowledge and knowing capability of a social collectivity, such as an organization, intellectual community, or professional practice" (p.

245), while social capital is defined as ”the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit” (p. 243). Intellectual capital is a valuable resource in the form of accumulated knowledge which is embedded within an organisation, while social capital resides in the relationships firms have with their network partners. Nahapiet and Ghoshal (1998) argued that innovation is the ultimate outcome of the creation of new knowledge which results from the combination and interaction between intellectual capital and social capital of firms.

In the light of the above concepts and premises, we selected knowledge management (KM) and creativity management to represent intellectual capital as internal resources which firms develop and own for the purpose of realising innovation. For social capital, we selected two major trading partners with whom most firms intensively interact: customers and suppliers. The relationships with both customers and suppliers represent network resources which firms develop for enhancing innovation. There is evidence that intellectual and social capital are evolving in Thai manufacturing industries. In a study of Malaysian and Thai innovation systems, Wonglimpiyarat (2011) found that both countries were growing their capabilities in knowledge-intensive economic activities and that there was reliance on foreign direct investor to drive innovation-based activities. A similar finding was presented by Wong (2011) who noted that government incentives and infrastructure has encouraged multinational organisations to set up R&D activities in countries including Thailand and Malaysia. Lin (2004) went further and suggested that many manufacturing organisations in several Asian countries, including Thailand had developed design and R&D capabilities. The potential of social capital to influence intellectual capital in Thailand was also identified by

Berger and Diez (2008) when they found that multinational customers setting up R&D units in Thailand required their suppliers to also enhance their R&D efforts. The following section will focus on theoretical arguments of the role of each resource (internal and external) in determining innovation performance.

3.2 The role of strategy as a driver

Competitive strategy reflects the avenue chosen by a firm in outperforming its competitors in specific markets. Among a number of strategies which have been identified, we consider differentiation strategy as the most appropriate for the purpose of this study. According to Porter (1980), a differentiation strategy seeks to achieve competitive advantage by creating a product or service that is perceived as unique. The way firms differentiate themselves from competitors vary depending on the business environment and the markets where they compete. This includes new product features or characteristics, technical superiority, product quality and reliability, comprehensive customer service, and unique competitive capabilities (Thompson *et al.* 2005). Since strategy must be implemented in the form of resources before it can produce the expected outcomes, we consider that differentiation will drive the development of both aspects of resources or capital in order to produce innovation performance.

Miller (1988) affirmed that Porter's generic strategies have many implications for organisational structure and practices. Specifically, differentiation strategy requires a firm to employ highly trained professional technocrats to develop innovative products or processes. Differentiation strategy also requires an organisational structure which promotes communications and collaborations between functions in developing new products or

processes. As such, it is necessary to examine if a differentiation strategy which is focused on innovation drives firms to build resources by incorporating internal and external aspects with which they engage. From a strategic perspective, firms need to develop an intellectual asset management strategy which focuses on knowledge enterprise-level management in order to pursue their innovative strategy (Wiig 1997). Top management should focus their attention on knowledge accumulation because the intellectual capital of their companies and innovation infrastructure are real sources of future competitiveness (Leonard-Barton 1995). In other words, since KM is positively driven by innovation strategy, investment in the development of new knowledge will propel companies into developing innovative products or processes, or even new businesses (Carneiro 2000).

According to Shum and Lin (2007), innovation is a strategic objective. Therefore, organisations, that intend to be innovative, need to differentiate themselves strategically. However, Subramaniam and Youndt (2005) noted that the ability to innovate has a strong association with the ability to utilize knowledge resources and they further suggested that knowledge and skills that facilitate innovation are helped by individuals within the organisation. Furthermore, as part of a strategy to promote innovative capabilities, leaders need to ensure that there are adequate resources and a supportive climate entrenched in the organization (Gumusluoglu and Ilsev 2009). As such we postulate that organizations that develop a differentiation strategy are likely to develop and exploit their knowledge and other internal resources. Specifically, we hypothesise:

H_1: Differentiation strategy has a positive relationship with internal resources

The strategy adopted by an organisation can set it apart from competitors when networked organizations seek for partners. According to Flores *et al.* (2009), partners in innovation networks are typically selected because of their competencies and skills. In a study of the new product development process, Emden *et al.* (2006) identified the importance of strategic and relational alignment with network partner to ensure partnership sustainability. As such, we postulate that organisations that have a differentiated innovation-based strategy will be better at relating with network partners. Specifically, we hypothesise:

H_2: Differentiation strategy has a positive relationship with network resources

3.3 Internal resources

The role of knowledge management (KM) in determining innovation performance is rooted in the concept of "absorptive capacity" developed by Cohen and Levinthal (1990). They defined absorptive capacity as the ability of an organisation to recognize the value of new information, assimilate, and apply it. This capacity is a critical part of an organisation's innovative capability. The importance of KM in innovation has increased as innovation is understood as a process of developing new knowledge to offer solutions (Nonaka 1994). From a market's point of view, the solutions are new products or processes which meet or exceed the needs and expectations of customers. KM has been considered as resource in the sense that it is a management process of intellectual capital in the forms of structural capital and human capital in people (Wiig 1997). Since knowledge is the core ingredient of innovation, firms need to stimulate and improve knowledge of their human capital so as to prepare themselves to face today's rapid changes (Nonaka and Takeuchi 1995). In this regard, knowledge is considered as intellectual capital which is embedded in human capital.

Hiring educated and experienced staff and training are among the prominent practices for improving knowledge. However, not less important is the avenue where knowledge can be further developed through communication and information sharing. Through these processes, knowledge can be amplified and extended by intensive interactions among individuals within an organisation (Carneiro 2000; Yang 2008).

While knowledge reflects the capacity to innovate, people may not exploit their knowledge to produce innovation if they lack motivation and a supportive environment. As such, firms need to provide individuals with avenues which encourage them to stimulate their creativity and generate new ideas (Amabile and Grykiewicz, 1989). The importance of a supportive environment is to provide enabling conditions to channel out individual innovation and translate it into organisational innovation (Angle 1988, Glynn 1996). Several managerial practices which have been considered as facilitating creativity and idea generation include cross-functional teamwork which encourages people to think "outside their box", opportunities (i.e. slack) which allow people to think of ideas outside their routine work, and rewards (tangible and intangible) which provide strong motivation for people to innovate (Kanter 1983, Barney and Griffin 1992).

The combination of knowledge and creativity management is crucial in building up innovative capital in organisations. Subramaniam and Youndt (2005) suggest that knowledge is the major organisational capital required for innovation, and Nonaka and Takeuchi (1995) describe innovative companies as knowledge creating ones. As such, we postulate that organisations that build internal resources in terms of knowledge and creativity will be able to produce better innovation outcomes. Specifically, we hypothesise:

H_3: Internal resources have a positive relationship with innovation performance

3.4 Network resources

A significant body of literature has highlighted the importance of establishing solid networks with customers and suppliers for achieving various aspects of competitive performance, including innovation (Pittaway *et al.* 2004, Romero *et al*, 2011). The idea that innovation should be jointly developed by firms and their supply chain partners (i.e. customers and suppliers) is based on the notion that it can promote capabilities of the collaborating firms in learning, coordinating and integration. Such dynamic capabilities are important to build, integrate, and reconfigure resources to adapt to rapidly changing environments (Leonard-Barton 1992). The creation and leveraging of linkages to market channels and end users requires strong relationships with customers and shaping of their perceptions (Spekman and Carraway 2006). Shaping market perceptions of new products have been instrumental in determining product success (i.e. acceptance) in the market (Peterson *et al.* 2005). Several empirical works (Appiah-Adu and Singh 1998, Han *et al.* 1998, Lukas and Ferrell 2000, Shum and Lin 2007) have shown a positive and significant relationship between customer orientation and organisational innovation in the context of understanding of market needs.

Similarly, literature on innovation has also identified the important role of suppliers in determining innovation performance. Early and close involvement of key suppliers in product development projects positively impact the speed of product development, product quality, and cost (Ragatz *et al.* 1997, Handfield *et al.* 1999, Peterson *et al.* 2005,

Eschenbächer *et al*. 2011). Some other studies have also begun to recognise innovativeness as a key supplier selection criterion in addition to more commonly used criteria (i.e. quality, cost, delivery, and flexibility) (Bhoovaraghavan *et al.* 1996, Boyer and Lewis 2002). This strongly indicates an increased understanding of strategic alliances with suppliers with the goal of enhancing organisational competitiveness through innovation.

The importance of organizational network on innovation development has been increasingly important as firms can benefit from inputs from their business partners in their innovation activities. Specifically, customer relationships allow firms to understand customer needs and expectations and to ensure that the voice of the customers is properly incorporated in the innovation development process (Pietrobelli and Rabellotti 2011). Firms that build relationship with customers beyond their contractual agreement actually build social capital which could give them strategic advantage in innovation (Souitaris 2001). On the other hand, supplier relationships allow firms to ensure that the new product design can be properly realised as suppliers are capable of supplying required components or materials. Indeed, supplier relationships allow suppliers to reinforce knowledge and provide ideas for new product development (Kumar and Subrahmanya 2010). As such, we postulate that firms which build stronger relationships with customer and suppliers have valuable resources for enhancing their innovation performance. Specifically we hypothesise that

H_4: Network resources have a positive relationship with innovation performance

After reviewing literature and identifying the research opportunity as described above, this study aims to examine the effect of internal resources and network resources on innovation

performance. Furthermore, the study addresses the notion of differentiation strategy as a driver of the development of both resources and innovation success. The research framework illustrated in Figure 2 shows a structural path between strategic choice, strategy implementation, and strategic outcomes.

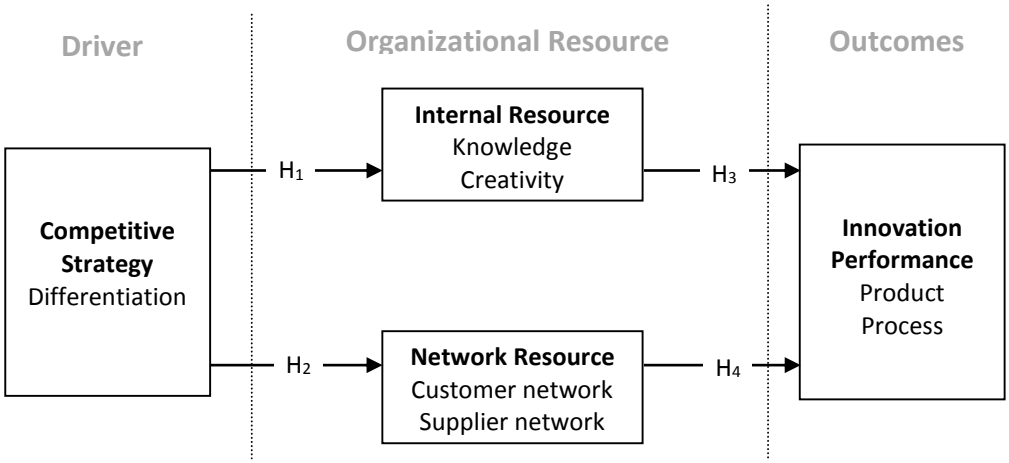


Figure 2 Research framework

Differentiation strategy was considered as a strategic choice which drives the development of organisational capital (i.e. internal and network resources). Internal resources comprise of knowledge management (KM) and creativity management, and network resources comprise of the relationships with customers and suppliers. These two strategic resources then produce strategic outcomes in terms of product and process innovation.

4. Methodology

4.1 Measures

The variables used in this study were measured using scales which were derived from relevant previous studies. The complete description of the seven scales is presented in Table 2.

The competitive strategy measure adopted the scale used in the study by Prajogo (2007) which was based on the scale originally developed by Miller (1988). The differentiation strategy measure comprises of three items which assesses the use of major and frequent product innovation, product novelty, speed of innovation, and the innovative orientation of the firm.

The scales for knowledge management and creativity management were adapted from previous studies by Prajogo *et al* (2004), Tang (1999), Darroch and McNaughton (2002), and Amabile (1996). The content for knowledge management (KM) scale comprises four key practices that were developed based on systematically managing knowledge: facilitating knowledge-related activities such as creation or assimilation of knowledge, transferring knowledge across the organization, maintaining the KM infrastructure, and leveraging knowledge assets to realize their value. The measurement items for creativity and idea generation were focused on key activities which build environments which provide resource and opportunities (time) to generate ideas, working in team (groups) with people with different skills, taking up non-routine and challenging work, and providing reward/recognition for creative ideas.

The scales for measuring customer and supplier relationship were also adapted from the study by Prajogo *et al* (2004) whose content were derived from empirical studies on TQM (Samson and Terziovski, 1999; Dow et al., 1999; Forza and Flipini, 1998). For customer relationship, the content was built on the concept of customer focus which captures a comprehensive range of practices from pre-development of the product to post-delivery

processes and includes key activities, such as searching customer needs, disseminating those needs in the firm, measuring customer satisfaction and resolving customer complaints effectively, and maintaining close relationship with customers. For supplier relationship, the content was focused on selecting the dependable suppliers and building a long-term relationship with those suppliers, including involving them in product design which is an important factor in successful innovation.

As mentioned earlier, this study is focused on two key areas of innovation: product and process. The scales for product and process innovation performance were also adapted from previous studies by Prajogo *et al* (2004), Avlonitis *et al* (1994), Deshpande *et al* (1993), Miller and Friesen (1982), Subramanian and Nilakanta (1986), Tidd *et al* (2005), and Zhuang *et al* (1999). The scales were built on the basic characteristics of innovation which been recognised in the literature, including the number of innovations, the speed of innovation, the level of innovativeness (novelty or newness of the technological aspect), and being the 'first' in the market. The scale of product innovation assess the novelty of the new products and how early they enter the market, the number of new products, the use of latest technologies, and the speed of product development. The scale of process innovation measures the level of technological competitiveness, the use of novel technology and the speed of adopting new technology, and how often the technologies are changed in the organisations.

These criteria were measured on a 5-point Likert scale. We chose 5-point Likert scale because literature on the subject suggests that 5 and 7 points are the optimum and most commonly used range (Malhotra and Petterson 2006). Also, the study by Dawes (2008)

found that the 5- and 7-point scales produced the same mean score as each other, once they were rescaled. The items measuring differentiation strategy, R&D management, knowledge management, customer focus and supplier relationship used 5-point Likert scale ranging from 1 (strongly disagree), 3 (neutral) to 5 (strongly agree). On the other hand, the items measuring product and process innovation used 5-point Likert scale ranging from 1 (well below), 3 (comparable) to 5 (well above). In this regard, we specifically asked the respondents to rate their firm's relative position against the average competitor in the industry.

4.2. Pilot testing

Prior to the mail out, the questionnaire was pre-tested by a group of experts. These consisted of six policy makers of the national innovation system and twelve practitioners from the automotive, electronics components, and telecommunication devices manufacturing industries. For industry practitioners, managers of operational functions (i.e. production, engineering, and production planning and control) who had at least 7 years of experience in managing process and product innovation in their company were invited. For policy makers, middle to top level managers were invited to share their insights on the developed scales.

4.3 Sample and procedures

After pre-testing, a total of 850 questionnaires were sent to companies listed on the Thai Industrial Standards Institute Database: ISIC 29-Machinery and equipment; ISIC 31-Electrical machinery; ISIC 32-Radio, TV, communication equipment; and ISIC 34/35-Motor vehicles/transport equipment. All companies were located in major foreign direct

investment areas including Bangkok, Ayutthaya, and Rayong Province where manufacturing industrial zones have been well established and developed. The reason for selecting these industry classifications is that most companies are OEMs, and their major customers (typically foreign factories) require them to start considering incremental innovation (process and product) as an order-winner. In addition, in order to reflect organizational phenomena in innovation development, the size of population focused on in this study was limited to those 850 companies which have been supported by one of the major investment incentive schemes known as Skills, Technology, and Innovation (STI) Policy. The unit of analysis used in this study is firm level. Of the total of 250 returned questionnaires, 32 were discarded due to excessive missing responses, thus resulting in 218 usable cases, a response rate of 25.65%. All respondents hold managerial position ranging from top management to shop floor operations control level. Table 1 presents the demographic data of respondents.

Table 1 Demographic data for respondents

Position of the respondents	Frequency	%
CEO/General manager/ President/Factory Manager	10	4.6
Divisional Manager/Production/QA/Logistics	77	35.3
Assistant Manager/Engineers/Technical	95	43.6
Leaders/Supervisors	36	16.5
Total	218	100.0

4.4 Non-response bias

To test for non-response bias, we compared the responses of early and late waves of returned surveys based on the assumption that the opinions of late respondents are representative of the opinions of the theoretical non-respondents (Rogelberg and Stanton

2007). Student's t-tests yielded no statistically significant differences between early-wave and late-wave groups, suggesting that non-response bias was not a problem.

4.5 Analytical method

The study analysis was carried out by using Structural Equation Modelling (SEM). SEM was selected because it is suitable for testing relationships between variables developed from a theoretical basis. In addition, SEM enables simultaneous estimation of several separate, but interrelated, relationships between variables. Furthermore, Kunce *et al.* (1975) posited that for SEM, the sample size shall be at least ten times the number of variables in multivariate research. The research model for this study has four variables and so the sample size of 218 makes SEM suited to the analysis.

5. Analysis and results

5.1 Scale validity and reliability

The seven scales incorporated in this study were factor analysed using principal component analysis and varimax rotation to examine their construct validity as employed by Flynn *et al*. (1994), Samson and Terziovski (1999), and Meyer and Collier (2001). The result supports the validity of these seven scales as indicated by their variance explained which exceeded 50% and the load factors of all items within each scale which exceeded 0.5 (see Table 2). The reliability analysis, through calculating the Cronbach's alpha for each scale, revealed that the Cronbach's alpha values for the seven scales surpassed the threshold of 0.7 as suggested by Nunnally (1978). Having met the requirements of construct validity and reliability, the composite scores of each construct were measured by calculating their factor scores from principal component analysis.

5.2 Common method bias

We used Harmann's single-factor test to check for common method variance (Podsakoff and Organ 1986). This test was conducted using principal component analysis and loading all 29 items on one factor. The test checks if one single factor would emerge from factor analysis, which would point towards the presence of common method bias. The factor analysis indicated that less than 25% variance was extracted and that half of the items suffered from poor factor loadings, well below 0.5. These results suggest that common method variance was not a significant problem in the data set.

Table 2. Scale validity and reliability.

Scales	Items	Factor loadings	Cronbach's alpha
Differentiation (Diff)	Major and frequent product innovations	.87	0.84
	Product novelty or speed of innovation	.89	
	Growth-, innovation-, and development-oriented	.87	
Knowledge Management (Know)	Build-up intellectual capital	.79	0.77
	Upgrade knowledge and skills	.77	
	Sharing and disseminating information	.83	
	Managing intellectual assets	.71	
Creativity Management (Crea)	Time and resources for generating ideas	.89	0.88
	Diversely skilled work groups	.91	
	Non-routine and challenging work	.85	
	Reward and recognition for creativity	.79	
Customer relationship (Cust)	Search customer needs and expectations	.77	0.82
	Disseminating customer needs in the firm	.73	
	Maintaining close relationship with customers	.75	
	Effective process for resolving complaints	.76	
	Regularly measure customer satisfaction	.78	
Supplier management (Supp)	Long-term relationships with suppliers	.80	0.75
	Use a supplier rating system to select suppliers	.73	
	Rely on a small number of dependable suppliers	.81	
	Involving suppliers in product design	.68	
Product innovation (Prod)	Level of newness (novelty)	.86	0.88
	Use of latest technology	.90	
	Speed of product development	.87	
	Number of new products	.92	
	Early market entrants	.89	
Process innovation (Proc)	Technological competitiveness	.85	0.89
	Speed of adopting the latest technology	.90	
	Novelty of the technology used	.91	
	Rate of changes in technology	.90	

5.3 Discriminant validity

As an additional check, we conducted discriminant validity analysis to examine if the explanatory and the dependent constructs significantly overlap. As suggested by Venkratraman (1989), discriminant validity was established by conducting Confirmatory Factor Analysis (CFA) on each pair of the constructs in this study. For each pair, CFA was conducted twice. The first CFA allowed the correlation between the two constructs to be freely estimated. The chi-square value of this model was estimated. In the second CFA, the correlation between the two constructs was fixed to 1.0, and the chi-square value of this model was estimated. If the difference between the chi-squares obtained from the first and second CFA (i.e. $\Delta\chi^2$) is greater than the chi-square value at the degree of freedom of 1 and significance level of $p<0.01$ (i.e. 6.64), this provides reasonable evidence of discriminant validity of the constructs (Ahire *et al.* 1996). With seven constructs incorporated in this study, we conducted six chi-square tests. The values of $\Delta\chi^2$ for all tests confirm the discriminant validity of the constructs and lend further evidence towards the lack of common method variance.

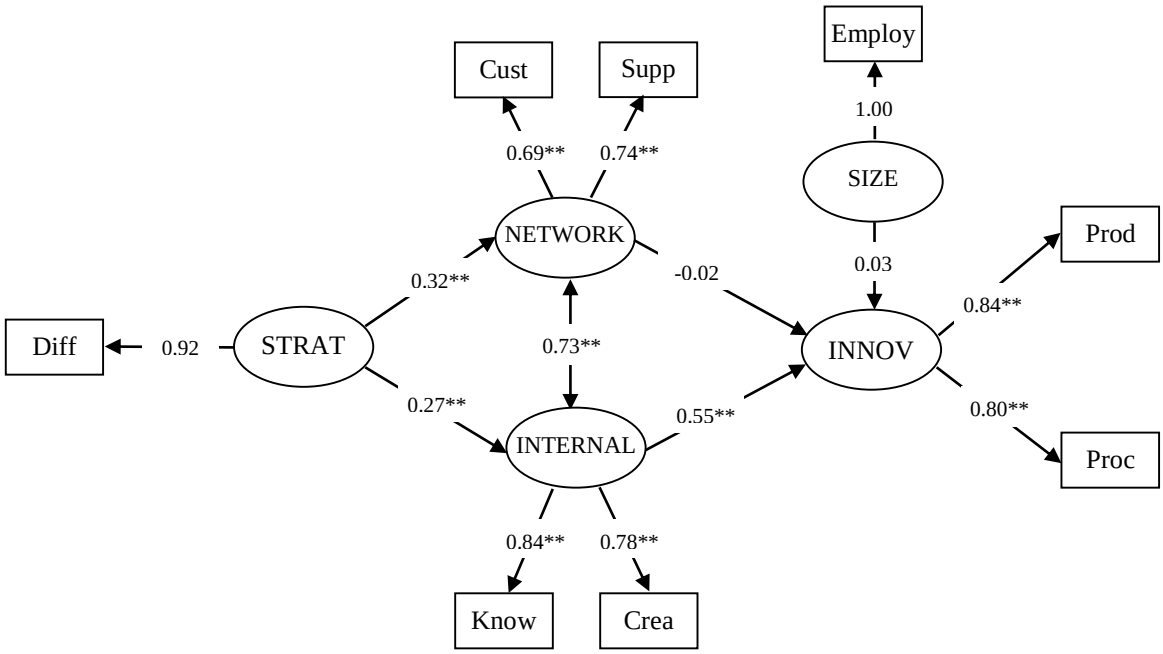
5.4 Composite scores

Once the scale validity and reliability was completed, mean scores were calculated from the scale's items to generate the composite scores for the seven constructs which were subsequently used in the structural relationship analysis (Hair *et al.* 1998). Furthermore, the normality of the four composite scores was checked and the result indicated no violation, with skewness and kurtosis values well within the accepted range (± 1 and <5, respectively) recommended by Hair *et al.* (1998).

5.5 Structural relationships analysis

Structural Equation Modelling (SEM) was used to test the four hypotheses captured in the research framework, and the result is presented in Figure 3. We chose Structural Equation Modelling (SEM) over the other multivariate techniques for several reasons. First, SEM is a confirmatory approach that aims to test the relationship between variables which are developed apriori from a theoretical basis. Therefore SEM fits the purpose of this study based on the framework in Figure 2. Second, while SEM performs a similar function to other multiple regression analysis methods, SEM allows simultaneous estimation of several separate, but interrelated, relationships between variables. This is not possible with other techniques. Such simultaneous analyses will give us a more reliable indication of how all hypothesised relationships in Figure 2 fit with the dataset overall as opposed to more conventional regression analysis where each relationship is analysed separately. Third, SEM provides an explicit representation of a distinction between observed and latent (unobserved) variables. Latent variables are constructs that cannot be directly measured and therefore must be inferred from a set of observed variables which are gathered through data collection procedure. In our research model (Figure 3), four latent variables were established, namely strategy (STRA), internal resources (INTERNAL), network resources (NETWORK), and innovation performance (INNOV). Internal resources were measured by two observed variables: knowledge management (know) and creativity management (crea). Network resources were measured by customer network (cust) and supplier network (supp). Innovation performance was measured by product innovation (proc) and process innovation (proc). Differentiation strategy was measured by a single observed variable: differentiation (diff). As such, the loading path was set at a fixed value

using the square root of the construct reliability presented in Table 2, and its error variance was calculated using the formula: (1 – construct reliability) × variance of the observed variable.



Chi-square = 16.68, df = 15, RMSEA = 0.02, SRMR = 0.03, NFI = 0.97, CFI = 0.99, GFI = 0.98

Figure 3. The structural relationships between strategy, capital, and innovation performance.

The results of SEM showed that at the overall level, the model showed an acceptable fit as indicated by the goodness of fit indices. The Comparative Fit Index (CFI) and Bollen's Fit Index (NFI) exceed the cut off value of 0.95, and the values of RMSEA and SRMR are below the cut off values 0.08 suggested by Hu and Bentler (1999). Since SEM estimates simultaneously both the measurement model and structural relationship of the research model, the results also validate the three latent variables of internal resources (INTERNAL), network resources (NETWORK), and innovation performance (INNOV). The results strongly support the validity of the three latent variables as indicated by strong loading paths (around 0.7 or above) between observed variables and their respective latent variables.

In terms of the structural relationship, the results indicate that the relationship between differentiation strategy and both internal and network resources are positive and statistically significant (0.27 at $p<0.01$ and 0.32 at $p<0.01$ respectively), thus, supporting H_1 and H_2. Internal resources had a positive effect on innovation performance (0.54 at $p<0.01$), supporting H_3, but network resource did not show a similar effect (-0.01 at $p>0.05$), thus, failing to support H_4. These results suggest that innovation among Thai firms is still more determined internally and the direct effect of external parties has remained small. In addition a confirmatory test was performed to check if differentiation strategy had a direct effect on innovation performance other than those mediated by both organizational asset, and the result did not support the direct effect.

Although not hypothesised, the correlation between internal resources and network resources was tested. The result indicated a positive and significant relationship (0.73 at $p<0.01$). This result concurs with what Nahapiet and Ghoshal (1998) emphasised on the

mutual effect between the two elements of organisational capital in the sense that social capital facilitates the development of intellectual capital and vice versa. This correlation promotes the "complementarity" of both aspects of capital in the dynamics of the firm's capabilities.

6. Discussion of the findings

The results showed that differentiation strategy has led firms to develop network asset in addition to internal asset. Firms that strive for differentiating themselves from competitors will build up resources with greater levels of competence internally as well as building up a strong network with competent partners. The findings also showed that differentiation strategy is not directly related to innovation performance. This is an important finding as it indicates that a differentiation strategy, while desirable, may not necessarily lead to innovation. According to Shum and Lin (2007), innovation should be a strategic objective and so the implication from this study is that a differentiation strategy that intends to lead to innovation needs to be explicit and indicate that differentiation would be linked to the level of innovativeness of the organisation.

However, having a strategic intent to differentiate by innovation will not be successful without acknowledging the importance of both internal and network resources. From the point of view of manufacturing organizations in Thailand, only internal resources were shown to be positively and directly related to innovation performance. This finding reinforces previous studies which have underscored the importance of organisational knowledge (intellectual capital) in innovation, and, indeed, considered innovation as a knowledge management process (Nonaka and Takeuchi 1995). Network resources, on the

other hand, can indirectly affect innovation performance through its positive influence on internal resources. Therefore, while several studies including Zeng *et al.* (2010) and Souitaris (2001) have suggested that co-operation with external organisations and particularly customers and suppliers positively correlates with innovation performance, our study shows that such a relationship is, at best, indirect. Hence, from the RBV point of view, both internal (knowledge and creativity) and external (customer and supplier relationships) resources influence the level of absorptive capacity of the organization leading to increase innovation performance. However, the internal resources showed more direct impact on innovation performance.

The implication for Thai manufacturing organizations is that while it is necessary to have a differentiation strategy and also understand and react to supply chain partners' drive for increased innovation, success will only be achieved with the right level of internal resources. Consequently, we can consider internal resources to be the 'gateway' to innovation performance irrespective of whether the initial drive for innovation derived from a differentiation strategy or a network partner(s). According to Pietrobelli and Rabellotti (2011), and Sun and Du (2010), developing countries rarely achieve frontier innovation as they lack the talents and capital for state-of-the-art research. Therefore, Thai organisations which aspire towards innovation need to invest in building up their intellectual capital which include hiring, training, and retaining of staff as well as establishing knowledge management practices and facilities. It has been suggested that with respect to innovation, organisations will typically select partners with the right skills and technology in order to enhance their absorptive capability (Feller *et al*, 2005, Emden *et al.* 2006).

An equally important but less tangible dimension of internal resources is the development of a culture of innovation. While it can be relatively straightforward to invest in training and research facilities, success in innovation also requires a cultural re-invention. The positive impact of organisational culture on innovation potential was identified by Wagner *et al.* (2011). Perhaps more importantly, a study by Leskovar-Spacapan and Bastic (2007) found that the absence of a culture that supports creativity and innovation in employees was a key reason why innovation capabilities in their case study setting were not well developed. The lesson from this study is that in addition to having a differentiation strategy which emphasises innovation and exploiting network resources, manufacturing organizations need to develop a culture of innovation among their workforce. This includes allocating time and resources to promote innovative ideas and providing reward and recognition for multi-functional teams that promote creativity. It is also important to note that commercialization of any innovative ideas should be considered as a focal point in this re-invented organizational culture.

The effectiveness of network resources has yet to be shown in predicting innovation performance. In other words, firms have done it, but have not realised its benefits. This could be one of the most serious challenges for manufacturing organizations in managing innovation. Efficiency and effectiveness in transferring technology among their networks is also crucial to ensure that process innovation, for example, will be adopted, adapted, and assimilated properly. However, given the strong correlation between internal and network resources, we can infer that network resources have an indirect effect on innovation by strengthening the internal resources and shaping ideas of market requirements. Being open to external knowledge sources is an important element for innovative potential. This is

because firms not only need outside sources of cognition and competence to complement their own but also need inter-organisational linkages in order to convert knowledge into new types of knowledge and develop new products, processes or services (Nonaka and Takeuchi 1995). Existing studies suggest that the interaction between external sources of knowledge and in-house R&D activities can stimulate the absorptive capacity of the R&D team, resulting in innovation (Cohen and Levinthal 1990, Berasategi *et al*. 2011).

From our literature survey, it was suggested that level of innovation is closely related to ability to exploit internal and external resources (Lee and Wong, 2011). However, it was unclear if these had to be direct relationships. This study has shown that it is possible to have both direct and indirect relationships. Therefore, while some authors have suggested that network resources are directly important for innovation performance through activities such as joint innovation, relationships and shaping of perceptions (Leonard and Barton, 1992; Spekman and Carraway, 2006; Romero *et al*, 2011), this study has indicated that this may not always be the case and probably more so in cultures where supply chain relationships are ephemeral. Rather, this study has shown that such network resources could, in fact, become drivers of internal resource development by encouraging organisations to focus in their internal knowledge and creativity management. Therefore, a key finding of this study is that while development of internal resources has been traditionally driven by factors such as motivation, creative thinking, rewards, education and internal communication (Kanter, 1983; Amabile *et al*, 1996; Carneiro, 2000; Yang, 2008), network resources can be a strong driver of the decision to develop internal resources. While this finding was not hypothesised originally, it was identified in our analysis.

In the light of the above discussion, it is important to revisit the research questions posed at the start of this paper. The first question sought to identify the resources that are effective to achieving innovation success. The findings suggest that internal resources have a direct and significant relationship with innovation success while external resources do not. The second and third research questions sought to investigate the role of competitive strategy in driving resources and consequently, innovation performance. The findings suggest that competitive strategy has a significant impact on both internal and network resources and consequently, impacts innovation performance indirectly.

Finally, it is important to revisit the role of national agencies such as the NIA in supporting innovation development in the light of the findings of this study. Two of the three key strategies – upgrading innovative capability and promoting innovation culture – relate to internal resources but it is unclear if these are reasons why, in Thai manufacturing organizations, internal resources directly relate to innovative performance and external resources do not. What is clear, however, is that Thai manufacturers have not fully exploited their available external resources with respect to innovation. It has been shown that product innovation is getting increasingly challenging and that collaboration is important for the future of innovation (Emden *et al.* 2006). It has also been suggested that regulatory frameworks are important in shaping the innovation activities of organisations. Therefore the focus of the NIA should be reconsidered to identify opportunities to support Thai manufacturers to fully exploit network resources. Furthermore, opportunities for encouraging a differentiation strategy based on innovation in Thai manufacturing organizations need to be identified by organisations such as the NIA. This is even more

important in developing countries where private investment organisations may not be well entrenched.

7. Conclusions

This study has examined the role of internal and external resources in the innovation performance of Thai manufacturers. It has found direct and positive relationships between the development of a differentiation strategy and development of internal and external resources. However, only internal resources positively and directly impacted innovation performance while external resources can potentially indirectly affect innovation performance by influencing internal resources. The study had also discussed the role of national regulators such as the NIA in the improvement of innovation performance.

The study has implications for both industry and academia. For industry, it is important to understand the significant influence that internal resources hold as the 'gateway' to innovation performance. However, it is perhaps more important to understand the reasons why external resources have not directly impacted innovation performance. This may mean that Thai manufacturers need to become even closer to their supply chain partners and start to consider activities such as joint development of new products. For the NIA, there needs to be a re-evaluation and expansion of their focus to include activities that support greater exploitation of network resources. For academia, the research in innovation in developing economies needs more drive particularly as these economies become increasingly important in global manufacturing and world trade. Within the context of Thai manufacturers, there needs to be research on their cultural leanings with respect to

innovation and an understanding of the barriers that have affected full exploitation of network resources.

We conclude by discussing the limitations of the study. The study is based on the experience of Thai companies and its applicability to other countries may be dependent on the level of innovation development, choice of competitive strategy and type of national culture. This study could be improved by incorporating other determinants, including R&D and technology investment. Also, the research framework can be tested by considering the age of company to examine possible differences of the effectiveness of both assets. It is also worthwhile to replicate this study in developed or industrialized countries and compare the relationships between strategy, asset, and performance of innovation.

References

Abernathy, W.J. and Utterback, J. M. 1988. Innovation over time and in historical context. In: Tushman, M. L. and MOORE, W. L. (eds.). *Readings in the Management of Innovation*. 2nd ed. New York: Harper Business.

Ahire, S.L., Golhar, D.Y. and Waller, M.W., 1996. Development and validation of TQM implementation constructs. *Decision Sciences*, 27 (1), 23–56.

Amabile T.M., Conti, R., Coon, H., Lazenby, J. and Herron, M., 1996. Assessing the work environment for creativity. *Academy of Management Journal,* 39 (5), 1154–1184.

Amabile T.M. and Grykiewicz N D., 1989. The Creative Environment Scales: Work Environment Inventory. *Creativity Research Journal*, 2, 231–253.

Angle H.L., 1988. Psychology and organizational innovation. In: A.H. Van de Ven, H. Angel, and M.S. Poole, eds., *Research on the management of innovation*. Ballinger, Cambridge, MA.

Appiah-Adu, K. and Singh, S., 1998. Customer orientation and performance: a study of SMEs. *Management Decision*, 36 (6), 385–394.

Atuahene-Gima, K., 1996. Market orientation and innovation. *Journal of Business Research*. 35(2), 93-103.

Avlonitis, G.J., Kouremenos, A. and Tzokas, N., 1994. Assessing the innovativeness of organizations and its antecedents: project innovstrat. *European Journal of Marketing*, 28 (11), 5–28.

Barney, J.B. and Griffin, R.W., 1992. *The management of organization: strategy, structure, behavior*, Houghton Mifflin Company, Boston.

Berger, M. and Diez, J., 2008. Can host innovation systems in late industrializing countries benefit from the presence of transnational corporations? Insights from Thailand's manufacturing industry. *European Planning Studies*, 16 (8), 1047–1074.

Berasategi L., Arana J., and Castellano E. 2011. A comprehensive framework for collaborative networked innovation. *Production Planning & Control*. 22(5-6), 581-593.

Bhoovaraghavan, S., Vasudevan, A. and Chandran, R., 1996. Resolving the process vs. product innovation dilemma: a consumer choice theoretic approach. *Management Science*, 42, 232–246.

Boyer, K.K. and Lewis, M.W., 2002. Competitive priorities: investigating the need for trade-offs in operations strategy. *Production and Operations Management*, 11 (1), 9–20.

Brown, S.L. and Eisenhardt, K.M., 1995. Product development: past research, present findings, and future directions. *Academy of Management Review*, 20 (2), 343–378.

Bullinger, H-J, Auernhammer, K. and Gomeringer, A., 2004. Managing innovation networks in the knowledge-driven economy. *International Journal of Production Research*, 42 (17), 3337–3353

Carbonell, P., Rodrı´guez-Escudero, A. and Pujari, P., 2009. Customer involvement in new service development: an examination of antecedents and outcomes. *Journal of Product Innovation Management*, 26, 536–550.

Carneiro, A., 2000. How does knowledge management influence innovation and competitiveness? *Journal of Knowledge Management*, 4 (2), 87–98.

Childe S.J. 2009. Operations management research agenda. *Production Planning &Control*. 20(5), 383-384.

Cho, H.J. and Pucik, V., 2005. Relationship between innovativeness, quality, growth, profitability, and market value. *Strategic Management Journal*, 28 (6), 555–575.

Cohen, W.M. and Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128–152.

Cooper, R.G. and Kleinschmidt, E.J., 1987. New products: what separates winners from losers? *The Journal of Product Innovation Management*, 4 (3), 169–184.

Carranza, J. E. 2010. Product innovation and adoption in market equilibrium: The case of digital camera. *International Journal of Industrial Organization*, 28, 604-618.

Danneels, E. 2002. The dynamics of product innovation and firm competences. *Strategic Management Journal*, 23, 1095–1121.

Darroch, J. and McNaughton, R., 2002. Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, 3 (3), 210–222.

Dawes, J., 2008. Do data characteristics change according to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research*, 50 (1), 63-77

Deshpande, R., Farley, J.U. and Webster, Jr. F.E., 1993. Corporate culture, customer orientation, and innovativeness in Japanese firms: a Quadrad analysis. *Journal of Marketing*, 57 (1), 23–27.

Dow, D., Samson, D. and Ford, S., 1999. Exploding the myth: do all quality management practices contribute to superior quality performance? *Production and Operations Management*, 8 (1), 1–27.

Eschenbächer J., Seifert M., and Thoben K-D., 2011. Improving distributed innovation processes in virtual organisations through the evaluation of collaboration intensities. *Production Planning & Control*, 22(5-6), 473-487

Emden, Z., Calantone, R. and Droge, C., 2006. Collaborating for new product development: selecting the partner with maximum potential to create value. *Journal of Product Innovation Management*, 23, 330–341

Feller J., Hirvensalo A., and Smeds R. 2005. Inter-partner process learning in collaborative R&D—a case study from the telecommunications industry. *Production Planning & Control*. 16(4), 388-395.

Flores, M., Boër, C., Huber, C., Plüss, A., Schoch, S. and Pouly, M., 2009. Universities as key enablers to develop new collaborative environments for innovation: successful experiences from Switzerland and India. *International Journal of Production Research*, 47 (17), 4935–4953

Flynn, B.B., Schroeder, R.G. and Sakakibara, S., 1994. A framework for quality management research and an associated measurement instrument. *Journal of Operations Management*, 11 (4), 339–366.

Forza, C. and Filippini, R., 1998. TQM impact on quality conformance and customer satisfaction: a causal model. *International Journal of Production Economics*, 55 (1), 1–20.

Galbreath J., 2005. Which resources matter the most to firm success? An exploratory study of resource-based theory. *Technovation*, 25(9), 979–987.

Glynn, M.A., 1996. Innovative genius: a framework for relating individual and organizational intelligences to innovation. *Academy of Management Review*, 21 (4), 1081–1111.

Gumusluoglu, L. and Ilsev, A., 2009. Transformational leadership and organizational innovation: the roles of internal and external support for innovation. *Journal of Product Innovation Management*, 26, 264–277

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C., 1998, Multivariate Data Analysis, Fifth Edition. Upper Saddle River, New Jersey: Prentice-Hall International Inc.

Han, J.K., Kim, N., and Srivasta, R.K., 1998. Market orientation and organisational performance: is innovation a missing link? *Journal of Marketing*, 62 (4), 30–45.

Handfield, R.B., Ragatz, G.L., Petersen, K.J. and Monczka, R.M., 1999. Involving suppliers in new product development. *California Management Review*, 42 (1), 59–82.

Hollenstein, H. 1996. A composite indicator of a firm's innovativeness - An empirical analysis based on survey data for Swiss manufacturing. *Research Policy*, 25(4), 633-645.

Hu, L. and Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1–55.

Huban, J. P. and Bouhsina, Z. 1998. Innovation and the quality of labour factor: An empirical investigation in the French food industry. *Small Business Economics*. 10. 389-400.

Intarakumnerd, P., 2005. Government mediation and transformation of Thailand's National Innovation System. *Science, Technology and Society*. 10(1), 87-104

Intarakumnerd, P., Chairatana, P. and Tangchitpiboon, T., 2002. National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, 31, 1445– 1457.

Intarakumnerd, P. and Virasa, T., 2004. Government policies and measures in supporting technological capability development of latecomer firms: A tentative taxonomy. *Journal of Technology Innovation*, 12(2), 1-19.

Kang, K-M. and Park, H., 2012. Influence of government R&D support and inter-firm collaborations on innovation in Korean biotechnology SMEs. *Technovation*, 32 (1), 68–78.

Kanter, R.M., 1983. The change master - innovation & entrepreneurship in the American corporation. Simon & Schuster, New York.

Kleinschmidt, E. J., Cooper, R. G. 1991. The Impact of product innovativeness on performance. *Journal of Product Innovation Management*. 8(4), 240-251.

Koen, P.A. and Kohli, P., 1998. Idea generation: who has the most profitable ideas? *Engineering Management Journal*, 10 (4), 35–40.

Kraft, K. 1990. Are product- and process- innovations independent of each other? *Applied Economics*, 22, 1029-1038.

Kramer J.P., Marinelli E., Lammarino S. and Diez J.R., 2011. Intangible assets as drivers of innovation: Empirical evidence on multinational enterprises in German and UK regional systems of innovation. *Technovation*, 31(9), 447–458.

Kumar, R.S. and Subrahmanya, M.H.B., 2010. Influence of subcontracting on innovation and economic performance of SMEs in Indian automobile industry. *Technovation*, 30, 558–569.

Kunce, J.T., Cook, D.W. and Miller, D.E. (1975), "Random variables and correlational overkill", *Educational and Psychology Measurement*, Vol. 35 pp. 529-34.

Laosirihongthong T., and Techawiboonwong A. (2009). Adoption of global operations strategy: A resource-based view perspective. *Proceedings of the 14th Cambridge International Manufacturing Symposium*, 24-25 September, Cambridge, UK.

Lee, K.B. and Wong V., 2011. Identifying the moderating influences of external environments on new product development process. *Technovation*, 31 (10–11), 598–612.

Leskovar-Spacapan, G. and Bastic, M., 2007. Differences in organizations' innovation capability in transition economy: internal aspect of the organizations' strategic orientation. *Technovation*, 27, 533–546

Leonard-Barton, D., 1992. Core capabilities and core rigidities: a paradox in new product development. *Strategic Management Journal*, 13 (2), 111–125.

Leonard-Barton, D., 1995. Wellsprings of Knowledge - Building and Sustaining the Sources of Innovation. Harvard Business School Press, Boston, MA.

Lin, B-W., 2004. Original equipment manufacturers (OEM) manufacturing strategy for network innovation agility: the case of Taiwanese manufacturing networks, *International Journal of Production Research*, 42 (5), 943–957

Lukas, B.A. and Ferrell, O.C., 2000. The effect of market orientation on product innovation. *Journal of the Academy of Marketing Science*, 28 (2), 239–247.

Malhotra, N. and Peterson, M., 2006. Basic marketing research: a decision-making approach, Second Edition. New Jersey: Prentice Hall.

Meyer, S.M. and Collier, D.A., 2001. An empirical test of the causal relationships in the Baldrige Health Care Pilot Criteria. *Journal of Operations Management*, 19 (4), 403–426.

Miller, D., 1988. Relating Porter's business strategies to environment and structure: analysis and performance implications. *Academy of Management Journal*, 31 (2), 280–308.

Miller, D. and Friesen, P.H., 1982. Innovation in conservative and entrepreneurial firms: two models of strategic momentum. *Strategic Management Journal*, 3 (1), 1–25.

Nahapiet, J. and Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23 (2), 242–266.

National Innovation Agency (www.nia.or.th).

Nieto, M.J. and Santamaría, L., 2007. The importance of diverse collaborative networks for the novelty of product innovation. *Technovation*, 27(6-7), 367-377.

Nilsson, L., Elg, M. and Bergman, B., 2003. Managing ideas for the development of new products. *International Journal of Technology Management*, 24 (5, 6), 498.

Nonaka, I., 1994. A dynamic theory of organisational knowledge creation. *Organization Science*, 5 (1), 14–37.

Nonaka, I. and Takeuchi, H., 1995. The knowledge creating company: how Japanese companies crate the dynamics of innovation. Oxford University Press, Oxford.

Nunnally, J., 1978. *Psychometric theory*. McGraw-Hill, New York.

Oszelick, E. and Taymaz, E., 2004. Does innovativeness matter for international competitiveness in developing countries? The case of Turkish manufacturing industries. *Research Policy*, 33, 409–424

Page, A. 1993. Assessing new product development practices and performance: Establishing crucial norms. *Journal of Product Innovation Management*, 10, 273-290.

Peterson, K.J., Handfield, R.B. and Ragatz, G.L., 2005. Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, 23, 371–388.

Pietrobelli, C. and Rabellotti, R., 2011. Global value chains meet innovation systems: are there learning opportunities for developing countries? *World Development*, 39 (7), 1261–1269.

Pittaway, L., Robertson, M., Munir, K., Denyer, D. and Neely, A., 2004. Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews*, 5/6 (3/4), 137–168.

Podsakoff, P.M. and Organ, D., 1986, Self-reports in organizational research. *Journal of Management*, 12 (4), 531–544.

Porter, M. E., (1980). Competitive Strategy: Techniques for analyzing industries and competitors. Free Press, New York.

Porter, M.E., 1985. Competitive advantage: creating and sustaining superior performance. Free Press, New York.

Prajogo, D., Power, D. and Sohal, A., 2004. The role of trading partner relationships in determining innovation performance: an empirical examination. *European Journal of Innovation Management*, 7 (3), 178–186

Prajogo, D. I., 2007. The relationship between competitive strategies and product quality. *Industrial Management & Data Systems*, 27 (1), 69-83

Ragatz, G.L., Handfield, R.B, and Scannell, T.V., 1997. Success factors for integrating suppliers into new product development. *The Journal of Product Innovation Management*, 14 (3), 190–202.

Reichstein, T. and Salter, A. 2006. Investigating the sources of process innovation among UK manufacturing firms. *Industrial and Corporate Change*, 15, 653–682.

Rogelberg, S.G. and Stanton, J.M., 2007. Understanding and dealing with organizational survey nonresponse. *Organizational Research Methods*, 10 (2), 195–209

Romero D., Molina A., and Camarinha-Matos L-M. 2011. Co-innovation and collaborative networks. *Production Planning & Control*. 22(5-6). 445-446.

Samson, D. and Terziovski, M., 1999. The relationship between total quality management practices and operational performance. *Journal of Operations Management*, 17 (4), 393–409.

Shum, P. and Lin, G., 2007. A world class new product development best practices model. *International Journal of Production Research*, 45 (7), 1609–1629

Silveira, G., 2001. Innovation diffusion: research agenda for developing economies. *Technovation*, 21, 767–773

Souitaris, V., 2001. External communication determinants of innovation in the context of a newly industrialised country: a comparison of objective and perceptual results from Greece. *Technovation*, 21, 25–34.

Spekman, R.E. and Carraway, R., 2006. Making the transition to collaborative buyer-seller relationships: an emerging framework. *Industrial Marketing Management*, 35 (1), 10–27.

Subramanian, A. and Nilakanta, S., 1996. Organizational innovativeness: exploring the relationship between organizational determinants of innovation, types of innovations, and measures of organizational performance. *Omega*, 24 (6), 631–647.

Subramaniam, M. and Youndt, M., 2005. The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, 48 (3), 450–463.

Sun, Y. and Du, D., 2010. Determinants of industrial innovation in China: evidence from its recent economic census. *Technovation*, 30, 540–550.

Tang, H.K., 1999. An inventory of organizational innovativeness. Technovation, 19, 41–51.

Thompson A.A., Strickland A.J. and Gamble J.E., 2005. *Crafting and executing strategy*. McGraw Hill, Boston, MA.

Tidd, J., Bessant, J. and Pavitt, K., 2005. *Managing innovation: integrating technological, market, and organizational change*. John Wiley & Sons Ltd., Chichester, England.

Tushman, M. and Nadler, D., 1986. Organizing for innovation. *California Management Review*, 28 (3), 74–92.

Verhees, F. J. H. M. and Meulenberg, M. T. G. 2004. Market orientation, innovativeness, product innovation, and performance in small firms. *Journal of Small Business Management*, 42, 134-154.

Venkatraman, N., 1989. The concept of fit in strategy research: toward verbal and statistical correspondence. *Academy of Management Review,* 14 (3), 423–444.

Vega-Jurado, J., Gutiérrez-Gracia, A., Fernández-de-Lucio, I. and Manjarrés-Henríquez, L., 2008. The effect of external and internal factors on firms' product innovation. *Research Policy*, 37 (4), 616–632.

Von Hippel, E., (1986). Lead users: a source of novel product concepts. *Management Science*, 32 (7), 791–805.

Wagner, H., Morton, S., Dainty, A. and Burns, N., 2011. Path dependent constraints on innovation programmes in production and operations management. *International Journal of Production Research*, 49(11), 3069–3085.

Weiss, P. 2003. Adoption of product and process innovations in differentiated markets: The impact of competition. *Review of Industrial Organization*, 23, 301–314.

Wiig, K.M., 1997. Knowledge management: an introduction and perspective. *Journal of Knowledge Management*, 1 (1), 6–14.

Wolfe, R.A., 1994. Organizational innovation: review, critique, and suggested research directions. *Journal of Management Studies*, 31 (3), 405–431.

Wong, C-Y., 2011. Rent-seeking, industrial policies and national innovation systems in Southeast Asian economies. *Technology in Society*, 33, 231–243.

Wonglimpiyarat, J., 2004. The use of strategies in managing technological innovation. *European Journal of Innovation Management*, 7(3), 229 - 250.

Wonglimpiyarat, J., 2011. Government programmes in financing innovations: comparative innovation systems cases of Malaysia and Thailand. *Technology in Society*, 33, 156–164.

Wynstra, F., Corswant, F. and Wetzels, M., 2010. In chains? An empirical study of antecedents of supplier product development activity in the automotive industry. *Journal of Product Innovation Management*, 27, 625–639.

Yamin, S., Mavondo, F., Gunasekaran, A. and Sarros, J., 1997. A study of competitive strategy, organizational innovation and organizational performance among Australian manufacturing companies. *International Journal of Production Economics*, 52 (1/2), 161–172.

Yang J. 2008. Antecedents and consequences of knowledge management strategy: the case of Chinese high technology firms. *Production Planning & Control*, 19(1). 67-77.

Yeung, A.C.L., Lai, K. and Yee, R.W.Y., 2007. Organizational learning, innovativeness, and organizational performance: a qualitative investigation. *International Journal of Production Research*, 45 (11), 2459–2477

Zeng, S., Xie, X. and Tam, C., 2010. Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, 30, 181–194.

Zhuang, L., Williamson D. and Carter, M., 1999. Innovate or liquidate - are all organisations convinced? A two-phased study into the innovation process. *Management Decision*, 37 (1), 57–71.