UNIVERSITY OF SOUTHERN QUEENSLAND

THE IMPACT OF TECHNOLOGICAL CAPABILITY ON POWER, TRUST AND INTER-FIRM RELATIONSHIP PERFORMANCE

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ABSTRACT

This study investigates the impact of technological capability on power, trust and inter-firm relationship performance between manufacturers and their suppliers within the supply chain context. This study also verifies the mediating effect of power and trust in the relationship between technological capability and inter-firm relationship performance. Building from the perspective of supply chain management, Resource Base View, power, and trust theories; a conceptual model is developed and the hypotheses are drawn to show the interrelationship between these constructs.

This study adopts a mixed method approach where data is collected in two phases. Phase One consists of a quantitative based approach whereby data is obtained through paper-based postal survey questionnaires. Phase Two involves qualitative method and the data is acquired through a series of case study interviews. In phase one, the survey questionnaires were mailed to 800 Malaysian manufacturing companies listed in the Federation of Malaysian Manufacturers Directory 2009. A total of 132 surveys were received of which 126 responses were usable, signifying a response rate of 15.75 per cent. The partial least square (PLS) statistical approach has been conducted to test the research hypotheses. Meanwhile in phase two, the data was collected from five manufacturing organisations. Case study approach was chosen and the data was analysed by identifying specific themes that emerged from the interviews, followed by cross case analysis.

The quantitative results indicate that there is an association between technological capability and the inter-firm relationship performance. The PLS path coefficient shows positive direction (0.2782) which is significant at $p<0.001$. This finding is supported by the qualitative result that found the association between both constructs and thus confirms that the Resource Based View theoretical perspective can be applied to the association between firm competitive advantage and the relationship performance in the context of Malaysian manufacturing supply chain.

The role of relationship power (which focuses on the non-mediated power based in the quantitative phase) is also examined in this research. The quantitative phase confirms that there is a positive association (PLS path coefficient of 0.6943) between technological capability and power which is significant at $p<0.001$. The association between power and the inter-firm relationship performance is also found to be positive (PLS path coefficient of 0.2710) and significant at $p<0.005$. Interestingly, the quantitative analysis also found that power significantly mediates the positive relationship between technological capability and inter-firm relationship performance. The Sobel test of mediation effect indicates z value of 2.652 and significant at $p<0.01$. Meanwhile, the qualitative phase confirms these associations with a caution that technological capability might also create coercive power along with the non-mediated power based in the relationship.

The empirical results from the quantitative data analysis also reveal the association between technological capability, trust and inter-firm relationship performance constructs. The findings suggest that there is a positive association between technological capability and trust at significant level of $p<0.001$ (PLS path coefficient of 0.6170). The association between trust and the inter-firm relationship performance is also found to be positive (PLS path coefficient of 0.3252) and significant at $p<0.001$. This research also reports the mediation impact of trust on the positive association between technological capability and inter-firm relationship performance. The Sobel test of mediation effect indicates z value of 3.703 and significant at $p<0.001$. As expected, the qualitative findings provide support for these associations and, interestingly, add to the possibility of benevolence trust occurrence in a relationship as a result of technological capability deployment.

This research contributes to the literature by offering further understanding of Resource Based View theory in the context of a developing country viewpoint (Malaysia) since previous studies have largely focused on developed countries. This research also expands the theoretical application of Resource Based View by examining the mediating effects of both power and trust constructs in enhancing relationship performance outcomes and thus provides linkages between Resource Based View theory, power-dependency theory and trust theory. This study also contributes to the knowledge by extending the previous research on measuring technological capability, power, trust and inter-firm relationship performance by conceptualising them as multi-dimensional constructs.

This thesis recommends that policy makers should encourage Malaysian manufacturers to focus on the development of inter business relationships, and technological capability in order to sustain a high level of business performance among them. In this notion, emphasis should be given by the policy maker to continuously providing support in high technology activities such as promoting the growth of R&D activities. Finally, this research is useful to the business community in the manufacturing sector since it provides useful information to management on the advantages of possessing technological capability which can form the basis of making future decisions in technology related expansions.

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LIST OF ACRONYMS AND ABBREVIATIONS

AMT	Advance Manufacturing Technology
APITD	Action Plan for Industrial Technology Development
AVE	Average Variance Extracted
CBSEM	Covariance base Structural Equation Modelling
CFA	Confirmatory Factor Analysis
EDI	Electronic Data Interchange
FMM	Federation of Malaysian Manufacturers
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IFR	Inter-firm Relationship Performance
IMP	Industrial Master Plan
IT	Information Technology
KEMP	K-Economy Master Plan
MIMOS	Malaysian Institute of Micro Electronics Systems
MNC	Multi-National Corporation
MSC	Multimedia Super Corridor
NIE	New Industrializing Economies
PLS	Partial Least Square
R&D	Research and Development
RFID	Radio Frequency Identification Device
SCM	Supply Chain Management
SEM	Structural Equation Modelling
SME	Small and Medium Enterprises

CHAPTER 1: INTRODUCTION

1.1 Research background and problem statement

Recent factors in today's world such as globalisation, maturing markets and rapid technological change, and intensified and swift change within marketplace competition have fostered manufacturers to seek new ways of establishing and maintaining sustainable competitive advantage (Santoro & Chakrabarti 2002). There are two major competitive advantages in business that have been widely documented in the literature, namely:

1. Firms develop closer inter-firm relationships within the supply chain as part of sustaining competitive advantage. Evidence shows that, increasingly, firms realise the importance of engaging in strategic collaborations to survive in the current dynamic business environment and, therefore, engage in developing inter-firm relationships, especially within the supply chain, to create more effective links with their trading partners (Corsten & Felde 2005; Gyau & Spiller 2008; Ryssel, Ritter & Gemunden 2004; Sengun & Wasti 2009; Thakkar, Kanda & Deshmukh 2008). Manufacturers, together with their major suppliers, realise the need to form closer alliances in order to reap mutual benefits in technology, skills and other important resources.

2. Technological capability is one of the foundations of a firm's competitive capability. Technological capability has been acknowledged as being the root of a firm's competitive advantage in many literatures (Chang 1996; Hsieh & Tsai 2007; Tsai 2004). It helps firms to increase their ability to apply technical knowledge in creating and delivering innovative products that consumers may value; and thus affect the overall business performance and new product development performance of a firm (Wang et al. 2006).

Indeed, the relationship between manufacturers and their suppliers has evolved over the past two decades from merely transactional processes based on arms-length agreements to much closer collaboration processes based on trust and technology. Researchers have highlighted a logical and compelling argument for the need to develop closer relationships to foster a win-win environment. They argue that a closer inter-firm relationship between manufacturers and their key suppliers can play an important role in increasing the organization's capability, as well the ability by its supply chain to respond quickly to any unpredictable changes (Hoyt & Huq 2000).

It is argued that an inter-firm relationship occurs when two or more business entities commit to enter a business relationship. It is also believed that they enter a relationship for various specific reasons, such as outsourcing, uninterrupted supply of material, etc., and the end result is both sides are able to reap benefits in terms of overall business performance and non-financial performance such as future collaboration in new product development (Ryssel, Ritter & Gemunden 2004; Vlosky, Fontenot & Blalock 2000). These benefits actually form the backbone of the concept of inter-firm relationship

performance. It is an extension of the of inter-firm relationship concept and is gauged through the perception of whether the relationship is perceived to be productive and rewarding (Gyau & Spiller 2008).

Over time, technological capabilities are able to increase competency within the supply chain by integrating the systems and processes in the chain. The development of technological competencies further supports the manufacturer-supplier relationship by offering a seamless coordination of almost all activities among the members in the supply chain (Abdullah 2009). In support of this notion, Bongsug et al. (2005) reveal the importance of technology as one of the components in enabling supply chain integration. They report that technology can help to increase the information processing of a relationship and, thus, support greater inter-firm cooperation while reducing the uncertainty in the collaboration.

In a similar vein, Carr and Smeltzer (2002) in their research on the relationship between technological use and the manufacturer-supplier relationship found that maintaining up-to-date information systems and having direct computer-to-computer links with suppliers is crucial in the manufacturer-supplier relationship.

At first glance, these evidences may suggest that technological capability promotes closer relationships between manufacturers and their suppliers. Nevertheless, in a recent comparative study between countries, Patrakosol and Lee (2009) reveal that technology is positively related to inter-firm relationship performance, but is only true in certain countries - with insignificant results in other countries. These findings reveal the

dynamic association between these two constructs and, thus, the catalyst for further investigation.

This initial perception also fails to take into account the existence of power and trust in business relationships. For example, Boeck and Wamba (2008) argue that the adoption of technology may lead to potential conflict rather than benefit to inter-organisational relationships. They contend that there is the possibility that firms may initially encourage other members in the partnership to adopt the same technology. Subsequently, any disagreement on this matter will result in the exercise of power to generate pressure on members - which may create conflict in the relationship.

The concepts of power and trust are both complementary and contrary to each other in social behaviour study. As such, they need to be managed simultaneously to ensure the efficiency and effectiveness of a business relationships (Ireland & Webb 2007). In a complementary nature, both have the ability to substitute for each other when one fails to reach the expected outcome. For example, firms may exercise an appropriate level of power in relationships, together with contractual and competence trust, to achieve the desired outcome. In this sense, power exists in the form of a non-coercive manner that binds relationships more than what has been stated in the business contract, while trust is a complementary control to prevent extra cost arising from opportunistic behaviour (Ireland & Webb 2007; Ke et al. 2009; Maloni & Benton 2000).

On the other hand, power and trust may work against each other in a relationship. Researchers argue that power originates from scarce resources possessed by one partner

in a relationship. Restricting access by other parties to these resources will raise questions as to a partner's intention and can be perceived as denying other partners the opportunity for survival. As a result, the level of trust between these firms may deteriorate and, thus, affect the inter-firm relationship (Ireland & Webb 2007; Ke et al. 2009).

The purpose of this research is to investigate the impact of technological capability on power, trust and inter-firm relationship performance within the context of Malaysia's manufacturing supply chain. This study also introduces the mediating effects of both power and trust in the relationship between technological capability and inter-firm relationship performance. Research into technological capability is still sparse, especially in the operational management field (Kam 1999; Tuominen, Rajala & Möller 2004; Wang et al. 2006) both in developing and developed countries and, to date, there is no known research linking it with power and trust and their subsequent association with inter-firm relationship performance within the supply chain context. Thus, this study investigates the impact of technological capability on power, trust, and inter-firm relationship performance within the perspective of a developing country, specifically Malaysia.

1.2 Research question

The main research question for this research is addressed below:

What impact does technological capability have on power, trust and inter-firm relationship performance?

The sub-questions derived from the above research question are as follows:

- *What impact does technological capability have on inter-firm relationship performance?*
- *What impact does technological capability have on power?*
- *What impact does technological capability have on trust?*

1.3 Motivation

Possession of capability in technology has been regarded as one of the sources of competitive advantage for a firm. In the supply chain context, this capability has been extended beyond the internal organisation to between organisations in the supply chain (Ritter & Walter 2006). However, most of the empirical evidence focuses on unique capability such as RFID, e-procurement, EDI and IT (Abdullah 2009; Boeck & Wamba 2008; Chong & Ooi 2008; Kamaruddin & Udin 2009; Paterson 2007; Tan et al. 2009) to the B2C or C2C relationships (Wong, Chan & Leung 2005). The impact of multidimensional constructs of technological capability on power, trust and inter-firm relationship performance within the supply chain context has yet to be explored

especially in developing nations like Malaysia and this is the prime motivation for this study.

Conversely, power and trust are closely related to the study of inter-firm relationships. Both constructs have been identified in most prior research as being important factors in the business relationship (Bachmann 2001; Benton & Maloni 2005; Brown, Lusch & Nicholson 1995; Ke et al. 2009; Ratnasingam 2000; Sengun & Wasti 2009; Zhao et al. 2008). However, there is no known research being conducted to gauge their relationship with technological capability as mediators and this has provided extra focus for this study.

Finally, Malaysia is among the world's fastest growing economies and it has been classified as one of East Asia's new industrialized economies (NIE). The manufacturing industry has been a main contributor behind this economic achievement (Economic Planning Unit 2006; Sundaram & Felker 1999). Nevertheless, Lall (1999) found that the relationship performance between firms in this country is questionable. After nearly ten years since Lall's (1999) statement, the Federation of Malaysian Manufacturers (FMM) argue in its latest manufacturing report that inter-firm cooperation and collaboration among Malaysian manufacturing companies is still low and needs to improve. The FMM has urged manufacturers to strengthen their business relationships and to become actively involved in new business collaboration in order to be competitive in both domestic and international markets (FMM 2008).

1.4 Expected contribution

The study is expected to explain the impact of technological capability on power and trust and inter-firm relationship performance. Therefore, there are several contributions which can be expected from this study. This study seeks to contribute to the literature by providing empirical evidence relating to technological capability, power, trust and inter-firm relationship performance within the supply chain context.

The association between technological capabilities with inter-firm relationship performance appears to be unexplored in prior studies (further discussion is provided in Section 2.4). Most of the studies available focus on the adoption of unique technological capability rather than from the multidimensional construct perspective, for example, RFID or EDI, e-procurement and R&D expenditure (Abdullah 2009; Boeck & Wamba 2008; Chong & Ooi 2008; Coombs & Bierly 2006; Kamaruddin & Udin 2009; Lee, Kwon & Severance 2007; Paterson 2007; Tan et al. 2009), with trust or power as the antecedents for adoption. Therefore, the adoption of a multidimensional construct such as production, investment and linkage capabilities as multidimensional constructs of technological capability as suggested by various researchers (Dahlman, Ross-Larson & Westphal 1987; Jonker, Romijn & Szirmai 2006; Lall 1999; Lee, Kwon & Severance 2007) in examining the association between technological capability and inter-firm relationship performance is expected to provide broader knowledge in this field. This study also intends to provide an understanding on how different firms with comparable technological capability levels may have a different inter-firm relationship performance outcome.

Grounded by Resource Based View theory, this research is also expected to make a contribution towards the theory by exploring how inter-firm relationship performance between manufacturing firms and their suppliers derive benefits from the use of their technological capability. In addition, this research will offer empirical evidence from a developing country viewpoint (Malaysia) and may contribute further insights to the literature as previous studies have, for the most part, focused on developed countries.

In addition, this study is also expected to contribute to the literature by providing linkages between Resource Based View theory, power-dependency theory and trust theory. Empirical evidence in this research examines the mediating effects of both power and trust on the relationship between technological capability and inter-firm relationship performance. Most of prior technology-related studies only looked at power or trust as dependent variables (Abdullah 2009; Ryssel, Ritter & Gemunden 2004). Based on theoretical grounds, it is found that both power and trust co-exist in firm interrelationships and are interrelated with technological capability. Thus, incorporating these variables (power and trust) in one study as a mediator may enrich the current literature and provide a broader understanding of the relationship between Resource Base View, power-dependency, and trust theories.

Meanwhile, the study also expects manufacturing companies to benefit from this study by enhancing their understanding of the potential impact of technological capability on firms' power and trust, and how this association affects inter-firm relationship performance. It may also provide useful insights into the advantages and disadvantages of possessing such capability which can act as the basis for making future investment

decisions related to technological capability expansion. This study also hopes to provide valuable information on the current status of technological capability of manufacturing industries in Malaysia to assist the government in planning the development of or review of current policy relating to the country's manufacturing sector.

1.5 Research setting

Globally, technological capability has always been recognised as one of the primary components that contribute towards a country's economic growth and prosperity. The utilisation of more advanced technology will undoubtedly continue to be a significant source of competitive advantage in the future but, unfortunately, it is not being dispersed evenly across countries and knowledge creation is largely concentrated in highly-developed and industrialised nations. Although this knowledge can be disseminated to other countries through various channels of technology transfer such as international trade, foreign direct investment, or public awareness in promoting the use of technology, there is still a gap in the level of achievement in this area across countries. Many countries continue to fall behind in upgrading their technological capability and some have failed to absorb the knowledge that has already become obsolete in other countries (Archibugi & Coco 2004).

In the Asia region, the ability to conquer various state-of-the-art technological capabilities has resulted in remarkable industrial achievements in many countries such

as Japan, Taiwan and South Korea. During the early stage of industrialisation, these countries were merely users of advanced technology that they acquired from developed industrialised nations. However, these countries have transformed from being users into becoming masters of technological competencies by developing their own technological capability. Since then, these countries have grown swiftly into new grounds of technology and have become world class players in the advanced technology sector, particularly in areas such as telecommunications and semiconductors (Rahman & Bennett 2009).

In comparison, Malaysia does not enjoy the same level of technological capability as many developed countries such as Japan, South Korea or Taiwan. In accord with the developing nation status, there has been no formal attention to building basic high technology infrastructure until the government decided to transform its manufacturing industry and thus change its dependency from a traditional agricultural base economy to modern industrialisation (Rasiah 2004).

This study focuses on the Malaysian manufacturing sector since it is one of the most important components that contribute to the achievement of Malaysia's Gross Domestic Product (GDP). The country has been classified as one of the new industrializing economies (NIEs), together with other developing countries such as Thailand, Indonesia and The Philippines. The country's economy is among the best performing in the developing world and the manufacturing sector share of GDP has been consistently maintained at an average of 30 percent per annum from 1993 to 2008 (Economic Planning Unit 2006; Treasury Malaysia 1996, 2009).

Since the 1960s, the Malaysian manufacturing industry has evolved from light to heavy industries. The country's light industry consists of traditional activities such as food processing, wood and textile. On the other hand, the national heavy industry comprises capital intense and complex activities that include electrical, semiconductor and electronic products. This transformation began in the late 1960s and grew rapidly during the 1980s. By the 1990s, the country possessed advanced industrial infrastructure which was only slightly lower than that of South Korea and Taiwan (Lall 1999).

The growth in the manufacturing sector has been driven by the introduction of a 'Look East' policy in the early 1980s. This policy aimed to integrate Japanese and South Korean heavy industrial technology with Malaysia's resource-based industrialization in order to improve the nation's productivity and economic performance. The policy intended to assimilate these countries' working culture to focus on relationships and collaboration between firms in the same supply chain (Lim 2008). This aimed to counter the weaknesses of manufacturing companies in their inter-firm collaborations since they are traditionally stand-alone organisations that serve domestic markets and not export-oriented manufacturing organisations (Lall 1999).

Apart from the 'Look East' policy, the growth of the manufacturing sector has been driven by the regular 5-year economic plan known as the Malaysian Plan (Economic Planning Unit 2006; Lall 1999). The Ninth Malaysia Plan (or 9MP) for the period 2006-2010 has outlined a strong focus on the manufacturing sector. The government has encouraged this sector to acquire a high level of technology, strong innovation capability and the ability to produce higher value-added products in order to remain

competitive in the market. New sub-sectors which focus on high value-added manufacturing such as petrochemicals, heavy machinery, aerospace, maritime and defence industries have been promoted. Consequently, the government will enhance and develop existing and new industrial clusters, as well as Small and Medium Enterprises (SMEs) in all states in order to move the economy up to the value chain (Economic Planning Unit 2006).

Meanwhile, the root of technological capability development in Malaysia can be traced to early 1985 when the government set up the Malaysian Institute of Micro Electronics Systems (MIMOS) in that year. The main objective in establishing the MIMOS was to focus on providing critical technology infrastructure to help the local electronics manufacturing industry in building technological capability to design, produce and market an exceptional quality of electronic products internationally during the global growth of the electronics industry in the mid-1980s (MIMOS 2010).

Later, the Industrial Master Plan (IMP) was introduced in 1986, with the objective of developing a broad-based manufacturing sector. IMP was viewed as a ten year plan, acting as a blueprint to build high technology institutions (Rasiah 2004). Among the outline of the first IMP was the goal to transform the national economic dependence from the traditional agricultural sector to a product based manufacturing sector (Johan 2006).

To keep this momentum, the government introduced another related policy in 1990 called Action Plan for Industrial Technology Development (APITD) as the latter part of

the Fifth Malaysia Plan (5MP). This action plan acted as a complement to the first IMP to increase industrial technology development effectively, since the country's expenditure on Research and Development (R&D) and R&D activity was still relatively low (Kondo 1999). The action plan continued in the Sixth Malaysia Plan (6MP) and the report outlined that the APITD is an essential step in providing strategies and guidelines to develop technological capability through selected technology acquisition from abroad. Apart from that, another aim of the APITD centres on developing human resources and infrastructure, promoting the importance of basic science in education systems and building a society that appreciates science and technology (EPU 2010).

However, there are flaws in the execution part of both policies since the government's emphasis is mainly on institutional development (for example Sapura Electronics and Celcom). The focus on building high-tech institutional centres under these policies is not followed by increases in investment in human capital development and the need for strengthening the inter-firm relationship, as well as coordination within industrial conurbations. Rasiah (2004) elaborates that the country lacks expert manpower in technical fields and inadequate R&D expenditure; and this has hindered most of the R&D activity and thus slowed down the innovation and creativity process. On top of that, there are no serious efforts in building inter-firm connections and cooperation among them.

As a result, the government launched the Second IMP in 1996 to be implemented until 2005. The Second IMP has a broader scope than the First IMP and deeply focuses on business support services. Its emphasis is on stronger industrial linkages, improving