UNIVERSITY OF SOUTHERN QUEENSLAND

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

A dissertation submitted by

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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.

CERTIFICATE OF DISSERTATION

I certify that the ideas, results, analyses and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any awards, except where otherwise acknowledged.

Nor Azrin Md Latip | Date

ENDORSEMENT

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Dr Heather Maguire | Date

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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 productivity and competitiveness. The main concern is to uplift Malaysia's contribution to the value-added aspect and thus the strategy focuses move up to the value-added chain. As the world shifted to Knowledge Economy (K-economy) in the year 2000, the government reacted by introducing K-Economy Master Plan (KEMP) in 2003. This plan aimed to help the manufacturing sector to embrace innovation, re-engineer the business process, create new ideas, and develop outstanding value-added products and services. The manufacturing industry was urged to build their core competencies and to rely more on ICT to enhance the value added component of their products and services (Johan 2006).

The implementation of KEMP in 2003 was reasonably effortless since the momentum of technological capability development was continued by the Government of Malaysia through the establishment of the Multimedia Super Corridor (MSC) project in 1995 - modelled after Silicon Valley, California. The MSC is part of the Vision 2020 program which was formulated to transform the country into fully developed by the year 2020. The Vision 2020 program was proposed by the government during the tabling of 6MP in 1996.

The objective of MSC is to prepare the nation in the new era of a knowledge based-economy by emphasizing technological and innovative development. One of the focuses of the MSC program is to encourage the local manufacturing industry to be actively involved in research and development (R&D) collaboration, especially with multi-national corporations (MNCs). Incentives such as R&D grants have been created by the government to facilitate R&D activities between firms. Since the MSC has attracted participation from numerous numbers of MNC such as Microsoft, Motorola and Sony, local firms can obtain the benefits from the technology and knowledge brought in by these MNCs through strategic R&D activities (Mohan, Omar & Aziz 2004; Ramasamy, Chakrabarty & Cheah 2004).

Meanwhile, the government introduced the Third IMP, launched in 2006, covering a fifteen year period up to the year 2020. The objective of the Third IMP is to achieve long term global competitiveness mainly through transformation and innovation of the manufacturing sector. Some of the aims under this IMP are to sustain the contribution of the manufacturing industry towards the nation's economy and to strengthen integration among manufacturers - not only domestically, but also in promoting industrial conurbation regionally and globally. It also promotes the use of extensive ICT and other technologies up to the value chain. The plan also emphasizes the importance of developing innovative and creative human capital in the country. This is to ensure that industry has sufficient technical expertise; and this would later ease to promote an active R&D environment (MITI 2010).

1.6 Research approach

Based on the identified research questions, this study incorporates mixed methods as the approach to describe the impact of technological capability on power, trust and inter-firm relationship performance. There are two phases involved in gathering the data needed for this study.

The quantitative design is selected as the first phase to describe the association among the studied variables. Data is gathered via a paper-based postal survey questionnaire distributed to manufacturing companies in Malaysia. The FMM Directory 2009 has been chosen as the primary source of population. Initial statistical procedures, such as data screening, testing of multivariate assumptions and analysing the demographic profiles, uses the Statistical Package for Social Sciences (SPSS) software. The test of hypotheses is largely based on the Partial Least Square approach via SmartPLS software.

Subsequently, the second phase involves the qualitative design, and case study method is used to uncover the nature of the problem by gathering in-depth information from the same population, since very few studies have been conducting to measure the relationship between the variables involved. The purpose of the case study is to gather information on these occurrences and data is collected from these cases via semi-structured interviews and documentation. The data is then analysed to identify the areas of interest and later a cross case analysis was conducted to support the findings in Phase One. The definitions of key terms are briefly discussed in the following section.

1.7 Definition of key terms

This section offers definitions, as well as a brief description of the main variables and key terms used in this study.

1. Technological capability - refers to the firm's level of technological capability which is categorised into three major technical functions, namely, production capability, investment capability and linkage capability (Lall 1999).

2. Inter-firm relationship performance - refers to the degree the business relationship between two or more firms is perceived to be effective and beneficial for both parties (Gyau & Spiller 2008).

3. Power - the quantitative phase focuses on the non-mediated power base, while qualitative phase investigates both mediated and non-mediated power bases. These power bases reside in the organisation that possesses or controls the scarce resources and the power exercised over the firm seeking those resources (Ireland & Webb 2007).

4. Trust - refers to a firm's willingness to take a risk by depending on another party whom they strongly believe could fulfil their obligations in an exchange relationship (Paterson 2007).

5. Federation of Malaysian Manufacturers (FMM) - an economic organisation established in 1968 representing more than 2000 Malaysian manufacturers and industrial service companies.

6. Manufacturing industry – refers to the Malaysian manufacturing sector which has been chosen as the population of this study due to its substantially contribution to the country's Gross Domestic Product (GDP).

7. Structural equation modelling (SEM) - an advance multivariate analysis that combines aspects of factor analysis and multiple regression, allowing the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs (variates), as well as between several latent constructs.

8. Partial Least Square (PLS) - an alternative method to SEM approach which provides parameter estimates for a linear equation - as does SEM - but is less sensitive to sample size considerations.

1.8 Organisation of the thesis

This thesis comprises seven chapters as follows:

1. Chapter 1 provides the background of the study, problem statement, and research questions; and explains the justification for undertaking the research, research settings, definition of key terms and the organisation of the thesis.

2. Chapter 2 reviews the relevant literature on supply chain, technological capability, inter-firm relationship performance, as well as a discussion on power and trust.

3. Chapter 3 explains and presents the conceptual model and the associated hypotheses to be tested.

4. Chapter 4 describes the research methodology procedure which involves two phases of data collection. The first phase engages in quantitative data collection procedures via distribution of survey questionnaires, basic analysis using SPSS and test of path model. The second phase employs the qualitative data collection through semi-structured interviews with the identified participants.

5. Chapter 5 covers the results of the first phase which involves quantitative data collection and analysis as described in Chapter 4. The results of the structural model and hypotheses testing are presented.

6. Chapter 6 reports the results of the second phase which covers qualitative data collection and analysis.

7. Chapter 7 integrates the findings of both phases, theoretical implications and practicality of the study, as well as detailing limitations and recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter aims to review the theories and the prior literature that are relevant to this study. This chapter is divided into several sections. Firstly, a brief outline of the supply chain management concept from the general business and manufacturing sector perspective is provided. Secondly the chapter provides a discussion of the related theories underpinning the concept of technological capability, relationship power, and the factor of trust that relates to the context of this research. This section continues with a discussion of why firms engage in inter-firm relationships with their suppliers, as well as the concept of inter-firm relationship performance. The chapter concludes by highlighting the gaps and scarcity in the literature and an analysis of the impact of technological capability on power, trust and inter-firm relationship performance.

2.2 Supply chain management literature

As this study is conducted within the manufacturing supply chain environment, it is relevant to start with a review of the literature that relates to the supply chain management concept. Managing the supply chain has become a pivotal issue since the 1990s for several reasons, in particular the dramatic changes in the competitive environment. Increasing competition from both domestic and international markets has widened manufacturers' options to choose from multiple sources to satisfy their demand. As a result, the importance of locating products within the entire distribution channel for customer accessibility with minimal cost has become more challenging than ever before. Companies also realise that optimal performance of an organisation cannot be achieved through performance maximisation of a single department. All functions need to be optimal and companies must have the ability to look at the entire supply chain and understand the impact of decisions in any particular area. Vertically integrated companies have become more specialised and instead of providing their own source of supply, they have started utilising suppliers who can provide low cost quality materials. They realise that parties in the supply chain could stand to benefit from the success of other parties (Lummus, Vokurka & Alber 1998; Simchi-Levi, Kaminsky & Simchi-Levi 2003; Zhao et al. 2008).

Generally, supply chain management (SCM) can be viewed as a critical strategic initiative that seeks to create sustainable competitive advantages through integration of the internal functions of a company and active involvement of supply chain members (Jeong & Hong 2007; Kim 2006). The definition of supply chain management (SCM) has been debated over the last 20 years by researchers in the operations management field. Some researchers view SCM as the integration of business operations within the organisation. Others believe that the integration goes beyond the organisation itself and involves other business entities such as suppliers, manufacturers, storage facilities, distributors and retailers, as illustrated in Figure 2.1 below.

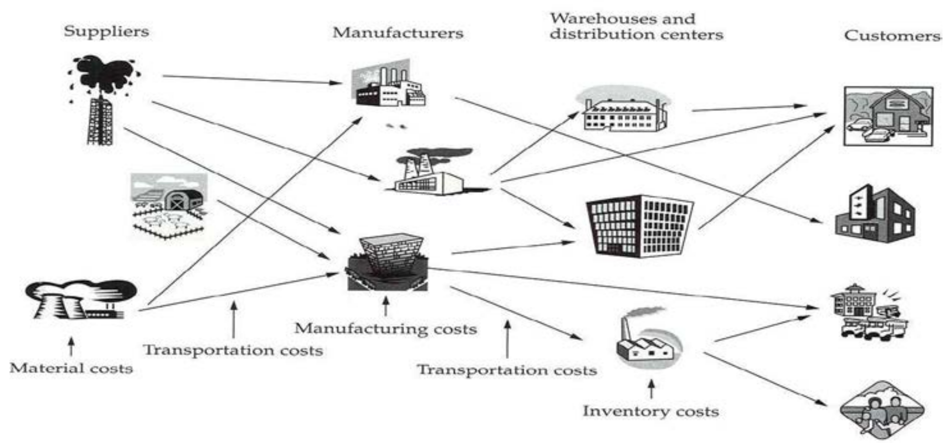

Figure 2.1: Supply chain network
Source: Simchi-Levi, Kaminsky and Simchi-Levi (2003)

The Global Supply Chain Forum (GSCF), a group of non-competing firms and a team of academic researchers, define SCM as 'the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers' (The Global Supply Chain Forum (1998) as cited in Lambert, Cooper & Pagh 1998).

Ballou, Gilbert and Mukherjee (2000) point out that SCM consists of three dimensions, namely intra-functional coordination, inter-functional coordination and inter-organisation coordination. Administrative and process functions within a firm take place in the intra-functional coordination. Coordination among departments within a firm is defined as inter-functional coordination. Meanwhile, coordination of activities between business enterprises within the product-flow network is known as inter-organisational coordination. This research used SCM's definition offered by Simchi-Levi, Kaminsky and Simchi-Levi (2003, p. 1) since it is more inclusive and appropriate to the study. They elaborate that SCM is:

> *'...a set of approaches utilised to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, at the right time, in order to minimise system wide costs while satisfying service level requirements. The supply chain consists of suppliers, manufacturing centres, warehouses, distributor centres, and retail outlets, as well as raw materials, work in progress, inventory, and finished products that flow between the facilities'.*

The above definition is utilised in this research since it takes the consideration of every facility and units which includes suppliers and manufacturers throughout the supply chain with the objectives to achieve efficient integration and relationship between manufacturers and their suppliers, attaining cost effective networking and taking consideration onto improve the overall supply chain performance.

Other definitions of SCM by various researchers can be found in Table 2.1.

Table 2.1: Definitions of supply chain management

Authors	**Definition of SCM**
Jones and Riley (1985, p. 19)	Managing the total flow of materials from suppliers to the end users.
Cooper and Ellram (1993, p. 13)	An integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user
Lummus, Vokurka and Alber (1998, p. 49)	Managing the network of entities that may include suppliers, carriers, manufacturing sites, distribution centres, retailers and customers through which material and information flow.
Mentzer et al.(2001, p. 18)	The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purpose of improving the long term performance of the individual companies and the supply chain as a whole.
Ho, Au and Newton (2002, p. 4422)	The philosophy of management that involves the management and integration of a set of selected key business processes from end user through to original suppliers that provides products, services, and information that add value for customers and other stakeholders through the collaborative efforts of supply chain members.
Stadtler (2005, p. 576)	The task of integrating organisational units along a supply chain and coordinating materials, information and financial flows in order to fulfil customer demands with the aim of improving competitiveness of the supply chain as a whole.
Thakkar, Kanda and Deshmukh (2008, p. 98)	A set of business activities including purchase from open/spot market, manufacturing or processing of subcomponents/ subassembly within the plant and delivery to large enterprises using hired transportation to enhance value of end product and in turn to ensure long-term regular purchase order.

(Source: developed for this research by the author from literature)

There are two main elements of SCM that can be derived from the above definitions; the intra-organisational integration and inter-organisational integration as illustrated in Figure 2.2. For many years, organisations have strived to integrate their internal functions as part of their supply chain activities. The intra-organisational or internal/horizontal integration is not just about maintaining closer relationships or integrating processes between supply chain related departments, but also emphasizing managing information and materials across functional boundaries and processes within an organisation. Regarding the need for information dissemination across departments, Barratt (2004) clarifies that the exchange of information needs to be implemented at all levels of activity including operational, tactical and strategic levels.

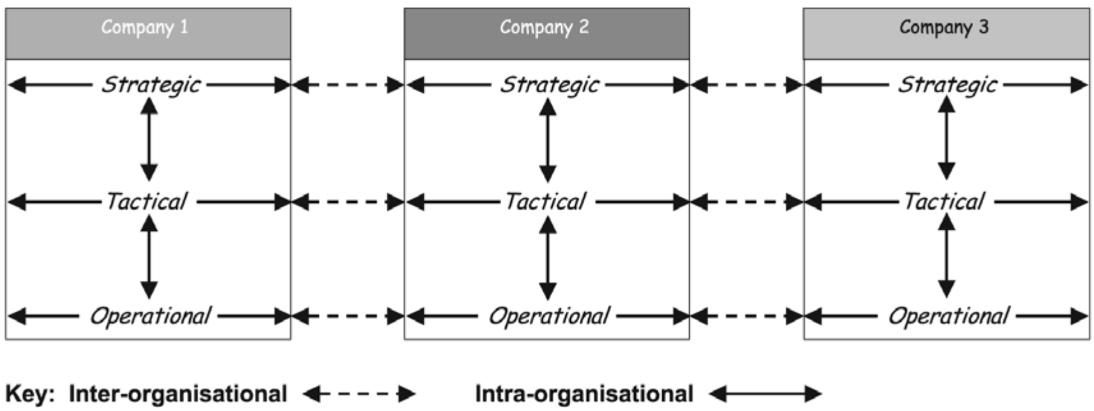

Figure 2.2: Inter and intra-organisational integration
(Source: Barratt (2004))

The other element obtained from the definitions is known as inter-organisational integration - known also as external or vertical collaboration - and involves relationships with other organisations in the supply chain network. There are two different types of external integration, namely, downstream and upstream collaborations. Downstream collaboration involves the interaction between the organisation and its customers. Handfield and Nichols (1999) clarify that downstream collaboration consists of functions and processes of the distribution channels where the product flows through to the end users. There are a number of potential opportunities involving the downstream side of the supply chain as explain by Barratt (2004), which include Customer

Relationship Management (CRM), collaborative demand planning and forecasting, demand replenishment and shared distribution (see Figure 2.3).

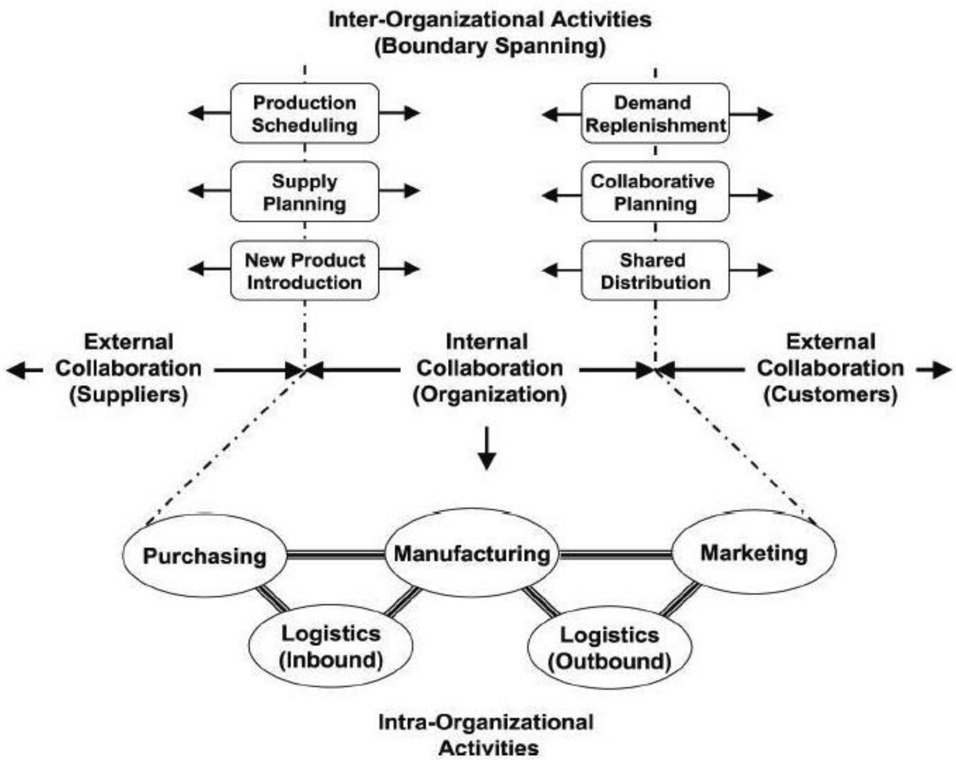

Figure 2.3: Vertical collaboration
(Source: Barratt (2004))

Meanwhile, this study focuses on the upstream collaboration, which involves cooperation between the organisations and their suppliers. Handfield and Nichols (1999) describe the upstream side of the supply chain as focusing on the function, processes and network of suppliers and suppliers' suppliers . They further state that firms need to ensure that the flow of materials, products or services by their suppliers and distribution channels is accomplished as per scheduled. This is to minimise delays in production time that could eventually increase the cost of production in the organisation. As inter-organisational integration involves dealing with firms from outside an organisation, mutual understanding needs to be developed in order to achieve a higher degree of production efficiency and to help reduce the risk of uncertainties in the production process (Mazlan & Ali 2006).

Therefore, Morash and Clinton (1998) conclude that building a healthier relationship with other firms involved in the supply chain is advantageous since it can result in operational excellence and a more responsive supply chain. Among the possible opportunities for collaboration with this side of supply chain (see Figure 2.3) are supplier development, supplier planning and production scheduling, collaborative design which includes new product development, and collaborative logistics (Barratt 2004).

In conclusion, the supply chain is important in developing a firm's competitive advantage and improving business performance. It generally integrates the functions within the organisation (internal integration), as well as inter-organisation activities (external integration). As the internal integration involves linkages between all functions in the organisation, external integration engages in upstream and downstream collaboration between the manufacturers and their suppliers and customers. This study examines the upstream collaboration which focuses on the vertical relationship between manufacturers and their major suppliers. As this involves cooperation between firms in the supply chain, maintaining a healthier inter-firm relationship is a must to reap the full advantages of a responsive supply chain. The following section discusses the relevant theories that underpin the constructs of interest in this study.

2.3 Related theories

The previous section discussed the concept of supply chain management. This section commences with an outline of the related theories underpinning this study. The first theory (the Resource Based View theory) concerns the technological capability concept. This is followed by an overview of related theories governing the issues of power, trust and inter-firm relationship performance.

2.3.1 The Resource Based View theory

The Resource Based View theory stems from strategic management studies which have been widely used over the last two decades and extends the concept of distinctive competence (Coombs & Bierly 2006). Retrospectively, the origin of Resource Based View theory can be traced back to 1984 when Wernerfelt (1984) laid the foundation of the concept of this theory by proposing the importance of the relationship between profitability and resources, and how firms manage these resources over time to persistently outperform other firms.

Nonetheless, academics and practising managers were unaware of this argument until Prahalad and Hamel (1990) published research on the importance of core competencies in creating unique and integrated systems that reinforce fit within diverse firm's production and technology skills. Since then, the Resource Based View theory has emerged as a widespread application and has become a predominant theoretical framework in contemporary research (Andersén 2011).

The key concern of this theory is accepting the transitory nature of a firm's resources that eventually lead to competitive advantage. Competitive advantage is defined by Barney and Clark (2007, p. 24) as the ability 'to create more economic value than the marginal (break-even) competitor in its product market'. In simple terms, firms need to mobilise their strategic resources in order to create more value by producing more net benefits via superior product differentiation with lower cost, relative to the least efficient competitor.

Nevertheless, it is also important to note the issue of sustainability of these advantages in the long run. Barney and Clark (2007, p. 52) coined the term 'sustained competitive advantage' and define it as the 'ability in creating more economic value than the marginal firm in its industry and when other firms are unable to duplicate the benefits of this strategy'. This definition implies that sustained competitive advantage does not exclusively focus on current competitors in the market, but also refers to potential competitors who might enter the industry in the future.

The sustained competitive advantage concept is extended from the concept of distinctive competency theory. This relates to the notion that firms need to identify their inner resources and capabilities to provide sustained competitive advantage (Coombs & Bierly 2006). Barney (2001) added that the resources and capabilities developed within the boundaries of the firm may hold the key to create above-normal rates of return.

In general, firms' resources correspond to 'all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable it to conceive of and implement strategies that improve its efficiency and effectiveness' (Daft 1983 cited in Barney 1991, p. 101). In short, it refers to a firm's inner strength that can be used to conceive of and enforce value creation activity (Hitt & Ireland 1985).

Meanwhile, capability is defined as the 'bundles of skills and accumulated knowledge, exercised through organisational process, which enables firms to coordinate activities and make use of their assets' (Cravens & Piercy 2006, p. 6). Nevertheless, both resources and capabilities can only be considered as the source of sustained competitive advantage if they are scarce, valuable, inimitable and non-substitutable (Barney 1991; Barney 2001; Barney & Clark 2007; Coombs & Bierly 2006).

Mahoney and Pandian (1992) explain that firms tend to generate better business performance from their resource and capability. They assert that firms with the ability to appraise effectively their capabilities in terms of strength and weaknesses have a sturdy basis for competitive advantage. Identifying their 'real' strengths, resources and capabilities will help firms differentiate themselves from competitors. The differences in terms of information resources and capabilities may result in unique technical know-how and managerial capabilities. These can be considered as an important source of heterogeneity, as well as sustained competitive advantage, that enables firms to generate revenue and thus lead to better business performance.

In a similar vein, Hittand and Ireland (1985) also agree that enhancing firms' competitive advantage may improve business performance. The argument is that distinct competence and superior organisational routines lead to resource advantage and employing them - particularly in value-chain activities - may help increase business performance.

Several empirical studies rely on the Resource Based View theory in explaining the link between firm resources and capabilities and performance. For example, Tan et al. (2011) investigated the effect of relationship quality as a mediator in the relationship between organisational capabilities and business performance in palm oil processing in Malaysia. They claim that integrating relationship quality with organisational capabilities (which, amongst others, consist of innovativeness and manufacturing capabilities) are relevant and significant to the palm oil processing companies. They argue that the interpretation of Resource Based View theory provides a logical explanation for the association between organisational capability and business performance. As expected, their research finding reveals that innovativeness has a significant effect on business performance. They argue that this relationship is strongly mediated by relationship quality. Interestingly, other competencies such as manufacturing capability do not have any significant effect on business performance. This would suggest that not all capabilities are unique and contribute towards performance. Nevertheless, they suggest that the Resource Based View theory has provided an explanation of the link between selected organisational capabilities and business performance.

Meanwhile, Chmielewski and Paladino (2007) have empirically examined the relationship between resource and capability in different market conditions. They have found a significant relationship between resource and capability, and the strength of this relationship is shown to be robust across various market conditions. They also report that resource orientation has a positive significant impact on all performance indicators.

Schroeder et al. (2002) investigated the linkage between manufacturing strategy from the perspective of Resource Based View theory and manufacturing performance. They contend that a firm's resources and capabilities are unique and difficult to duplicate or substitute. They further assert that these resources and capabilities are built by the employees through internal cross-function training, suggestion systems, external learning via customers and suppliers, and proprietary processes and equipment developed by the firms. Based on 164 manufacturing firms' data, the findings empirically reveal that, driven by internal and external learning, the proprietary processes and equipment developed by firms are significantly related to manufacturing performance. Interestingly, they found that generic resources are ineffective in achieving high level performance since they are also freely available to competitors. Therefore, consistent with the Resource Based View theory, they conclude that resources and capabilities which are idiosyncratic and difficult for competitors to imitate lead to higher competitive performance.

From the above argument, five explicit characteristics of a resource that would allow firms to attain sustained competitive advantage have emerged. As also suggested by many researchers (for example Barney 1991; Peteraf 1993; Rungtusanatham et al.

2003), these characteristics are as follows. Firstly, the resource must be valuable to the firm in the sense that it contributes to firm efficiency and effectiveness, and neutralises threats in a firm's environment. Secondly, the resource must be scarce among firms' current and potential competitors and thus controlling it may result in disadvantage to its competitor. Thirdly, the resource should be hard to imitate by competitors to prevent them developing it easily. Fourthly, the resource should be imperfectly mobile to prevent ex-post competition that would nullify any advantages of controlling it in the first place. Lastly, there is no known substitute or strategically equivalent resource that can be used for the same purpose.

In short, the above argument concerns Resource Based View theory whereby it predicts how firms can achieve a sustainable competitive advantage via firms' resources and capabilities. It is also concerned with the issue of managing these resources to achieve better business performance. Therefore, this theory is applicable in explaining the effects of technological capability towards inter-firm relationship performance. Technological capability has been recognised by many researchers (Hsieh & Tsai 2007; Ortega 2010; Wang et al. 2006) as the strategic source of competitive advantage that leads to a firm's efficiency and superior performance compared to other competitors within the industry. The following section discusses the concept of technological capability as a source of competitive advantage underpinned by the Resource Based View theory.

2.3.2 Technological capability

Technological capability within the manufacturing sector has been identified as a crucial strategic resource that enables firms to remain competitive in the market (Ehigie & McAndrew 2005; Meyer-Stamer 1999; Tsai 2004; Tyler 2001). This concept has also been highlighted as part of the supply chain operational capabilities, together with logistics capability and structure capability. In brief, supply chain operational capabilities are defined as 'the pattern of decisions related to sourcing products, capacity planning, conversion and distribution of finished product, demand management, communication and delivery' (Kim 2006, p. 1085). Nonetheless, it is important to note that, to date, there is little consensus on the exact definition of this concept. For example, García-Muiña and Navas-López (2007, p. 31) define technological capability as

> '---*the generic knowledge-intense ability to jointly mobilize different scientific and technical resources which enables a firm to successfully develop and design new products (goods or services) and productive processes, in creating the desired outcome, by implementing competitive strategy*'.

Also emphasizing the importance of technical knowledge, Wang et al. (2006, p. 30) identify the concept of technological capability as 'a set of pieces of knowledge that includes both practical and theoretical know-how, methods, procedures, experiences and physical devices and equipment'.

Other definitions of technological capability, their research objective and major findings of are offered in Table 2.2 below.

Table 2.2: Definition of technological capability, previous research objective and major findings

Authors	Definition	Objective	Findings
Acha (2000, p. 3)	The knowledge and skills required to identify, appraise, utilise and develop technologies and techniques relevant to the industry. Through the application and extension of knowledge and skills (in particular technologies and skills), the firm is building its stock of both explicit and tacit knowledge accordingly.	To describe the relationship between technological capabilities and operational performance in the case of the upstream petroleum industry	The study reports mixed relationship between technological capability dimensions and operational performance. The author suggests further investigation needed to confirm this relationship.
Figueiredo (2002)	Resource needed to generate innovation in production, processes, and project engineering. The resource is also accumulated to manage future technological change.	To understand the practical implication of technological capability, accumulation path on operational performance.	Technological capability and accumulation path has impacted the operational performance.
Afuah (2002, p. 172)	Each firm has specific technology resources such as patent, skilled engineer, knowledge, product design etc. that is used to offer products with desirable characteristics and technological capability then refers to the firm's ability to use these resources to combine components, methods, processes and techniques, and underpinning core concepts to offer products.	To present a model for estimating the value of distinctive technological capabilities.	The study has provided the linkage between customer value and the competitive advantage from technological capabilities.
Reed and Walsh (2002)	The capability to innovate and awareness of future technology requirements.	Aim to discuss the potential to enhance the technological capability through supply development scheme.	The formal processes of supplier development are found to have little direct impact on suppliers' technological capability.
Kim (2006)	The ability in developing differentiation capability through the use of scientific knowledge in production that can guarantee the delivery of value-added products and facilitate rapid response to changing market needs and new customer requests.	To identify the interaction of corporate competitive capability and supply chain operational capability for performance improvement.	Technological capability has positive a significant impact on market performance (which includes sales and market share growth).

(Source: developed for this research by the author from literature)

Therefore, based on the various definitions above, this study defines technological capability concept as the firm's capability to employ a salient and diverse range of resources which include knowledge, skills and various technical resources (including software and hardware such as information technology (IT) and machinery) to offer products and remain competitive in the market. This definition generally denotes that technological capability in each firm is unique and each firm has its own technology resources to stay competitive in the market. This is consistent with Lall (1992, 1999) who proclaim that technological knowledge is different among firms and not shared equally, nor easily imitated or transferred across firms. It also has been recognised as the driving force and the root of a firm's long-term sustainable competitive advantage (Tsai 2004).

Table 2.2 also denotes that the contribution of technological capability has not only been acknowledged as crucial towards overall competitive advantage of firms, but also to supply chain performance as a whole, and to inter-firm collaboration. Consequently, organisations should focus their attention on investing in state-of-the-art facilities and equipment in order to strengthen the operational aspect of their business, as well as to enhance the efficiency of the supply chain, and further support inter-firm relationships (Abdullah 2009).

Sohal et al. (2001) denote the importance of technological capability within the manufacturing perspective. They stress that the use of technology, that is, Advance Manufacturing Technology (AMT), will be an important source of competitive advantage. In their research on South African manufacturers, they found that the first six benefits of adopting AMT is obtaining competitive advantage, increase throughput, improved quality, reduced cost, better management control, and increased flexibility. The findings also reveal that there is no significant difference in perceived benefits of the South African manufacturers on this manufacturing technology across all firm sizes.

Researchers also believe that superior technological capability can increase efficiency and higher differentiation through improved process and product innovations (Kam 1999; Lall 1992; Wang et al. 2006). Organisations with remarkable technological competencies are able to produce higher differentiation through innovative products in response to rapid changes in the market needs since they can secure efficiency benefits by pioneering innovation activities. Therefore, firms are able to create greater value than their competitors which allows them to achieve an above-average return on investment (Teece & Pisano 1994; Tsai 2004).

Meanwhile within the Malaysian perspective, the linkage between technical resources and inter-firm relationships is mentioned by Chong et al. (2009) in their research on Small and Medium Enterprises (SMEs). They argue that automated business transactions via electronic communication can provide seamless interoperation and interactive links between relevant members such as suppliers, designers, and manufacturers, trading partners, logistics providers and customers in the supply chain. They also highlight the benefits of applying technology in the supply chain. They state that firms can expect improvements in response speed, cost savings, knowledge sharing, inventory reduction and better communications and, as a result, they conclude that firms begin to realise the importance of automating their supply chains through electronic mechanisms.

In an exploratory study by Patrakosol and Lee (2009) on the impact of technology on inter-firm relationship performance in a two-country comparative study (the USA, a developed country; and Thailand, a developing nation), their findings reveal that technical resources are positively associated with inter-firm relationship performance across these two countries. However, they caution that not all technology capabilities have a significant impact on inter-firm relationship performance, for instance, only the Thai firms recognise higher innovation performance as a result of technical adoption as compared to US firms.

Researchers also caution that there is no guarantee that firms will attain all the potential advantages (Wang et al. 2006). Indeed, empirical evidence reported that the acquisition of various technologies has a mixed association or no change in inter-firm relationships (Boeck & Wamba 2008; Jayaram & Vickery 2008). Although there are reports that support positive effects of technological capability on supplier collaboration and supply chain relationships, these studies omit an analysis of pre-existing suppliers' relationships. These studies also reveal that technological capability is shown to have predictive power in the relationship, therefore, it is a mistake to believe that technological capability investment will automatically lead to supply chain integration, better inter-firm relationships or higher business performance (Bongsug, HsiuJu & Chwen 2005).

In addition, researchers argue that trying to achieve supply chain optimization through technology assimilation could result in a potential breakdown in the supply chain relationship. As such, many researchers believe that more research should be conducted to further clarify the link between these two constructs (Boeck & Wamba 2008; Deeter-Schmelz & Kennedy 2004; Jayaram & Vickery 2008).

In short, technological capability has been regarded by many researchers as the source of competitive advantage. It is also an important element, especially in the supply chain, as it helps to increase efficiency and integrate systems and processes in the chain. Nevertheless, it has a mixed impact on various performance outcomes and the key reason may lie in the multidimensionality of this concept.

The infamous typology for measuring technological capability is production capability, investment capability and linkage capability, as proposed by Lall (1992). He discloses that production capability ranges from the skills of operating, maintaining and controlling that process and product technology, as well as efforts in absorbing the new technology either by newly buying or imitation by other firms. Meanwhile, Dahlman, Ross-Larson and Westphal (1987) believe that production capability is about the ability of a firm to monitor, improve and optimise overall manufacturing operations.

It is also argued that production capability involves research and development (R&D) activities that empower the in-house process innovation and new product development (Lall 1999). R&D has been used as a surrogate for technological capability in many research studies in its relationship with inter-firm performance.

The evidence of R&D as a crucial component in building firm's level technological capability has been recorded in many previous research. For example, Acha (2000) employs R&D as technology indicators to unravel the relationship between technological capability and operational performance in the vertical chain within the petroleum industry. Their findings reveal that there is a positive association between R&D as part of the production capability on the inter-firm performance.

Schoenecker and Swanson (2002) also include R&D in their technological capability model that employs R&D expenditure and other statistics on new product development as a proxy to measure technological capability, concluding that technological capability has a positive association with both sales growth and profits. Therefore, it is not surprising that R&D has been utilised in many other studies (Coombs & Bierly 2006; Corsten & Felde 2005; Hsieh & Tsai 2007; Tsai 2004; Wang et al. 2006) as an indicator for measuring technological capability.

Meanwhile, researchers such as Belderbos, Carree and Lokshin (2004) have analysed the impact of collaborative R&D on firm business performance and found that R&D has a positive impact in improving the business performance of firms. Their findings also reveal that R&D has resulted in an increment in firms' innovation activities in terms of developing new products and ongoing perfection of the process system. Consequently, these have led to the improvement in firm's productivity and growth performance.

Nevertheless, the increment of R&D activities is closely related with the investment capability of firms. Thus, it is worth noting that investment capability is one of the indicators of technological capability, especially in R&D investment, since it reflects a firm's innovative activity and possibly enables firms to accumulate technical knowledge through staff learning and development (Tsai 2004). Therefore, the next section discusses the importance of investment capabilities within the technological capability context.

In general, investment capability is often associated with the firm's ability to upgrade its manufacturing equipment so as to increase its operational capability. Apart from increasing firm's operational performance, the decision to invest in manufacturing technology may yield some strategic business performance indicator. According to Small and Chen (1995), firms can expect major strategic benefits such as early entry to the market via new product development, perceived market leadership, ability to offer a continuous stream of customized product and improved flexibility which is very important for the growth and sustainability of the firm.

Monge et al. (2006) have validated this statement when they found that investment in manufacturing equipment is positively impacted the overall operational performance as well as the business performance. Interestingly they also found that investment in this facility may also increase innovating in new products and, create dependence and commitment of the market (suppliers and customers) to the organization. This finding is in line with HassabElnaby, Hwang and Vonderembse (2012) argument that investment in manufacturing technology enables firm to achieve both operational and business performance outcome since it increases firm's ability in developing new products quickly and effectively and taking effective actions in improving its financial flexibility.

Meanwhile, the concept of investment capability is actually broader than acquiring the manufacturing equipment alone. It is also consists of skills and knowledge needed in identifying the capital cost of the project in obtaining the selected technology, manufacturing equipment procurement, the appropriateness of the manufacturing equipment in building the technological capability to the operating firm, organizing appropriate training to adequately equip staff, and the understanding gained by the operating firm from the new technology (Lall 1992; Molina-Domene & Pietrobelli 2011).

It is interesting to note here that educating, training and developing technical manpower is included as the measurement criterion of the investment capability dimension. Coombs and Bierly (2006) divulge that the ability to absorb new technology partly depends on the experience and expertise of employees to assimilate external knowledge and develop internal capability. This is in line with Wignaraja's (2002) argument that investment in human capital leads to improvement in technological performance. The importance of human capital investment through training and learning has been widely recognized as the source of technological capability (Molina-Domene & Pietrobelli 2011).

Nevertheless, this statement is subject to the type of training, for instance, specialized training or education on specific technology (Lall 1992). Therefore, it can be concluded that as long as the investment in staff training and development is to acquire technological related knowledge, then it can be considered as an important source of technological capability for the organisation. Nevertheless, this knowledge can only be useful if it can integrate technology with other resources within and outside the organisation. Thus, the next section discusses the final dimension of technological capability known as linkage capability.

Linkage capability consists of skills and knowledge in receiving and transmitting information within the organization itself, as well as technology transfer with other firms in the supply chain (Lall 1992). As technological capability is part of supply chain operational capability, a firm's capability to integrate its resources within and outside its surroundings is essential to survive and thrive, especially if the resources are becoming scarce (Kim 2006).

On one hand, the role played by technological linkage in cross functional integration within an organisation can provide cost minimisation by eliminating work redundancy (Bowersox & Closs 1996; Kim 2006). Lee et al. (2007) assert that internal linkage includes providing easy access to key operational aspects by various internal departments, sharing and accessing real time inventory information within the supply chain, and utilizing a high degree of information system integration for production processes. On the other hand, external integration with suppliers enables firms to disseminate information effectively to members of the supply chain, gain technological knowledge via technological transfer, and gain an advantage in logistical capability (Bowersox & Closs 1996; Kim 2006). Lee et al. (2007) divulge that external linkage includes strategic linkage with suppliers, inviting suppliers to participate in new product development, integrating production and inventory planning, exchanging information, and a reliable supplier network.

Nevertheless, both internal and external linkages are closely link to each other. Recently Huo (2012) in his research on the impact of supply chain integration on company performance using data collected from 617 manufacturers in China has found that internal linkage improve external integration and that internal and external linkages directly and indirectly enhance the manufacturers performance. He argues that the component of internal linkage which includes joint product design, cross-functional teams, information sharing, communication and inter-firm relationship can positively enhance external linkage capabilities because the conducive partnership atmosphere has created free flow of information sharing across the supply chain. The findings of this research is consistent the previous research in this domain when Flynn, Huo and Zhao (2010) also found the positive association between internal and external capabilities with operational and business performance. The next section continues with a discussion on power theory.

2.3.3 Power theory

Power has been debated and studied by researchers for decades in many areas such as political science, social studies, organisational behaviour, operational and marketing management (Cox 1999; Emerson 1962; Molm 1997; Salancik & Pfeffer 1978; Yeung et al. 2009).

In general, power has been defined as 'the ability to influence another person's or organisation's behaviour' (Monczka, Trent & Handfield 2001, p. 500). Ratnasingam (2000, p. 56) further specified it as 'the capability of a firm to exert influence on another firm to act in a prescribed manner'. In the supply chain context, Doherty and Alexander (2006) extended this definition to how a partner could influence the behaviour of another partner within the supply chain.

Meanwhile, from the perspective of a manufacturing firm's power with respect to its supplier, Jin (2008, p. 14) defines power as 'the ability of a manufacturing firm to alter its supplier's decision which otherwise would not have been changed'. In this sense, the manufacturers are believed to hold significant control over the supplier's decision making.

In explaining this situation, power dependence theory states that the basis of power 'resides implicitly in the other's dependency' (Emerson 1962, p. 32). This theory provides an explanation on how power exists through the mutual dependency of organisations in a relationship channel dyad. Emerson (1962) assumes that firms will try to influence each other's conduct in a relationship and the power to control emerges when a firm possesses scarce resources needed by the other party. Therefore, power can be classified as one of the important resources to the manufacturing firm. Manufacturers that hold the potential power resources by possessing scarce resources needed by another party might translate it into actual power resources by influencing the target firm to do something it would not otherwise do (Baldwin 1979).

Meanwhile, Salancik and Pfeffer (1978) extended the concept of power theory through increasing the focus on dependency by introducing resource dependency theory. This theory provides a major review on power formation in a business relationship (Ireland & Webb 2007). The theory is based on the assumption that organisations will depend on each other in relation to the need to secure important resources or materials (Salancik & Pfeffer 1978).

Researchers argue that there will be a certain degree of dependency between two partners in the manufacturer-supplier relationship. A partner who has the ability to provide access to scarce resources will have significant power to control inter-organisational transactions (Chong & Ooi 2008; Jun, Cai & Peterson 2000).

Ireland and Webb (2007) further explain that power will reside in the organisation that possesses or controls the scarce resources and that power will be exercised over the firm seeking those resources. This situation will create dependency of the target firm on the source firm, which could cause a power imbalance in the relationship.

Therefore, researchers believe that the source firm may have the ability to direct the target firm to do something unwillingly due to dependency of the latter (Anderson & Narus 1990). Wilson (1995) supports this notion by clarifying how power disparity can affect inter-firm relationships since it is closely related to the degree of interdependence between partners in the supply chain.

El-Ansary and Stern (1972) uncovered two main roots of organisational power: power source/base focus and power dependency focus. Although all of their hypotheses are not supported by the data, this research has shed light on the inter-firm relationship research domain since it is one of the earliest studies to provide empirical evidence on the manufacturer-supplier relationship within the distribution channel.

Power is a multi-dimensional construct and in the prominent research by French and Raven (1959) can be segregated into five bases namely, reward, coercive, expert, referent and legitimate. Table 2.3 indicates the bases of power (together with a brief description), particularly in inter-firm relationship research which reflects the reason why one party may have influential authority over another.

Table 2.3: Sources of power

Power source	**Brief description**
Reward	Source retains ability to mediate rewards to target.
Coercive	Source holds ability to mediate punishment to target.
Expert	Source has access to knowledge and skills desired by target.
Referent	Target values identification with source.
Legitimate	Target believes source retains natural right to influence.

(Source: developed for this research by the author from literature)

Traditionally, reward and coercive are the most common power bases. Reward power is the extent to which a source firm has the ability to use rewards to control target firms in a relationship. An example of such a reward is prolonging an existing business contract or rewarding a new one. In contrast, coercive power is the extent to which a source firm has the ability to punish a target firm through negative consequences in order to control a relationship. For example, the source firm may threaten to withhold payment, revoke existing contracts or freeze the business relationship (Benton & Maloni 2005).

Besides these traditional power bases, there are other sources of power that may exist in the inter-firm relationship context such as legitimate, expert and referent power bases. Legitimate power is the extent to which a source firm has formal hierarchical authority in the chain of command. It stems from the extent to which one firm has 'the right of command' to control the target firm. For example, the target firm believes in the right of the source firm to wield influence via a sales contract (Schermerhorn, Hunt & Osborn 2005).

Meanwhile, expert power is the extent to which a source firm has the ability to provide knowledge, information and expertise to the target firm. The target firm obeys the source firm because of the possession of technology, knowledge or information that they (target firm) do not have, but need. On the hand, referent power is the extent to which the source firm has the ability to control a target firm because of their strong personality and reputation - not only in the supply chain, but also in the market (Quinn & Doherty 2000; Zhao et al. 2008).

However, these five power bases have been simplified by many researchers to facilitate exploration of the concept of power. Scholars have dichotomised all the different power sources into categories such as coercive/non-coercive, mediated/non-mediated and economic/non-economic. It is found that the mediated (coercive, legitimate and reward) and non-mediated (expert and referent) power classifications are commonly used in the literature and have consistent empirical support from researchers (Benton & Maloni 2005; Brown, Lusch & Nicholson 1995; Maloni & Benton 2000). In fact, initial discussions with industrial practitioners reveal that the mediated/non-mediated grouping is the most suitable method in examining types of power in the context of supply chain rather than other classifications.

Mediated power classifications including coercive, legitimate and reward, refer to the firm's ability to mediate punishment if the other firm fails to cooperate accordingly (Benton & Maloni 2005). Imposing financial penalties and withholding support from initial promises are an example of punishment under mediated power category (Ke et al. 2009). Empirical studies have shown that the use of mediated power may allow firms to realize short term economic gain (Ramaseshan, Yip & Pae 2006). However, it may also lead towards an unhealthy and destructive relationship (Ke et al. 2009) since pressure and frustration will rise in the relationship due to disapproval of the actions of one party; and the target party feeling offended by these actions (Leonidou, Talias & Leonidou 2008) .

In contrast, non-mediated power classification derives from two sources of power, namely, expert and referent, and does not include any aggressive influences from the dominant party that may damage the relationship (Benton & Maloni 2005; Maloni & Benton 2000). It stands on the principle that all the decision making by the target firm is not mediated by the dominant firm (Ke et al. 2009). It cultivates discussion and a free flow of ideas among parties involved in the relationship and, as a result, conflict and frustration in the relationship is reduced (Leonidou, Talias & Leonidou 2008).

This research focuses on the use of a non-mediated power base since its focus is to maintain a long term relationship - which is vital to reap the benefits of relationship performance as compared to mediated power base that only produces short term benefits and leads towards destruction of a relationship in the long run (Ke et al. 2009; Zhao et al. 2008). In addition, researchers also questioned whether the mediated power base can be linked with actions in the focal supply chain relationship dyad, because manufacturers and their suppliers have been seen to achieve common goals and enjoy mutual benefits from the relationship (Berthon et al. 2003). Furthermore, technological capability is closely related to the manufacturer's knowledge, expertise or skills which are closely related to expert power which is non-mediated in nature (Benton & Maloni 2005; Maloni & Benton 2000; Zhao et al. 2008), Therefore it is appropriate to examine non-mediated power in this study.

In summary, power may permit dominant firms to influence other firms' behaviour. However, different types of power will result in different outcomes from the inter-firm relationship perspective. As such, it is important to be clear about types of power examined in this study and to operationalise the construct accordingly (Ke et al. 2009). Therefore, this study stands to examine the existence of non-mediated power in the association between technological capability and inter-firm relationship performance. The next section reviews the relevant literature on trust theory.

2.3.4 Trust theory

Trust is commonly defined as a willingness to take risk in a relationship (Mayer, Davis & Schoorman 1995; Schoorman, Mayer & Davis 2007), relying on exchange partners in whom one has confidence (Kwon & Suh 2005; Moorman, Deshpande & Zaltman 1993), and the expectation that a trading partner will act according to mutual interests (Sako 1991, 1998). The current research suggests that trust refers to a firms' willingness to take risk by depending on another party whom they strongly believe could fulfil their obligations in an exchange relationship (Paterson 2007).

The theory of trust attempts to explain how socio-economic development is shaped through the level of trust inherited by society in a social relationship (Fukuyama 1996). This theory posits that the key to achieving economic development lies in the amount of trust by firms in their business partners (Brewster 1998).

This theory predicts that business relationships built on a high level of trust will be able to produce efficient outcomes and reduce business costs since such relationships operate under a common set of ethical norms (Fukuyama 1996). In addition, this phenomenon helps firms to better innovate since the relationships permit the creation of other opportunities for business cooperation.

Sako (1998) extends this theory by introducing the concept of mutual trust between partners in business strategic alliances. She contends that trust is an expectation that trading partners will behave in a mutually acceptable manner. The assumption includes the expectation from both sides that there will be no exploitation of weaknesses by the trading partners. Trust in partners helps predict their plan of action and thus reduce partners' behavioural uncertainty (Kwon & Suh 2005).

This theory also postulates that lack of trust in business relationships will result in sole dependency on the enforcement of formal rules and regulations, which may involve the use of coercive power as a means of control. Substituting trust with legal proceedings can be seen as an extra transaction cost associated with distrust in business relationships as it is unlikely to occur in a high trust environment (Fukuyama 1996; Hill & O'Hara 2006).

Trust is a basic element needed in building most relationship models and applied in manufacturer-supplier relationships. Ray, Barney and Muhanna (2004) have classified trust as one of the crucial resources in achieving sustainable competitive advantage in the supply chain. Researchers agree that the biggest barrier to achieving supply chain improvement is the lack of trust between parties who have a mutual interest in cooperation (Paterson 2007; Poirier 1999, p. 46; Sherman 1992). Therefore, both parties must be willing to contribute undivided cooperation to ensure a successful supply chain partnership (Kwon & Suh 2005; Poirier 1999; Wilson 1995).

Many researchers argue that the presence of trust in the inter-firm relationship will help promote efficiency, productivity and effectiveness (Kwon & Suh 2005; Morgan & Hunt 1994). Sako (1998) reveals that trust building is an investment; and the return may appear in terms of low monitoring and coordination cost between the parties involved in the relationship. Thus, firms may benefit from a low transaction cost relating to high-trust business relationships (Sako 1998; Zhao et al. 2008).

The research on trust is significant due to its importance in building inter-firm relationships. Lee and Billington (1992) specified that supply chain management is founded on trust and commitment. Li et al. (2006) argue that trust is an important element in ensuring successful joint operational activities between firm and its suppliers within the supply chain. The importance of trust has been raised by researchers as a major factor in building inter-firm advancement; and lack of trust has been suggested as a cause of instant obstruction in achieving a successful and efficient supply chain (Peterson et al. 2000).

Jones et al. (2010) have listed several benefits to the supply chain that can be yielded from trust which include lower transaction costs, enhance value creation opportunity and create collaborative learning. First, developing and maintaining supply chain involved transaction cost especially in negotiating and governing business contracts. Firm with trustworthy partners may incur lower costs in term of enforcement and contract monitoring (Dyer & Chu 2003). Business relationship that build on trust is also expected to be long lasting which in turn reduce the switching and set up cost (Dyer 1997).

Secondly, Jones et al. (2010) argue that intensive collaboration that is governed by trust may create unique value-creation opportunities. According to Zaheer, McEvily and Perrone (1998), these opportunities exist as part of the trustworthy relationship and may emerge only in the presence of high level of trust. Relationships that are based on trust may encourage partners to work closely in identifying any problems which may emerge and to offer resources and skills in providing the solution (Jones et al. 2010).

Third, Jones et al. (2010) assert that trust promotes collaborative learning among partners. They argue that trust based relationship may permits information and expertise exchange between partners and this facilitates knowledge transfer and nurture the creation of new knowledge within the supply chain. Consequently, this may lead towards increase in profitability, innovation and growth of both parties.

Although trust has been recognised as a crucial factor in building alliances, it is not easy to achieve in a supply chain context, particularly due to the complexity of a chain's structure (Paterson 2007). In fact, the ability to build trust based relationship is often missing in the supply chain (Jones et al. 2010). Moreover, there is a lack of research being conducted to gauge the perceived level of trust after being linked with technological capability, firms' power and the combined impact on inter-firm relationship performance within the manufacturing supply chain (Kwon & Suh 2005).

Trust is a multifaceted dimension that has been included in many relationship based models since it focuses on relationship building (Das & Teng 2001; Dodgson 1993; Ireland & Webb 2007; Johnston et al. 2004; Liu et al. 2008; Mayer, Davis & Schoorman

1995; Moorman, Deshpande & Zaltman 1993). The common dimensions of trust can be grouped into four sub-dimensional constructs (see table 2.4), namely, contractual trust, competence trust, goodwill trust and benevolence trust (Das & Teng 2001; Ireland & Webb 2007; Johnston et al. 2004; Mayer, Davis & Schoorman 1995; Paterson 2007; Sahay 2003a; Sako 1991; Schoorman, Mayer & Davis 2007).

Table 2.4: Common dimension of trust

Trust dimension	**Brief description**
Contractual	Honesty in fulfilling contract requirement
Competence	Ability in delivering goods as promised
Goodwill	Reputation and good faith in doing business
Benevolence	Willing to do extra work without profit motive

(Source: developed for this research by the author from literature)

Contractual trust refers to the mutual understanding by firms to hold on to a specified agreement (Ireland & Webb 2007). It occurs when each member in the supply chain signs a detailed contract and respects the agreement’s terms and conditions, as well as promising to comply with them (Dodgson 1993; Sako 1991). This category of trust depends heavily on keeping promises and a partner’s honesty in fulfilling the contract (Sako 1998). Liu et al. (2008) explain how contractual trust obviates other members within the supply chain from engaging in opportunistic behaviour. They further argue that once contractual trust exists, firms will be able to interpret their partner’s behaviour positively. This, in turn, leads to a sustainable long term cooperative relationship between them.

Trust between members in the supply chain is closely related to competence or capability to fulfil obligations or agreements as promised (Paterson 2007). Competence trust refers to the expectation that a given firm has the ability to properly perform a given task (Sako 1991). The strong expectation and belief of the firm in relation to their trading partners in delivering goods or services as required is an acknowledgement of trust in their partners' competency (Kwon & Suh 2005; Paterson 2007; Zineldin & Jonsson 2000).

Competence trust has been reviewed as the degree of partners' perception of ability, skills, expertise and knowledge possessed by other members in the supply chain (Coulter & Coulter 2002; Das & Teng 2001; Mayer, Davis & Schoorman 1995; Schoorman, Mayer & Davis 2007). This statement is supported by Keng and Zixing (2003) in their summary of the foundation of competence trust in business relationships. They argue that competence trust is constructed based upon a partner's skills, expertise and operational abilities in producing goods or services. They also suggest that sharpening business competence will result in continuous trust from partners since the viability of the supply chain is heavily dependent on other members' professional expertise.

The other dimension that is crucial for trust building is goodwill. Goodwill trust denotes responsibility, dependability and integrity of a firm to demonstrate concern for interests other than its own (Barber 1983 cited in Das & Teng 2001). This definition depicts that goodwill trust is built on reputation, good faith, positive intention and high integrity among members within the supply chain. Sako (1998) found that the existence of goodwill trust largely depends on the understanding of both parties in relation to the principles of fairness in trading. She also argues that goodwill trust is built upon partners’ informal commitment, partners’ technical assistance and partners’ provision of information. Das and Teng (2001) further clarify that reputation in conducting business fairly and with consideration of other members’ interests within the supply chain will help diminish opportunistic behaviour - and thus help generate goodwill trust.

Meanwhile, benevolence trust stems from the belief that a given partner wants to do good to another partner, aside from an egocentric profit motive (Mayer, Davis & Schoorman 1995). In their more recent research, it is argued that benevolence trust has received minor attention, especially in the macro level of analysis (such as between organisations). Furthermore, they contend that the bottom line of each business organisation is to make a profit, thus, benevolence trust is unlikely to be the primary factor in building trust between organisations. However, they believe that in a supply chain context, the act of benevolence between each member is a focal point in building inter-organisational trust (Schoorman, Mayer & Davis 2007). Next, the review of literature continues with the final construct of this research known as inter-firm relationship performance.

2.3.5 Inter-firm relationship performance

Buyer and seller relationships commenced when humans learnt to trade goods and services. Since then, this relationship has developed naturally over time and become an integral component of business operating strategies (Wilson 1995). As the nature of doing business evolved, firms shifted their attention from continuously choosing the right business counterparts over the firm's life-cycle, to the continuance of existing favourable inter-firm relationships (Zerbini & Castaldo 2007). The inter-firm relationship is becoming an important component of a successful supply chain network. In the initial study of SCM, supply chain has been viewed within a limited set of organisational stakeholders and the extension of traditional areas such as operations, purchasing and logistics. However, research on SCM has evolved over the past decade and broadened towards a variety of perspectives such as manufacturer-supplier relationships and business collaboration (Cook, Heiser & Sengupta 2011).

The importance of keeping close inter-firm relationships within the supply chain is inevitable since it may result in a better return on investment, effectiveness and well synchronised supply chain activities. In turn, these aspects may eliminate excess inventories, and result in reductions in replenishment lead time, better product development, and improvements in delivery speed and after sales service (McLaren, Head & Yuan 2002). Hence, there are benefits in preserving long lasting inter-firm relationships throughout the supply chain.

Authors such as Bowersox and Closs (1996) also assert that the most critical component in supply chain is the level of cooperation; and a positive relationship should lead to the highest level of joint achievement. Meanwhile, long-term inter-firm relationships within the supply chain allow a greater level of coordination in business decisions (Cook, Heiser & Sengupta 2011). In accordance with this statement, Morash and Clinton (1998) established that closeness in inter-organisation relationships between firms and their suppliers in almost 2000 companies in the USA, Japan, Korea and Australia was the key to success for responsive and operational excellence in the supply chain.

Keeping close inter-firm relationships within the supply chain also permits resource sharing between firms whereby parties involved can exploit each other skills and resources, which includes technological, human resources or even financial capabilities through joint venture initiatives to develop better products and services (Samaddar & Kadiyala 2006).

Literally, the concept of inter-firm relationship performance focuses on the degree to which the relationship is perceived to be effective and beneficial by both parties (Anderson & Narus 1990; Gyau & Spiller 2008; LaBahn & Harich 1997). It is important to note in this study that the term inter-firm relationship performance primarily focuses on the existence of business to business relationship-specific performance achieved by manufacturers in their relationship with major suppliers.

Researchers such as Dwyer, Schurr and Oh (1987) believe that firms enter cooperative relationships with other firms because of their expectation of benefits from the collaboration. These alliances tend to continue as long as the perceived benefits exist in the relationships. As noted by Rahman and Bennett (2009), the need for closer relationships is inevitable due to recent factors such as globalisation and stiff competition in the market and the focus on cost, quality, delivery, and technology. Subsequently, this creates a greater need for inter-firm relationships, especially with the firm’s major supplier. Sheu, Yen and Chae (2006) argue that collaborative inter-firm relationships are beneficial in the manufacturer-supplier dyad since such an association can be mutually beneficial.

The review of the literature has recorded at least two different themes when it comes to operationalising this construct. On the one hand, the inter-firm relationship performance construct is often measured by the business performance that exists due to a healthy inter-firm relationship. For example, Boeck and Wamba (2008) state that maintaining healthy inter-firm relationships is essential in a competitive supply chain since it will result in better business performance.

Meanwhile, Vlosky, Fontenot and Blalock (2000) argue the central benefits firms seek in developing, and maintaining a business relationship is overall organisational performance, which includes increases in sales volume, and profit or cost savings. Kalwani and Narayandas (1995), in their research on the manufacturer-supplier relationship, also indicate sales, inventory cost, prices and profits as the performance dimension in gauging the relationship performance. This view is also supported by Gyau and Spiller (2008) in their research on inter-firm relationship performance in agribusiness. They point out that relationship performance is measured via short term results in the inter-firm relationship and these include an increase in profit and sales volume, and cost reduction.

On the other hand, the outcome of inter-firm relationship performance is also measured in the form of future cooperation between firms in terms of potential new product creation through joint venture agreements (Cunningham & Homse 1982; Jap & Anderson 2007; Patrakosol & Lee 2009; Ryssel, Ritter & Gemunden 2004; Wikström 1996; Zerbini & Castaldo 2007).

Within the context of manufacturing industry, Sahay (2003b) agrees that manufacturers seek benefits in terms of future collaboration in new product development. He argues that a close relationship may enable manufacturers to join forces with their supplier in terms of sharing and modifying new designs that would lead the manufacturers to produce new products better and faster. This view is also shared by Dyer (1996) in his buyer-supplier research. In his research he included the speed of new product development to measure relationship performance.

Meanwhile, Suwannaporn and Speece (2010) have argued that external linkages with the suppliers (one of technological capability dimension) are one of the important predictors in ensuring the success of new product development. They further assert that maintaining close relationships with the suppliers are inevitable since their expertise in certain technologies and the ability to implement a specific technology may be required in designing and developing new product. For optimal effects, the involvement of suppliers should be in all stages of new product development. This requires the deepest involvement of suppliers in the project and demand stronger manufacturer-supplier relationship (Petersen, Handfield & Ragatz 2003; Van Echtelt et al. 2008).

While past research has also shown that almost 33 per cent of company’s sales are contributed by the introduction of new product in the market (Chen, Lin & Chang 2006). Morash, Dröge and Vickery (1997) have found that new product development is uniformly related to all of the firm's operational functions. In addition, they also found that new product development is the most important function for overall firm financial success. In view of the above, it is crucial to ensure that firm maintain close inter-firm relationship with its suppliers and consistently collaborate in developing new product for the market as it is an important source of income in the future.

In conclusion there are two dimensions in the inter-firm relationship performance construct. This study, as suggested by the literature, utilises both business performance and future cooperation in new product development as dimensions. In summary, it is important to maintain a close relationship between manufacturers and suppliers, especially within the supply chain. There are numerous advantages in maintaining a close inter-firm relationship and it can be concluded that the inter-firm relationship is no longer a qualifying strategy but a winning one in order to harvest the fullest benefits of SCM. The next section provides a summary on the gaps in the literature.

2.4 Gaps in the literature

The above review on the literature provides evidence that much research needs to be conducted in relation to technological capability, power and trust, and inter-firm relationship performance. The main conceptual points derived from this review are that, notwithstanding the extensive research available on the topic of interest, especially in the marketing and strategic management fields, there have been very limited studies within the field of operations management that have looked at the relationship performance between firms and their major suppliers. More specifically, the link between technology capability and inter-firm relationship performance is still relatively unknown. Further, there is no known research about the role of power and trust in mediating the relationship between technological capability and inter-firm relationship performance in both developed and developing countries. Furthermore, the prior literature has largely focused on *developed* countries rather than *developing* economies. The literature shows that developing economies (in this case, Malaysia) does not enjoy the same level of technological capability as many developed countries. In accord with the developing nation status, there has been no formal attention in terms of building basic high technology infrastructure, technological knowledge and technical skills as compared to develop countries. It also appears there are limited studies in Malaysia examining the issues of resource and capability as suggested by the distinctive competence theory and Resource Based View theory; and none of them link technological capability with trust and power and inter-firm relationship performance. Thus, this research aims to conduct a thorough examination that could fill the literature gap, particularly in developing countries, within the empirical setting of Malaysia.

CHAPTER 3: CONCEPTUAL FRAMEWORK

3.1 Introduction

The previous chapter provided reviews of relevant literature relating to the study's concepts of interest. They include technological capability, power, trust and inter-firm relationship performance. This chapter focuses on the conceptual framework and hypotheses development, based on the previous chapter discussions and applicability of the related theories. Firstly the chapter provides the conceptual model drawn from the relevant theoretical perspective to answer the research question. Then discussion focuses on the development of the study's research hypotheses by providing linkages between the constructs of interest.

3.2 Conceptual model

This section draws on the conceptual model to answer the research question. The main focus of the study is to investigate the relationship between technological capability, power, trust and inter-firm relationship performance. The independent variable in this study is technological capability and the dependent variable is inter-firm relationship performance. Power and trust are utilised as mediators in the relationships the dependent and independent variables.

The study examines the relationship between technological capability and inter-firm relationship performance and, subsequently, a study of the association between technological capability and the role of power. Thereafter, the association between power and inter-firm relationship performance is drawn. The Resource Based View theory, as well as power-dependency theory, is used in an integrated manner. The Resource Based View theory is used to predict the relationship between technological capability and inter-firm relationship performance. Particularly, this theory is utilised to explain how technological capability is shaped as the competitive advantage of an organisation.

On one hand, power-dependency theory is employed to explain the existence of a power imbalance in a relationship as a result of having technological capability. On the other hand, the trust theory is employed to comprehend the impact of technological capability on inter-firm trust. Both of these theories (power-dependence and trust) are also employed to understand the relationship between the role of power and trust in impacting inter-firm relationship performance.

Figure 3.1 shows the conceptual framework that represents seven hypotheses investigated in this study. The next section then discusses the research hypothesis by examining the relationship between the constructs of interest.

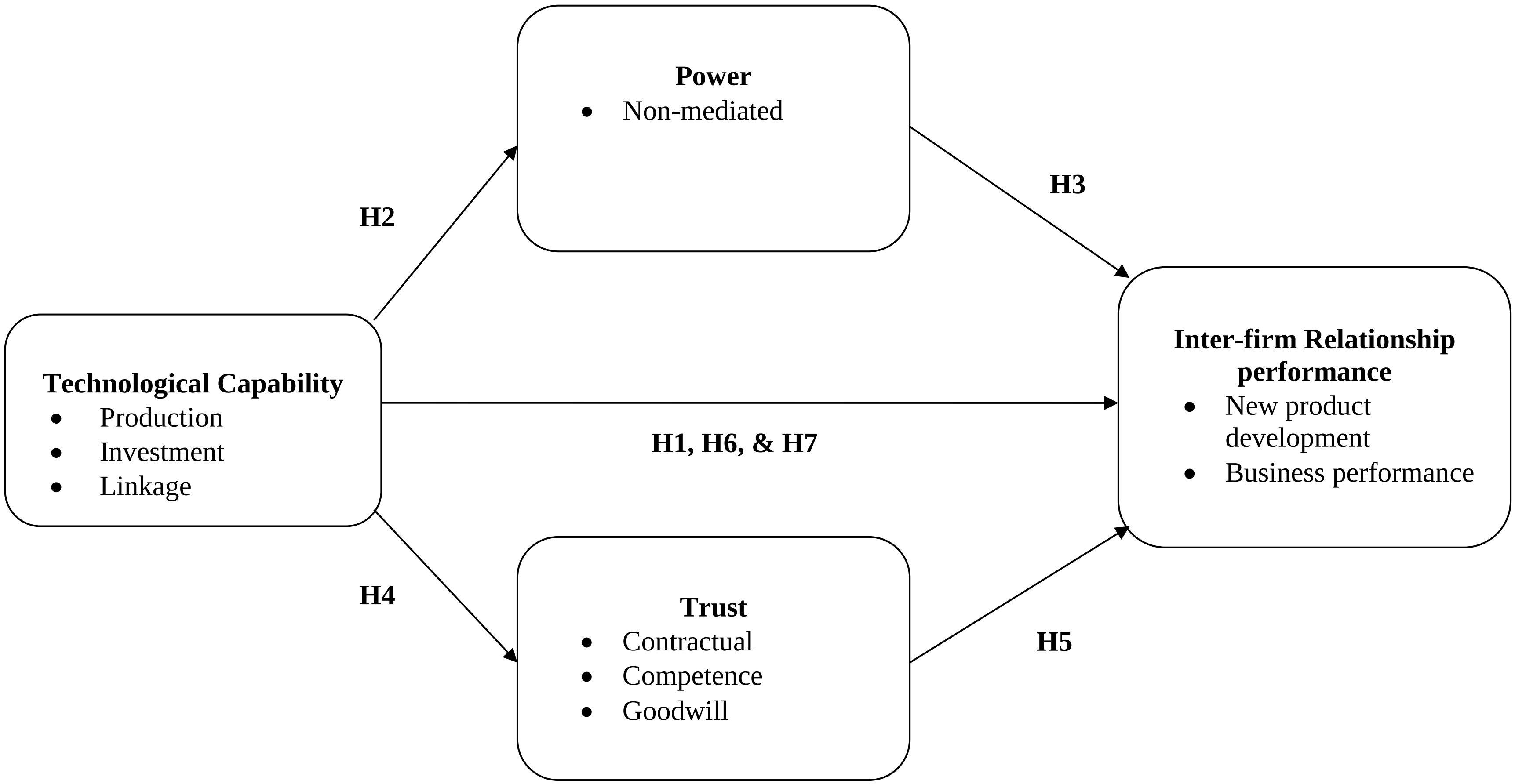

Figure 3.1: Conceptual model

3.3 Research hypotheses

3.3.1 Association between technological capability and inter-firm relationship performance

Previous literature has regarded technological capability as one of the essential resources to remain competitive in the market. This is parallel to the Resource Based View theory that acknowledges that firms compete with each other on the basis of resources and capabilities (Wang et al. 2006). The Resource Based View theory assumes that sustainable competitive advantage is necessary to survive and thrive (Wang et al. 2006) and can be acquired by firms through accumulating technological capability (Tsai 2004). Overall, in the competitive business environment, firms have no choice but to continue investing in state-of-the art technological equipment and facilities to ensure their business survival.

Several literatures reveal that superior technological capability allows firms to apply new knowledge that will enhances a firm’s competency development, thus resulting in greater business performance (Jonker, Romijn & Szirmai 2006; Kim 2006). On the other hand, technological capability also enables firms to produce new innovative products. Researchers believe that superior technological capability can increase efficiency and higher differentiation through improved process and product innovations and thus improve a firm’s capability in new product development (Kam 1999; Lall 1992; Tsai 2004).

Meanwhile, the Resource Based View theory also governs the concept of inter-firm relationships. Ramaseshan, Yip and Pae (2006) argue that firms engage in cooperative relationships with the objective being to achieve competitive advantage. They reveal that the main outcome of business cooperation is to permit firms to compete effectively in the marketplace. For example, maintaining healthy relationships may enable firms to enjoy uninterrupted supply of material in the long run (Jap & Ganeson 2000). Therefore, the concept of Resource Based View theory can be adopted in a dyadic channel relationship since a long term relationship between firms can be viewed as part of a firm's resources that cannot be easily imitated.

Conversely, the association between technological capabilities with the manufacturer-supplier relationship has also been recorded by many scholars in the literature. For example, a study by Angeles, Nath and Hendon (1998) on electronic data interchange (EDI) among 128 firms in the USA found that technology EDI implementation could develop closer cooperative relationship between manufacturers and suppliers. Vlosky, Fontenot and Blalock (2000) support the view that extranet usage leads to closer a partnership between manufacturers and suppliers. They argue that firms consistently producing superior benefits will be highly regarded by other members in the supply chain; and they tend to commit themselves to establishing, developing and maintaining this relationship.

Meanwhile, Boeck and Wamba (2008) investigated the association between the use of firm's technical resource; i.e. radio frequency identification (RFID) and manufacturer-supplier relationships in the retail supply chain. The data was collected via structured, semi-structured and non-structured interviews from 52 individuals in the retail supply chain. The findings reveal several implications of technological capability on the manufacturer-supplier relationship. First, technological capability (in this case the use of RFID) has allowed communication and information sharing both downstream and upstream in the supply chain. Second, it creates close cooperation among members in the supply chain and they look forward to the shared benefits from the system. Third, it increases relationship value since additional information is accessible to all members in the supply chain. Therefore, they conclude that technological capability leads to a positive interrelationship within members in the supply chain. They further suggest technological capability will able to shrink the supply chain and any new opportunities for collaboration shall further increase the relationship benefits as compared to partners who do not use the technology. Therefore, the above arguments would lead to the following hypothesis:

H1: Technological capability has a positive impact on inter-firm relationship performance.

3.3.2 The role of power

Power dependence theory states that the basis of power 'resides implicitly in the other's dependency' (Emerson 1962, p. 32). This theory explains how power exists through the mutual dependency of organisations in a relationship channel. The theory assumes that firms will try to influence each other's conduct in a relationship and the power to control emerges when a firm possesses unique resources needed by the other party (Emerson 1962).

The argument that technology deployment may create power imbalance in the inter-firm relationship can be found in several studies. Scholars caution that disruptions in a manufacturer-supplier exchange may exist in the event of acquiring technology-driven capability. One of the reasons behind this conflict is the emergence of power in the relationship. For example, Coughlan et al. (2001) assert that information technology has a strong impact on a firm's bargaining power in a supplier-manufacturer relationship.

Meanwhile, Vlosky, Fontenot and Blalock (2000) found that technological capability (via adoption of RFID) will result in a power imbalance and that could affect the level of inter-dependency of the other parties in the relationship. They claim that power imbalance will create an unjust balance in a relationship since powerful firms will have the advantage of dominating the relationship climate. They argue that members in the supply chain may feel technological initiatives give other parties in the chain more power and gain competitive position. In other words, possession of distinctive technological capability may affect the power-dependence relationship between parties in the supply chain. Therefore, these authors contend that continuous improvement of technological capability will tend to strain the relationship between members within the supply chain because the use of power may lead to conflict in the interrelationship.

Power dependency theory assumptions on power disparity can be applied to investigate the relationship between technological capability and power. Ryssel, Ritter and Gemunden (2004) assert that the implementation of technology will create power inequality in inter-firm relationships. As such, scholars believe that technological capability may increase dependency of one party on another and thus create a power imbalance in the relationship whereby one partner will have the ability to reshape rules in the relationship to serve their own interest (Anderson &

Narus 1990; Ke et al. 2009). Consistent with this statement, Ke et al. (2009) proclaim that technology implementation will enable a trading partner to be dominant in the alliance and thus affect the level of power-dependency of the target within the relationship. Ratnasingam (2000), in her paper focussing on an investigation into the influence of power on trading partner's trust in the electronic commerce environment, concluded that electronic data interchange (EDI) capability has the potential to change organisational behaviour, technology usage and the manufacturer-supplier relationship. Besides fulfilling the objective of enhancing the effectiveness of coordination, technological capability could create a power imbalance among partners in the inter-firm relationship.

The assumption of the power-dependency theory and evidence from studies to date suggest that technological capability may generate power in the relationship channel. Nevertheless, power does not necessarily link towards a negative connotation; it also may be the driver in improving inter-firm relationships and business performance (Arend & Wisner 2005). Additionally, a review of the literature provided in the previous chapter suggests that technological capability is closely related to the non-mediated power base. Therefore, this study contends that technological capability is related to the non-mediated power creation in the relationship.

In the interaction between non-mediated power base and the inter-firm relationship, it is perceived that the non-mediated power base enhances the attitude towards maintaining healthy relationships by fostering norms and values among supply chain members (Frazier & Summers, 1986 cited in Zhao et al. 2008).

It is argued that a dominant firm with expert power is expected to contribute their skills, knowledge and expertise (in this case technology) with their suppliers which, in turn, will benefit them in the relationship (Zhao et al. 2008). In other words, firms that hold expert power may influence other firms' behaviour based on its superior expertise (Rosenbloom 2004). Firms with referent power (whose goals are common with its supplier and often seen as a reference group) might influence their suppliers in a manner seen beneficial to them in the relationship (Ke et al. 2009).

Zhao et al. (2008) conducted research on the impact of power on relationship commitment within the context of the integration between manufacturers and customers in a supply chain. Their findings, based on 617 manufacturing companies in China, divulge that expert power and referent power are important in improving manufacturers' relationship commitment.

Meanwhile, Maloni and Benton (2000) argue on the impact of power on performance. They contend that the manufacturer-supplier relationship may significantly enrich performance. Given that the non-mediated power is perceived to improve inter-firm relationship, it may also positively affect the relationship performance. This argument is based on research by Brown, Lusch and Nicholson (1995) which established that the use of non-mediated power embellishes the suppliers' opinion of the manufacturer's performance that they hold more powerful resources in the relationship. Stern and Reve (1980) also support this notion when they argue that firms with dominant power enjoy better prosperity and power - enhanced cooperation in the relationship will lead to increase overall profitability.

In summary, the above arguments uncover the theoretical and possible empirical association between technological capability, power and inter-firm relationship performance. The supply chain environment enables firms to share information, make joint decision, integrate business process and share knowledge (Jasperson et al. 2002; Kim 2006). In order to realise all these benefits, a power dominant firm is expected to exercise its power; and this act may be deemed as exerting extra pressure by the target firm (Ke et al. 2009). Yet, there is no known research being conducted to determine the mediating effect of a firm's power on the association between technological capabilities and inter-firm relationship performance. This gap hinders the advancement of knowledge within this research domain, and thus it is crucial to clarify the impact of technology on a firm's power, especially within the manufacturer-supplier context. Thus, the statement above is formalised into the following hypotheses:

H2: Technological capability is positively associated with power.

H3: Power has a positive impact on inter-firm relationship performance

H6: Power mediates the positive association between technological capability and inter-firm relationship performance

3.3.3 The role of trust

Despite attention having been paid to the understanding of technological capability in various research streams, limited attention has been given to comprehending the impact of technological capability on inter-firm trust, especially from the operational management point of view. The empirical evidence shows that technological capability can promote trust-building in a relationship.

The theory of trust explains how socio-economic development is shaped through the level of trust inherited by society in a social relationship (Fukuyama 1996; Kim 2006). The theory posits that the key to achieving economic development lies in the amount of trust that is possessed by firms in their business partners (Brewster 1998).

Sako (1998) extends this theory by introducing the concept of mutual trust between partners in strategic business alliances. She contends that trust is an expectation that trading partners will behave in a mutually acceptable manner. The assumption includes the expectation from both sides that there will be no exploitation of weaknesses by the trading partners.

Researchers denote that attaining superior technological capability may improve a firm's competency level and thus increase the level of trust and confidence a party has in a firm's ability to honour their agreement. They believe that advancing technological capability will boost a firm's reliability to provide high quality products in a timely manner - and thus increase satisfaction in the relationship (Bongsug, HsiuJu & Chwen 2005; Ryssel, Ritter & Gemunden 2004).

Meanwhile, Wang et al. (2006) argue that instead of creating a power shift, possessing technological capability will actually enhance a firm's competency by making the production process more efficient and reliable in producing high quality products. It can also improve a firm's ability to deliver goods in a timely manner which, in turn, minimizes supply chain disruption and further increases other firms' trust and satisfaction. This achievement will reflect the partners' competency and their readiness to fulfil other parties' needs and, therefore, the level of trust may increase in a relationship (Ryssel, Ritter & Gemunden 2004).

In a similar vein, Blomqvist (2002) argues that a firm's technological capability is able to reflect a partner's ability to deliver state-of-the-art skills and technological knowledge. A firm's ability to maintain the existing technology while continuously absorbing a new one serves as a track record for other organisations in the relationship to evaluate a firm's competency level. Positive evaluation of this competency would increase trust at the level of confidence in the relationship. Therefore, it can be concluded that technological capability increases the level of trust in the alliance.

The theory of trust also postulates that business relationships built on high levels of trust will be able to produce efficient outcomes and enhance innovation since healthy relationships will permit the creation of various business opportunities (Brewster 1998). Consistent with this concept, Sengun and Wasti (2009) highlight that the level of inter-organisational trust is perceived to be related to relationship performance. They argue that business relationships with higher levels of trust may lead to positive relationship performance.

Meanwhile, Ryssel, Ritter and Gemunden (2004) explain the possible association between technology deployment and trust in allowing more value creation in a manufacturer-supplier relationship. They suggest that the association between technology deployment and high level of trust in a relationship will result in a higher level of value creation in a relationship which includes better business performance and possible future collaboration on new product development.

In short, the reviews of the literatures confirm that extensive research has been conducted to determine the importance of trust level in the manufacturer-supplier relationship. Nevertheless, there is no known research that has attempted to verify whether the level of trust mediates the relationship between technological capability and inter-firm relationship performance. To date, most of the empirical results on the mediating effect of trust are predominantly focused on improving commitment and control in the manufacturer-supplier relationship (Kwon & Suh 2005; Leonidou, Talias & Leonidou 2008; Ryu, Min & Zushi 2008). Hence, there is a need to further investigate the mediating effect of trust on technological capability and inter-firm relationship performance. Therefore, this study proposes to fill this gap by formalising the above statements into the following hypotheses:

H4: Technological capability is positively associated with the level of trust

H5: Trust has a positive impact on inter-firm relationship performance

H7: Trust mediates the positive association between technological capability and inter-firm relationship performance

3.4 Chapter summary

This chapter has offered the study's conceptual model, and specified the relationship between technological capability and inter-firm relationship performance and the role of power and trust in the relationship. It provides the arguments on the inter-connection between the Resource Base View, power-dependency and trust theories that are used to explain the conceptual model and stated the hypotheses based on these arguments and empirical evidences. The next chapter discusses the research methodology employed to address the research question of this study and details the statistical procedures adopted to test the hypotheses.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

The previous chapter offered the study's conceptual model and the research hypotheses which have been derived based on the review of relevant literatures relating to concepts of technological capabilities, power, trust and inter-firm relationship performance. This chapter provides a discussion on the research design, data collection processes and the data analysis procedures used to answer the research question. The selected research design is discussed offering overviews of the quantitative, qualitative and mixed method approach, together with an explanation of the rationale for choosing the appropriate design that has driven this study. These discussions are followed by an in-depth explanation on the approaches relating to the development of survey questionnaires, population and sample selection, and data collection administration. Ethical consideration to ensure that the research is conducted within the approved ethical boundaries is also discussed. As this study involves a mixed method approach, the data were collected in two phases. An explanation is provided of Phase One which concentrates on the quantitative procedures involving both data analysis techniques and statistical procedures. The discussion continues with Phase Two which focuses on qualitative data collection and analysis protocols.

4.2 Research design

Research design can be defined as a master plan of how the study will answer the research question (Saunders, Lewis & Thornhill 2009). In other words, it provides the procedural structures that the researcher follows, including data collection and data analysis (Leedy & Ormrod 2005). In general, the research design is developed in the spirit of inquiry and with careful consideration of a large number of factors. Nevertheless, the use of appropriate methodology is driven mainly by the objective of the research and the research question. Basically, there are three distinctive research designs that are widely used, especially in the social science field, namely, quantitative, qualitative and mixed method approaches.

The quantitative approach was originally dominant in the field of natural science to study natural phenomenon, but was later used in social science studies to predict general patterns of human activity by using a set of probabilistic causal laws (Neuman 1997). Singh (2007) viewed the quantitative approach as a research method that primarily aimed to determine the relationship between a set of independent and dependent variables to obtain answers to the research question.

Meanwhile, Blessing and Chakrabarti (2009, p. 79) state that 'quantitative approach in research is applied to investigate or measure the degree in which phenomena occur'. Leedy and Ormrod (2005) also share the same view when they suggest that the quantitative approach is all about exploring the possible correlation between more than two phenomena without intending to determine the cause and effect relationships. As this study is descriptive in nature and attempts to establish the relationship between technological capability, power, trust and inter-firm relationship performance, and not to institute causation among them, it is clear that the selection of quantitative approach is arguably appropriate and aligns with the above scholars' viewpoint.

On the other hand, the qualitative design stands in contrast to the procedure of the quantitative method. Qualitative design employs different approaches in the strategy of inquiry, data collection and data analysis (Creswell 2009). Traditionally, this design stems from the study of anthropology and sociology which emphasizes elaborating the description of the 'meaning' of phenomena for the people or culture under examination (Newman & Benz 1998, p. 9). This method is an approach that tries to interpret human's feelings and their experiences through detailed observation in their natural settings without the use of quantification and measurement (Neuman 1997; Terre Blanche & Durrheim 1999).

The focus of qualitative design is on subjective assessment of attitudes, opinions, and behaviour. This method possesses unique procedures in data analysis which rely heavily on data image and text manuscripts, while the outcome of the research generates results either in non-quantitative form or in a manner that is not subjected to rigorous statistical analysis (Creswell 2009; Kothari 2004). The use of qualitative approach is also inevitably important in this study to answer the research question, as it allows for accumulation of rich data to the relatively unexplored area of the studied variables. The added benefits of a broader study are invaluable since it could expand the knowledge gathered from this approach to provide more general findings.

The term mixed method basically refers to a research design that contains elements of both quantitative and qualitative approaches. Creswell (2009, p. 165) defines mixed method study as:

> ---*the study that involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research.*

The above statement simply denotes that research that falls into this methodology are those that involve collecting and analysing both forms of data in a single study. The interest of using mixed method approach is growing in popularity and this design has been widely used in a number of publications and research studies (see Becker 2007; Carr & Smeltzer 2002; Creswell 2009). These manuscripts not only symbolize recognition of significant advancement in the mixed method approach, but also denote the metamorphosis in research methodology study from the traditional quantitative-qualitative point of view.

Driven by the objectives of the study and the identified research questions, this study incorporates mixed method as the approach to describe the impact of technological capability on power, trust and inter-firm relationship performance. The basis of combining both methods is to provide a better understanding of the research problem.

As there are limitations in both qualitative-quantitative research designs, the use of mixed method can overcome or neutralise some of the drawbacks from each method. For example, the qualitative method is able to provide insights gathered from the rich data which is not available through a quantitative approach. Creswell and Clark (2007) clarify that the combination of quantitative and qualitative design will involve some triangulation elements that will provide strengths which can compensate for the weaknesses of both methods and thus increase the reliability of the results. Since there are advantages and disadvantages of using qualitative and quantitative approaches in a single research, the researcher in this study aimed to exploit the strength of both designs to obtained the synergy described by Creswell (2009).

There are two phases involved in gathering the needed data for this study. Figure 4.1 provides a useful way to depict the basic procedures of mixed method approach used in this study. The quantitative design is selected as the first phase to describe the association among the studied variables. Subsequently, the qualitative approach is used to uncover the nature of the problem by gathering in-depth information since very few studies have been done to measure the relationship between the variables involved. In other words, the qualitative method in this study is used to help explain the quantitative findings.

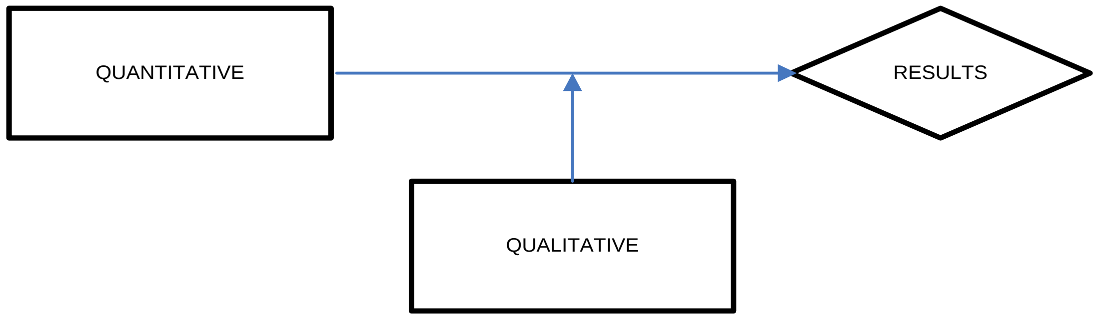

Figure 4.1: Basic model of the mixed method used in this study
(Source: Clark and Creswell (2008))

Greene et al. (2008) highlighted five different purposes of mixed method evaluation design: triangulation, complementarity, development, initiation and expansion. This research falls under triangulation category and Greene et al. (2008, p. 123) define it as ‘the use of multiple methods in investigating the same phenomenon, with offsetting or counteracting biases, in order to increase the validity of the inquiry results’. The core idea behind the triangulation principle is that all methods have biases and limitations. Nevertheless, when these methods are used to examine a given phenomenon, the results tend to converge or corroborate one to another and this will improve the clarity of the findings, and strengthen the validity of the inquiry results (Creswell 2009).

As mentioned above, there are two stages of data collection involved in this study. The priority is assigned to quantitative design followed by qualitative approach. The notation of this study can be viewed as: *QUAN* + *qual*, and under this approach, both findings are compared and integrated in the discussion of major findings section in Chapter 7. The first phase is quantitative data collection which involves distribution of survey questionnaires to the relevant sample and the second stage is qualitative data gathering, conducted through semi-structured interview. The recommended strategy of inquiry for the above data collection approach under the mixed method design illustrated under Figure 4.2 is known as sequential explanatory design.

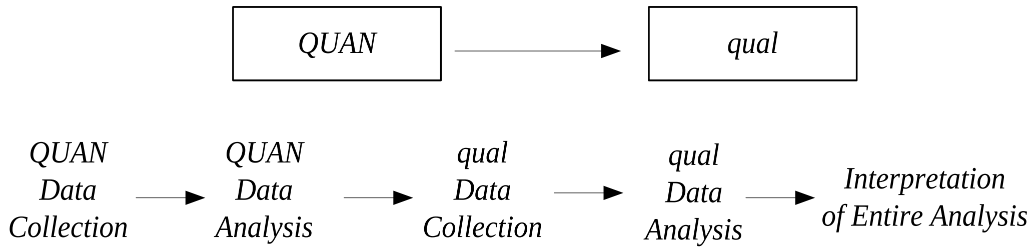

Figure 4.2: Sequential explanatory design
(Source: Creswell (2009))

As noted by Creswell (2009), there are six major mixed method approaches: sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested and concurrent transformative. The sequential explanatory design is the most common of all the major mixed method approaches. The design prioritises quantitative data collection and analysis, which is subsequently followed by the qualitative data. This design dictates that both stages of data collection need to be integrated in in interpretation stage and not in the analysis phase. Therefore, both findings from quantitative and qualitative methods will only be compared and integrated in the discussion chapter (Chapter 7) and not earlier. The main purpose of this strategy of inquiry is to utilise the qualitative results in explaining the primary findings gathered from quantitative analysis.

The rationale for choosing the sequential explanatory design for this study is because it is better suited in explaining and interpreting the relationships between the studied variables. Other explanation includes the straightforward nature of the design, its ease of implementation and that the steps are clearly divided into several separate stages - thus these traits can be seen as the main strengths of this design.

Furthermore, this design permits reporting of the results into two separate parts while the final discussion will integrate findings from both phases. Therefore, it is a more applicable approach to adopt in this study since it gives equal priority to both quantitative and qualitative design to achieve the research objective while answering the research questions, and is more appropriate than a single study. Clarification on other mixed methods mentioned above are summarised in Table 4.1.

Table 4.1: Mixed method type of design

Design Type	**Implementation**	**Priority**	**Stage of Integration**
Sequential explanatory	Quantitative followed by qualitative	Usually quantitative; can be qualitative or equal	Interpretation phase
Sequential exploratory	Qualitative followed by quantitative	Usually qualitative; can be quantitative or equal	Interpretation phase
Sequential transformative	Either quantitative followed by qualitative or qualitative followed by quantitative	Quantitative, qualitative equal	Interpretation phase
Concurrent triangulation	Concurrent collection of quantitative and qualitative data	Preferably equal; can be quantitative or qualitative	Interpretation phase or analysis phase
Concurrent nested	Concurrent collection of quantitative and qualitative data	Quantitative or qualitative	Analysis phase
Concurrent transformative	Concurrent collection of quantitative and qualitative data	Quantitative, qualitative or equal	Usually analysis phase; can be during interpretation phase

(Source: Creswell (2009, p. 179)

Having provided an overview of the mixed method approach which forms the backbone of this research design, the next the section continues with the ethical considerations to be undertaken as a guideline in this research.

4.3 Ethical considerations

Prior to undertaking of this research, an ethical clearance application has been submitted to the Chair of the USQ Human Research Ethics Committee (HREC) for approval. The HREC found that the study meets the requirements of the National Statement on Ethical Conduct in Human Research and granted full ethics approval (approval no. H10REA012, see Appendix 1).

In addition, several steps have been taken to ensure the research is undertaken within ethical boundaries. First, in both phases of data collection, an appropriate language to the audience is used in every cover letter explaining the purpose of the research. This is to ensure that the respondents understand the nature of the project, research objective and the benefits it might provide to the academic world, as well as to the manufacturing industry (Appendix 2). Meanwhile, consent forms (Appendix 3) were circulated to the interview participants prior to the interview session and they were asked to read and provide their signatures on the form to show that they understood their rights during the interview.

Next, assurance of respondent anonymity and confidentiality of proprietary data in both data collection phases is conveyed on the first page of the survey. The respondent identity is kept anonymous in Phase One and in Phase Two each case study organisation and the participant of the interview is represented by a code. Finally, it is important for the researcher to maintain a high standard of integrity in conducting the research to guarantee the accuracy of the data and, at the same time, respect participants' personality, rights, wishes, beliefs, consent and freedom (Tharenou, Donohue & Cooper 2007).

4.4 Phase One: Quantitative method

The first phase of data collection is the quantitative component. Driven by the conceptual framework developed from the literature review section, an appropriate strategy of inquiry to answer the research question is identified in this section. This phase consists of quantitative data collection, which primarily deals with the survey questionnaire development, administration and analysis. The data is collected through distribution of survey questionnaires across a sample of companies within the Malaysian manufacturing sector to allow empirical analysis of answers to the research issues. Details on survey instrument development, sample selection, data collection and statistical analysis involved in this research is discussed below.

4.4.1 Survey instrument development

There are various definitions found of survey questionnaire terms in many research-related text publications. For example, Zikmund and Babin (2007, p. 64) define survey as ‘a research technique in which a sample is interviewed in some form or the behaviour of respondents is observed and described in some way’. They further elaborate that it is a method of collecting primary data through communication with a representative sample of individuals from a target population. On the other hand Babbie (2007, p. 246) explain questionnaire as ‘a document containing questions and other types of items designed to solicit information appropriate for analysis’. Meanwhile Pathak (2008, p. 110) describe a questionnaire as ‘a set of questions, in which the respondents are expected to provide relevant and specific information’. Nonetheless, in this study the term survey questionnaire refers to the instrument used for the data collection gathered from the target population. This term is based on Babbie’s (2007) opinion that reflects survey questionnaire in a broader sense, that is, is to gather data on a particular issue from the sample of the studied population.

The rationale for choosing a survey questionnaire in this study is its ability to provide a quick, inexpensive, efficient, and accurate means of assessing information about a population (Zikmund & Babin 2007). Babbie (2007) believes that a survey questionnaire is one of the best methods available in collecting primary data to describe a large population without having to observe them individually. Meanwhile, Bailey (1994) reports that a survey questionnaire has various advantages including time saving, since all the questionnaires can be sent simultaneously to all the respondents, there is greater assurance of anonymity as there is no interviewer present at the scene who can identify the respondent, standardised wording so that each respondent is exposed to exactly the same set of questions, eliminating interviewer bias since there is no interviewer involvement, and greater accessibility as respondents can be reached easily despite being geographically dispersed.

The design of a successful survey questionnaire depends on the appearance of the questions. Among the important issues that need to be taken into consideration when designing a survey questionnaire is the wording of the questions, classification of the studied variables and the physical appearance of the survey questionnaire (Pathak 2008; Sekaran 2000). The wording of the questions is carefully developed to ensure clarity of the questions, comprehensiveness, and that it is in accordance with the background of the studied population. The studied variables are carefully classified in a logical manner to ensure coherence which will later ease the coding of the variables in the analysis. Meanwhile, the physical appearance of the survey questionnaire set is checked by the selected panel in the pilot study process to ensure the existence of face validity.

The instruments used in this study are adapted and adopted from previous research. The utilisation of previous studies' instruments of survey questionnaires not only assists in the reliability and validity of the instruments, but it also helps reduce the amount of work needed in developing and testing new instruments and thus manages to save time in conducting the research (Morgan & Hunt 1994).

However, these items are carefully adapted by considering the original purposes of those researches in order to maintain the reliability and validity of the instruments. For example, the measurement items adapted from Wang et al. (2006) are chosen since the purpose of their research is to know the association between technological capability and business performance within the context of Resource Based View theory which is found to be relevant to this research. Same with other measurement items for other constructs (power, trust, and inter-firm relationship performance) whereby they are assessed using the same criterion and chosen because of their suitability to this research. These selected items are then gone through the rewording process, categorisation and general appearance (Sekaran & Bougie 2009).

Next, these instruments are preliminary tested by supply chain professionals and revised accordingly to maintain and enhance their validity and reliability. This study has employed approximately 46 preliminarily items to measure all the four constructs: technological capability, power, trust and inter-firm relationship; and the full set of survey questions can be found in Appendix 2.

The set of survey questions in this study consists of five sections (refer to Appendix 2). The first section comprises the demographic items relating to the studied companies' background such as manufacturing subsector, legal structure, paid-up capital, average annual sales, number of major suppliers, annual allocation on research and development, staff training and technological infrastructure. The role of the participant in the organisation is omitted from the demographic section as the questionnaire were sent via postal service and addressed implicitly to the intended target respondents directly by mentioning their names and designations based on the list obtain from the FMM Directory. Thus, the exclusion of the target respondents roles in the organisation from the survey questionnaire are deemed appropriate.

The other four sections are arranged in a logical manner commencing with items on technological capability, power, trust and inter-firm relationship performance. The independent variable is technological capability, which has been defined in Chapter 2 as the firm's capability to employ its salient and diverse range of resources including knowledge, skills and technical resources to offer products and remain competitive in the market. As argued by Afuah (2002), technological capability is developed and accumulated over time. It reflects the firm's ability to employ various technological resources. The accumulation of technical knowledge it is argued, has an impact on a firm's ability to employ new technologies and skills in its daily operations and thus help the firm to quickly identify new technological trends, experiment with emerging designs and engage in product innovation (Zhou & Wu 2010). Based on the review on technological capability, 16 items (refer to Table 4.2) have been adapted from previous studies that assess a manufacturer's technological capability and its related characteristics (items adapted from Fantazy, Kumar &

Kumar 2009; Kim 2006; Narasimhan, Swink & Kim 2005; Wang et al. 2006; Zhou & Wu 2010).

Table 4.2: The measurement items of technological capability

Code	Category	Items
TC1	Production	Our firm uses technology to increase the company's productivity.
TC2	Production	Our firm uses technology to lower the cost of production.
TC3	Production	Our firm uses technology to develop a number of new products every year.
TC4	Production	Our firm uses technology to modify features and specifications of existing products
TC5	Investment	Our firm always makes relatively heavy investment in Research and Development activities.
TC6	Investment	On-the-job training is provided in our firm to improve the technical skills of employees.
TC7	Investment	Our firm is qualified to attract and motivate talented experts in R&D.
TC8	Linkage	Our firm has strong capability to integrate external technological resources with our in-house resources.
TC9	Linkage	Our firm has strong capability to integrate internal technological competency with other in-house resources.
TC10	Linkage	Our firm has the skills needed to transmit information, skills and technology to our major suppliers.
TC11	Linkage	Our firm is skilful in absorbing and applying new technology to problem-solving.
TC12	Investment	Our firm is one of the leaders in our primary industry to establish and upgrade technology standards.
TC13	Production	Our firm always use new technology to do something unique.
TC14	Production	Our firm always use technology to create new knowledge and competencies unavailable elsewhere.
TC15	Investment	Our firm has accumulated stronger and various technological skills.
TC16	Production	Our firm always leads technology innovation of the principle industry in which we operate.

As discussed in chapter 3, power is one of the constructs that may mediate the relationship between technological capability and inter-firm relationship performance. Based on the literature, the non-mediated power base (expert and referent) is found to have theoretical connections on both independent and dependent variables of this study. Therefore, the measurement items that represent non-mediated power have been adapted from various past studies (Brown, Lusch &

Nicholson 1995; Ramaseshan, Yip & Pae 2006; Zhao et al. 2008). A total of eight observations have been included in this study to measure the non-mediated power base and these items can be found in Table 4.3.

Table 4.3: The measurement items of power

Code	Category	Items
PW1	Expert	Our firm is viewed as a dominant partner with lots of technical experience by our suppliers
PW2	Expert	Using our firm's unique competency to make the suppliers accept our recommendations.
PW3	Expert	Our major suppliers often request technical advice from our firm.
PW4	Expert	Our firm had specially trained people who really knew what had to be done
PW5	Referent	Our major suppliers really admire the way we run our business and try to follow our lead.
PW6	Referent	Our major suppliers go along with our request because they have similar feelings about the way a business should be run.
PW7	Referent	Our major suppliers always want to be similar with our firm's opinions and values.
PW8	Referent	Because our major suppliers are proud to be affiliated with us, they often do what we ask.

Trust has been identified as the second construct that may mediate the relationship between technological capability and inter-firm relationship performance. The possible characteristics of this construct have been discussed in detail in Chapter 2. In order to measure this construct and its possible traits, this study has adapted 12 measurement items from the previous literature in this domain (Abdullah 2009; Kumar, Scheer & Steenkamp 1995; Liu et al. 2008; Sengun & Wasti 2009; Zaheer, McEvily & Perrone 1998) and these items are represented in Table 4.4 below.

Table 4.4: The measurement items of trust

Code	Category	Items
TR1	Contractual	Our major suppliers do not breach agreements to their benefit.
TR2	Contractual	Our major suppliers are always sincere and do not alter facts to get what they desire.
TR3	Contractual	Our major suppliers always carry out work/provide services with the standards and performance as agreed.
TR4	Contractual	Our major suppliers always try to inform us if problems occur.
TR5	Competence	Our major suppliers always provide the correct information we require.
TR6	Competence	Our major suppliers always listen and seriously respond to our proposals.
TR7	Competence	Our major supplier is trustworthy.
TR8	Competence	Our major supplier is always looking after our interest
TR9	Goodwill	Our major supplier has always been even-handed in negotiation with us.
TR10	Goodwill	Our major suppliers are always cooperative.
TR11	Goodwill	Our major suppliers always treat us kindly.
TR12	Goodwill	Our major suppliers commit to maintain and develop our relationships.

The final construct in this study is known as inter-firm relationship performance. This construct is also the main dependent variable in the conceptual framework. It measures the relationship performance that exists in the association between manufacturers and their suppliers. Ten measurement items for this construct have been identified covering financial, operational and overall performance - as well as collaboration with suppliers in terms of new product development - which have been adapted from several pieces of related literature in the manufacturer-supplier domain (Benton & Maloni 2005; Ryssel, Ritter & Gemunden 2004; Wu et al. 2004) and these items are listed in Table 4.5.

Table 4.5: The measurement items of inter-firm relationship performance

Code	Category	Items
IFR1	NPD	The relationship with the supplier has helped us to lower costs during new product development procedures.
IFR2	NPD	The relationship with the supplier has helped us to increase product quality during new product development procedure.
IFR3	BP	Firm's average net profit has improved as a result of association with the supplier.
IFR4	BP	Firm's average sales growth rate has improved as a result of association with the supplier.
IFR5	BP	The growth rate of firm's market share has improved as a result of association with the supplier.
IFR6	BP	The relationship with the supplier has helped us to improve operational efficiency and thus increase our firm's performance.
IFR7	BP	The relationship with the supplier has helped us to maintain a high profit margin.
IFR8	BP	Firm's overall performance has improved as a result of association with the supplier.
IFR9	NPD	The relationship with the supplier has benefitted our firm in terms of increasing the speed of new product development.
IFR10	NPD	This relationship has made it possible for us to collaborate and share knowledge and expert advice with the supplier during the new product development stage.

NPD – New product development
BP – Business performance

Meanwhile, all these items require participants of the survey to respond using a 7-points Likert scale ranging from 1 for strongly disagree to 7 for strongly agree. Sekaran and Bougie (2009, p. 141) define scale as 'a tool or mechanism by which individuals are distinguished as to how they differ from one another on the variables of interest to our study'. Likert scale falls under interval scale[1] category. It is designed to examine the magnitude of participants' agreement or disagreement with the statements on a given itemised scale. In this study, a 7-point Likert scale is chosen because it offers the respondents more possibilities for making subtle distinctions in their answers (Velde, Jansen & Anderson 2004).

[1]Interval scale allows grouping of participants into certain categories. It also permits measurement of the magnitude of differences, for example, the means and the standard deviations of the responses on the variables (Sekaran & Bougie 2009).

The 7-point Likert scale response categories used in this study can be observed in Table 4.6. This scale works from left to right where the left end of the scale is smaller, more negative than the right. There are two extreme values, that is, far left which signifies strongly disagree; and far right which symbolises strongly agree. Meanwhile, the middle answer category (number 4 on the Likert scale) represents neutral which means neither agree nor disagree (Velde, Jansen & Anderson 2004).

Table 4.6: 7-point Likert scale response categories

Strongly Disagree	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**	**6**	**7**

4.4.2 Pilot study

The pilot study is conducted to ensure the reliability and validity of the survey questionnaire instrument. The draft survey questionnaires were distributed to 200 manufacturing companies selected randomly from the list of Federation of Malaysian Manufacturers (FMM) Directory 2009. Following a courtesy telephone call prior to the distribution of the draft questionnaires to seek approval and consent to participate in the pilot study, the invitation letter for participation in the pilot study was prepared and these organisations notified via letter. From the 200 mailed questionnaires, 36 responded - representing a response rate of 18 per cent. These questionnaires were again sent within approximately three weeks to the participants for a second time for retest. The response received for the retest was slightly lower with only 28 responses received, representing a response rate of 14 per cent.

The feedback from the respondents was gathered and the issue of clarity raised by the respondents. Based on these concerns, the data from the pilot study was analysed using SPSS software to check for a potential structural problem. The outcome of the analysis identified a question from demographic section, *'What is your company's approximate annual sales turnover?'* The positioning of this question is not interconnected with previous or subsequent questions which resulted in a number of missing cases under this item. Meanwhile, the repeated item under inter-firm relationship performance was detected and the item excluded from the list.

4.4.3 Population and sample

Population can be define as a group of individuals, objects or items from among which samples are taken for measurement; on the other hand a sample refers to a finite part of a statistical population whose properties are used to make estimates about the population as whole (Singh 2007, p. 88). Meanwhile, Zikmund and Babin (2007, p. 403) offer a more simple definition on both population and sample. They explain that a population can be any complete group of entities that share some common set of characteristics; while sample is a subset or part of a larger population.

The target population of this study is all 2200 manufacturing companies of various sizes and from diverse manufacturing subsectors listed under the Federation of Malaysian Manufacturers (FMM) Directory 2009. Since the list of companies contained in the report is segregated alphabetically by manufacturing subsectors and not by the size of the firms, the researcher adopt a simple random sampling technique to extract respondents as a sample to represent the manufacturing sector's population.

Kothari (2004) explains that simple random sampling falls under the probabilistic sampling design. This design permits a researcher to specify in advance each segment in a population which is going to be represented by the sample (Leedy & Ormrod 2005). As noted by Sekaran and Bougie (2009), probabilistic sampling can be either unrestricted (simple random sampling) or restricted (complex probability sampling) in nature.

Simple random sampling falls under unrestricted design and it allows each possible sample combination an equal chance of being selected and each element in the population will have an equal chance of being included in the sample. In this sampling technique, the researcher planned to number all items in the population and random numbers used to select the respondents (Kothari 2004; Leedy & Ormrod 2005; Sekaran & Bougie 2009). The adoption of this technique is considered appropriate because every element in the population has an equal chance of being drawn. Furthermore, this technique offers more generalisability and has the least bias (Sekaran 2000).

There are various opinions from scholars in determining sample size from a given population. For example, Leedy and Ormrod (2005) argue that at least 20 percent should be sampled if the population size is around 1500; and about 400 should be adequate if the population is at about 5000 or more. On the other hand, Sekaran

(2000) state that at least 327 will be required given a population size of 2,200. He further argues that the return rate of the survey questionnaire is relatively low and suggests a response rate of 30 percent is acceptable. However, there are no standards in the literature on how to determine the perfect sample size needed to produce the best results (Kline 2005). According to Hair et al.(2006), there is a common rule of thumb that a study needs at least 100 responses in order to accommodate factor analysis statistics.

This study uses 46 items to measure all the four constructs: technological capability, power, trust and inter-firm relationship performance. The study managed to obtain a more than adequate ratio to facilitate further analysis since it recorded 132 responses from which 126 responses were found usable and thus meet the minimum requirement mentioned above.

4.4.4 Data collection

The survey questionnaire can be used to collect data once it has been designed, pilot tested, amended, and the size of the sample needed has been determined. This stage is known as administration of questionnaire. Saunders et al.(2009) have listed five common ways of administering a questionnaire: intranet-internet medium, postal, delivery and collect, telephone, and structured interview. This study uses postal or mailed medium to disseminate the survey questionnaire to the target respondents.

Sekaran and Bougie (2009) provide a comprehensive list of potential strengths and weaknesses of the postal survey method. They commented that the main advantage of using postal medium is that a wide geographical area can be covered in the survey. In addition, the respondents also can complete the survey questionnaire at their convenience at their own pace. Nonetheless, the return rate is among the major problems facing the researcher since it is typically low compared to other medium. Respondents also cannot receive clarification from the researcher immediately if they have any doubts or difficulties relating to questionnaire items.

However, there are techniques that can be employed to increase the response rate of postal questionnaires. As noted by Sekaran and Bougie (2009), the response rate can be improved by notifying the respondents in advance about the forthcoming survey. In addition, researchers may send follow-up letters, enclosing small monetary amounts that act as an incentive together with the questionnaire, or provide a self-addressed return envelope.

Every mailed package sent to the respondent consisted of a covering letter explaining the purpose of the research, instructions on how to complete the survey, a full set of survey questionnaire, postage-free self-addressed return envelopes, plus free book vouchers or table calendars. After approximately 3 weeks, a follow-up letter was sent to thank early respondents and to persuade others to respond.

The target respondent in this study is the key management personnel including the managing director or senior manager involved in logistics, supply chain, vendor development or marketing since they have extensive knowledge and experience in dealing with other members within the supply chain. They were asked to focus on their organisation’s relationship with their major supplier when answering the survey questionnaires. They were able to be identified and contacted since their details are provided in the directory list published by the FMM.

4.4.5 Control variables

Extraneous or confounding variables are those between group variables, other than the independent variables, that have effects on the dependent variable possibly confounding the results. These variables need to be controlled to keep them from affecting the study (Graziano & Raulin 2010, p. 202). Previous researchers denote that company size and type of industry have impacted the inter-firm relationship (Fryxell, Dooley & Vryza 2002; Izquierdo & Cillán 2004; Sengun & Wasti 2009). As noted by Porter (1991), the size of company often indicates the scope of operations within the company; while the type of industry has a level of attractiveness whereby both suppliers and manufacturers have bargaining power to influence the overall industry. Therefore, these variables are potentially confounding variables and classified as control variables in both aspects in the design of this study.

4.4.6 Data analysis

a) Data screening

Data analysis starts with data screening and cleansing processes which involve several basic procedures for reviewing any peculiarity, as well as missing values. Missing values represent any information which is made unavailable for any cases due to the failure of the respondents to answer any item in a given survey questionnaire (Hair et al. 2006). During the data screening process, a number of missing items are identified and investigated. Given that the total responses gathered are relatively small, deletion of these responses will reduce the power of the statistical test. Therefore, those three responses are retained and solution to missing values is identified, for example, replacing the missing values with the mean of the variable to ensure that the overall mean are unaffected by the new value. Meanwhile, if these cases occur in a non-random pattern, the most efficient solution is to delete the affected cases as suggested by Hair et al. (2006).

The data is also screened for any outliers that may exist and need further attention. Hair et al.(2006) describe outliers as observations which are different from others with a distinct and unique combination of identifiable characteristics. The data in this study is diagnosed in two different perspectives (univariate and multivariate) to identify outliers by screening for any consistent pattern across these methods.

The first aspect in examining the existence of outliers is through the univariate perspective. This method identifies outliers as cases that fall at the outer ranges of the distribution. Hair et al.(2006) suggest that the rule of thumb for standardised residual value (z – score) of samples more than 100 observations should range from 3 to 4. Therefore, the threshold value for designation of an outlier for this study has been set out at ± 3.

The second perspective is to access the multivariate outliers and Mahalanobis D^2 measure is conducted across the data. Hair et al. (2006) explain that this method of analysis evaluates each observation position and compares it with the centre of all observation within a set of variables. They stress the use of all metric independent variables and further clarify that the calculation of D^2/df value permits the identification of outliers. When the D^2 measure is divided by the number of variable involved (D^2/df), it yields approximately distributed as t-value. The threshold level of significance is suggested at $p < 0.001$ and the rule of thumb of D^2/df value is set at ± 2.5. Therefore, any D^2/df value exceeding 2.5 can be designated as outliers.

b) Basic statistical assumption

i. Test of normality

After dealing with the missing data and detecting outliers, next the data need to be tested for compliance with statistical assumptions underlying the multivariate techniques. Hair et al. (2006), on disclosing the need to conduct such a test in multivariate applications, argues that the complexity of the relationship based on the typical use of a large number of variables has the potential for distortions and biases when this assumption is violated. Also, the complexity of the analysis and results may also shadow the indicator of possible violations since the multivariate procedure may produce results even though this assumption is severely violated. Therefore, the researcher needs to be aware of this since the outcome can be distorted if assumption violation occurs (Meyers, Gamst & Guarino 2006).

The test of univariate normality is the most basic assumption in multivariate analysis. Authors like Meyers et al.(2006) and Tabachnick and Fidell (2007) agree that test of normality can be determined through assessment of skewness and kurtosis. Skewness is an index that indicates the symmetry of a univariate distribution (Raykov & Marcoulides 2000); meanwhile kurtosis's index represents the shape of the distribution in term of 'peakness' or 'flatness' as compared to normal distribution (Hair et al. 2006).

Both these indices can be calculated via SPSS (see Appendix 5) and Kline (2005) provide the rule of thumb in examining the minimal violation of the assumption of normality. He suggests that if the absolute value is below $|3.00|$ for skewness and absolute value of kurtosis lower than $|8.00|$, the distribution can be assumed normal. Any values of the indexes that exceed these absolute ranges can be described as minimal violation of the assumption of the normal distribution.

ii. Test of homoscedasticity

The next statistical assumption under multivariate techniques is the assessment of the data's homoscedasticity. This assumption refers to how 'the dependent variable exhibits equal level of variance across the range of predictor variables' (Hair et al. 2006, p. 73). It means that when the assumption of normality is met, the variability of the dependent variable is homogeneous across all levels of independent variables (Kline 2005; Tabachnick & Fidell 2007); and if there is unequal variance dispersion across the independent variables due to non-normality of the data, then the variable is said to display heteroscedasticity. The effect of heteroscedasticity can cause 'predictions to be better at some levels of independent variables than at others and thus further affect the hypothesis testing' (Hair et al. 2006, p. 74).

iii. Test of linearity

The final statistical assumption under multivariate techniques is the assessment of the data's linearity relationships. Hair et al.(2006) denote linearity as an implicit assumption-based correlational measure of all multivariate techniques including multiple regression, factor analysis and structural equation modelling. They further indicate that it relates to 'the pattern of association between each pair of variables and the ability of the correlation coefficient to adequately represent the relationship' (2006, p. 82).

Nonetheless, Tabachnick and Fidell (2007) assert that correlation coefficient only captures linear relationships between variables and nonlinearity association will not be captured by the Pearson's *r*. Eventually, this result can cause underestimation of the actual strength of the relationship and thus signifies the importance to examine all the relationships to detect any departures from linearity that may affect the correlation (Hair et al. 2006). Therefore, an examination on the variables' scatterplots needs to be conducted in order to identify the existence of any nonlinear pattern.

c) The partial least square approach

The statistical part of this study is largely based on the component-based Structural Equation Modelling (SEM) approach, known as Partial Least Square (PLS). The term SEM does not refer to a single analytical technique but, instead, refers to a family of related statistical procedures (Kline 2005). Hair et al. (2006, p. 710) define SEM as:

> ---*a multivariate technique combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs (variates) as well as between several latent construct.*

They further elaborate that this technique is characterised by two basic components, the structural model and the measurement model. The structural model is represented by the path model which is guided by the theory that relates the independent to dependent variables. On the other hand, the latter model enables the researcher to use several variables for a single independent or dependent variable. It also specifies the indicators for each construct and enables an assessment of construct validity (Hair et al. 2006).

The use of SEM in this research is justifiable because it allows the researcher to run a multiple regression analysis between constructs simultaneously and offers flexibility to interpretation even in the event of multicollinearity (Garson 2008). Furthermore, there are latent constructs among the variables in the model: power, trust and inter-firm relationship performance. Hair et al. (2006) stress that the latent concept cannot be measured directly but can be evaluated by one or more indicators. For example, a construct like trust is measured by indicators such as competence, contractual, goodwill and benevolence, and the same goes for other constructs such as power and inter-firm relationship quality. The SEM approach also seems to be appropriate since it will allow the use of confirmatory factor analysis that enables the researcher to access the contribution of each single item, as well as to discover the reliability of the scale in measuring the concept (Hair et al. 2006).

However, the minimum samples required to run SEM analysis is 200 and the accuracy and stability of SEM will decline in the event of decreasing valid sample size relative to increasing number of variables (Kline 2005). As the study does not manage to achieve the minimum valid response require running the SEM procedure effectively, Partial Least Square (PLS) method of analysis is used as an alternative to the covariance based SEM approach (CBSEM).

PLS is considered a second generation of SEM analysis initiated by Herman Wold when he introduced the idea of non-linear iterative least squares algorithm in 1966 (Wold 1966 cited in Tenenhaus et al. 2005). PLS has the ability to analyse a set of latent variables and a series of cause and effect relationships within the structural equation models (Gustafsson & Johnson 2004). This method is designed to focus on prediction maximisation rather than the model's fit. The loadings of measurement items on the construct are explicitly specified in the model. Meanwhile, the model fit is examined through the assessment of convergent and discriminant validity (Fornell & Larcker 1981).

PLS approach is chosen for its advantage of providing parameter estimates for a linear equation, as does CBSEM; but is less sensitive to sample size considerations. PLS is also gaining ground for its robustness in dealing with missing data, demonstrating its ability to handle multicollinearity in independent variables and can be applied to smaller sample sizes than CBSEM (Hair et al. 2006; Wang et al. 2006).

Furthermore, PLS can handle non-normal distribution sets of data and thus does not rely on any normality assumption (Chin 1998). In addition, PLS also works well for the study of mediation effects. Mediation can be interpreted as a product of two relationships; independent variable to mediator, and mediator to dependent variable. The effects of mediator in the model will be determined by employing the bootstrapping procedure, as well as the calculation of Sobel test (Bontis, Booker & Serenko 2007). SmartPLS 2.0 software is used to conduct the analysis and the two step-approach of PLS analysis is employed to evaluate the path model. Details of this analysis can be found in the next section.

i. PLS two step approach: Step 1: Assessment of the outer models

The two-step approach to PLS analyses is first recommended by Chin (1998) since PLS path modelling does not account for any goodness-of-fit criterion compared to CBSEM, which is mainly due to distribution free variance (Götz, Liehr-Gobbers & Krafft 2010). The CBSEM approach focuses on parameter estimates procedure to produce the observed covariance matrix and relies heavily on the model's goodness-of-fit which is not warranted by PLS. PLS works on minimization of error or maximization of variance explained and, therefore, the degree to which the PLS model achieves this objective is determined by the R^2 value for the dependent variable (Hulland 1999). Thus, Chin (1998) suggests a systematic application to assess partial model structures which encompasses a two-step processes. The two-step approach is incorporated in this study and is as follows:

- Developing assessment of the outer model via PLS confirmatory factor analysis (CFA).
- Performing inner model assessment through path analysis with latent variables to allow the testing of proposed hypotheses.

Regarding the rationale for the two-step approach, Hair et al.(2006, p. 600) highlight that accurate representation of the reliability of indicators is best accomplished in two steps to avoid the interaction of measurement and structural model. Even though the evaluation of interaction between these two cannot be done in isolation, the researcher must be aware of the potential effects of within-construct versus between-construct in doing estimations. This is crucial since the result can be substantial and may cause interpretational confusion.

Meanwhile, PLS path modelling is built upon outer and inner models. The outer model signifies the relationship between latent variables with its dimensions and measurement constructs. For instance, in this study the outer model inspects the association of technological capability with its dimensions and measurement constructs. The assessment of outer model includes determining the unidimensionality of constructs through PLS confirmatory factor analysis (CFA) by checking its reliability and validity (both convergent and discriminant) of the latent constructs (Henseler, Ringle & Sinkovics 2009).

Unidimensionality is defined as ‘a set of indicators that has only one underlying trait or concept in common’ (Hair et al. 2006, p. 584). The need to achieve unidimensionality of measurement is important when dealing with theory testing and development. As the answer from a respondent may not be the same with the intended meaning of the measure, an assessment of whether the multiple measure that represents a particular scale can be regarded as an alternative indicator for the construct has to be included in the scale development process (Anderson & Gerbing 1988). Analyses such as item-total correlation and exploratory factor analysis is statistically driven by an inadequate theoretical basis and thus cannot assess unidimensional measurement (Lu, Lai & Cheng 2007).

Confirmatory factor analysis

Confirmatory factor analysis (CFA) is a sophisticated technique often performed in SEM analysis to test a theory about latent processes (Tabachnick & Fidell 2007). CFA specifies the posited relations between the observed variables with the underlying constructs, as the constructs are permitted to inter-correlate freely with each other (Anderson & Gerbing 1988). The main objective of CFA is to assess unidimensionality by testing a theoretical expectation about the structure of a given set of measurements (Gefen, Straub & Boudreau 2000).

CFA is proven to overcome the limitation caused by other common analysis such as item-total correlation; and exploratory factor analysis such as principle component, which only caters for preliminary analyses rather than assessing unidimensional measurement. In PLS analysis, CFA manages to scale estimation and construct validity, as well as allowing the researcher to determine the correlation between pairs that share common factors, verifying the association between observed variables with common factors, specifying which observed variables are affected with unobserved measurement residual variance, and indicating the correlation between pairs' error term factors in the statistical model (Lu, Lai & Cheng 2007).

Construct validity is 'the degree of correspondence between constructs and their measures' (Jarvis, MacKenzie & Podsakoff 2003, p. 199). The importance of conducting the construct validity test has been pointed out by Anderson and Gerbing (1988, p. 453) who noted that 'it is necessary to ensure that the structural model is in proper specification for the measurement model before meaningful analysis can be assigned to the structural model'. Construct validity is divided into two categories namely: convergent validity and discriminant validity.

- **Convergent validity**

Convergent validity can be defined as 'a set of indicators that represents one and the same underlying construct, which can be demonstrated through their unidimensionality' (Henseler, Ringle & Sinkovics 2009, p. 299). Convergent validity can be determined by examining series of criterions such as the outer loading factors generated from CFA, internal consistency reliability, Cronbach's alpha coefficient and average variance extracted (Henseler, Ringle & Sinkovics 2009).

The first criterion is to assess the outer loadings generated from the CFA procedure in SmartPLS software. In general, the threshold value of PLS CFA outer loadings to be retained should be above 0.70 (Hatcher 1994; Henseler, Ringle & Sinkovics 2009; Hulland 1999). Although Hulland (1999) state that it is common to have several measurement items with factor loadings below 0.70 especially involving the employing of new items or newly-developed items, Hair et al.(2006) argue that the cut off point of below 0.50 is more suitable to be adopted during the explanatory factor analysis process. This argument is supported by Ghozali (2008), who stress that the loading factor of 0.70 is a recommended cut-off point to answer the convergent validity issue which is important in determining the unidimensionality of a construct, Therefore, this study adopts the recommended cut off point of 0.70, and items below this point will be deleted individually.

Nevertheless, Henseler et al. (2009) suggest that careful discretion is needed when deleting items with low factor loadings. They suggest that reliability coefficients such as composite reliability can be taken as a point of reference to keep or drop items with a low loading factor. Only if the deletion of items with low factor loadings can substantially increase the composite reliability coefficient, can the discarding of items be seen as necessary. Thus, this study adopts the latter criterion as a suitable threshold value and taking into account the composite reliability factor as a guideline in dropping-retaining the measurement items. The assessment of inner model is discussed in step 2 after the completion of the outer models analyses.

The second criterion is to test the internal consistency reliability of the measurement model. Prior to the execution of SmartPLS software, the reliability of the measurement construct is determined through reliability coefficient of Cronbach's alpha through SPSS program. However, Henseler et al.(2009) argue that Cronbach's alpha has a propensity for providing a severe underestimation of the latent variable's internal consistency, especially in the PLS path model. Therefore, to overcome this drawback, they suggest the usage of composite reliability instead of Cronbach's alpha in determining the reliability of the latent variables.

Since the outcome of the CFA result in PLS analysis is able to generate both composite reliability and Cronbach's alpha coefficients simultaneously, this study employs these indicators to gauge the internal consistency reliability of the measurement model. The rule of thumb of an acceptable value for both composite reliability and Cronbach's alpha is above 0.70 for early stage of analysis and above 0.80 in more advanced stages (Henseler, Ringle & Sinkovics 2009).

Finally, the third criterion is to determine the average variance extracted. Researchers such as Fornell and Larcker (1981) have suggested the use of average variance extracted (AVE) indicator as one of the criterion to assess convergent validity. AVE indicates the meaning of how much on average a latent variable is able to explain the variance of its indicator, and AVE value of above 0.50 indicates sufficient level convergent validity (Henseler, Ringle & Sinkovics 2009).

- **Discriminant validity**

Discriminant validity is a complement to convergent validity since it represents 'the extent to which measures of a given construct differ from measures of other constructs in the same model' (Hulland 1999). In other words, discriminant validity can be considered present when variance shared by a construct with its indicator is higher than other constructs in a given model (Fornell & Larcker 1981). Similar to convergent validity, discriminant validity is also measured using AVE. However, in determining discriminant validity, researchers such as Gefen et al.(2000) and Ghozali (2008) suggest that the AVE needs to be square rooted (√AVE) first before comparing it with inter-construct correlation. If the value of √AVE is higher than the inter-construct correlation then the existence of discriminant validity can be confirmed.

ii. PLS two step approach: Step 2: Assessment of the inner models via path analysis

In Step 2, the analysis is heavily focused on the assessment of the inner models via path analysis that will further permit the testing of the research's hypotheses. In this study, the inner model consists of relationships between technological capability with power, trust and inter-firm relationship performance. The dependent construct is inter-firm relationship performance with business performance and new product development as its dimensions. The assessment of inner model is to focus on inspecting the following criterion:

- the variance explanation of the endogenous (dependent) construct, and
- the significance of path coefficients (Hair et al. 2006; Henseler, Ringle & Sinkovics 2009).

The first criterion involves the inspection of variance explained and it is checked through the coefficient of determination (R^2) value of the dependent latent construct since it will measure to what extent the dependent variable is explained by the independent variables (Henseler, Ringle & Sinkovics 2009). The R^2 ranges between 0 to 1, whereby the value of R^2 near to 1.0 indicates the greater explanatory power of the regression model and thus a better prediction of the dependent variable (Hair et al. 2006).

The second criterion is to determine the significance of path coefficient. This is where all the study's hypotheses are going to be tested. The inner model is tested to determine the representation of all independent latent variables towards dependent latent variables by assessing the t-value of the proposed relationship (Mumbi & McGill 2007). The test of the proposed relationship can be derived through bootstrapping procedure.

Bootstrapping is a form of re-sampling in which the original sample is treated as population and repeatedly sampled for a specific number of times with continuous replacement to generate a number of new samples whereby each is a subset of the original sample for the purpose of model estimation (Hair et al. 2006). In identifying the specific number of bootstrapping samples, Henseler, Ringle and Sinkovics (2009) suggest that it should have the same number of cases as the original sample. Since this study has 126 samples, a bootstrapping procedure of 126 is employed to assess the significance of the path coefficients. The use of bootstrapping procedure in this study is not limited to determining the direct relationship between the studied variables. It is also used to check the mediation effects of the intervening variables, and details are provided in the next section.

4.4.7 Test of mediation effects

This study examines the impact of technological capability on power, trust and inter-firm relationship performance. The theoretical framework of this study shows that there are two intervening variables (power and trust) that mediate the relationship between technological capability and inter-firm relationship performance. In order to determine the effects of power and trust as mediators in the model, two common methods are employed: causal step approach; and Sobel test is conducted to determine the mediation effects on the model. The method known as the causal steps approach is employed based on the recommendation made by numerous researchers (Baron & Kenny 1986; Bontis, Booker & Serenko 2007; Judd & Kenny 1981). For example, Bontis, Booker and Serenko (2007) urge that PLS is best used with the causal steps approach that depends on the regression analysis. This argument is supported by Gefen, Straub & Boudreau (2000) who state that the path coefficients generated from the PLS analysis to provide indication on the relationship between variables can be inferred as similar to the traditional regression coefficients. There are four steps involved in the causal steps approach which can be emulated using PLS methods. The steps, as outlined by Bontis, Booker and Serenko (2007), are as follows:

- Direct link must be established between independent and dependent variable to show that there is a relationship to be mediated.
- Direct relationship between independent and mediator is drawn
- The mediator must be shown as related to the dependent variable.

- The relationship between independent variable and dependent variable is significantly reduced when the mediator is introduced.

Meanwhile, the assessment of the significance of the mediating effect cannot be visually inspected from the path model and has to be statistically calculated. Therefore, the Sobel test needs to be performed in order to confirm whether the mediating variables significantly mediate the relationship between the independent variable and the dependent variable. The Sobel test, also known as product-of-coefficient approach, involves the computation of regression coefficients and the standard errors of the path coefficient (Preacher & Hayes 2004). The formula for calculating the test is as follows:

$$z \text{ - value} = a*b/\sqrt{(b^2*\mathrm{S}a+a^2*\mathrm{S}b)}$$

whereby *a* is represented by the regression coefficient from independent variable to mediator, *b* is the regression coefficient from mediator to dependent variable, S*a* is the standard error of path from independent variable to mediator, and S*b* represents the standard error from mediator to dependent variable (Bontis, Booker & Serenko 2007). The standard error values in this test are derived from the bootstrapping procedure employed from the previous section.

4.4.8 Validity and reliability

It is almost impossible to diminish the threats of validity and reliability in social research, rather the researcher can reduce the effects of the threats by paying attention to them throughout the research project (Cohen et al. 2007). In this section, discussions on these matters solely focus on the quantitative part of the project. The same section is again appearing in Phase Two to clarify the effects of these threats on the qualitative aspects of the research.

Discussion in the survey instrument development section (see 4.4.1) indicates the use of adapted survey instruments from prior research in order to increase validity and reliability of the measurement items. The survey questionnaire was sent for preliminary testing to academic and supply chain professionals to ensure that the measurement items met the most basic kind of validity known as face validity, as well as content validity. Face validity is defined as the judgement made by the scientific community that the indicator really measures the construct (Neuman 1997, p. 142). This is to confirm that items used have the valid measurement ability on the face of it. Meanwhile, content validity can be achieved by ensuring that the measurement items cover all facets or dimension of the studied construct. In other words, the measure should be able to represent the studied construct (Neuman 1997).

Kothari (2004) clarifies that a measure possesses construct validity when it confirms to predict correlation with other theoretical propositions. He explains that in determining construct validity, the researcher may associate a set of other propositions with the results produced by the measurement items. If the scale correlates with another proposition then the existence of construct validity can be concluded. Therefore, factor analysis and correlation analysis are conducted in this study to determine the association among constructs, hence confirming the construct validity of the measurement items; and the results of these analyses are posted in the next chapter.

In general, reliability tell us about a measurement item's dependability, stability, consistency and trustworthy. A reliable measure produces the same results each time the same thing is measured. Hence, if another study is conducted in similar, predictable ways in different times it would yield comparable results (Neuman 1997). Therefore, in order to produce consistent results, this study utilised previous research measurement items to carry the reliability of the instruments. The study also conducted internal consistency testing by measuring the Cronbach's alpha and test-retest reliability on the replicated items during the pilot study administration.

In conclusion, the quantitative data analysis plays an important role in answering the study's hypotheses. Initially, the data is analysed for basic data operations such as data cleansing, assessing the univariate and multivariate assumptions, calculating the demographic profiles and identifying the dimensions of constructs through factor analysis using SPSS. In the latter part, the analyses proceeds with PLS two step approach, whereby the first step is to determine the unidimensionality of the outer model using PLS CFA. Step two is to assess the inner model via path analysis that further permits the hypotheses testing. Next, the analysis continues with a new set of data gathered through qualitative method to support the findings of Phase One analysis.

4.5 Phase Two: Qualitative method

The second phase of this study involved data collection from qualitative methodology which aimed to explore the interconnection between technological capability, power, trust and inter-firm relationship performance. The objective of this phase is to develop further understanding of the findings that need to be explained from Phase One. As noted by Creswell and Clark (2007), it is crucial to allow findings from the quantitative phase to inform the qualitative phase and the necessary findings that need to be further investigated following analysis in the quantitative stage. Based on the quantitative findings, the instrument in Phase Two is developed and the specific details involved in this research are discussed in the section below.

This phase consisted of data collection, and using interview method from the same population used in Phase One whereby selected individuals involved in logistics, supply chain, vendor development or marketing are chosen since they have extensive knowledge and experience in dealing with other members within the supply chain. The data is then analysed to identify the area of interest and later a cross case analysis conducted to support the findings in Phase One.

4.5.1 Case study approach

There are many types of design strategies under the qualitative rubric and one of the common designs is case study approach. Yin (2003, p. 13) define case study as 'the empirical inquiries that investigate a contemporary phenomenon within its real life context'. Meanwhile Kumar (2011, p. 379) state that this design is based on the 'assumption that the studied case can provide insight in the events and situations prevalent in a group from where the case has been drawn'. He further clarifies that this design is appropriate when exploring a little known area or where there is a need to have a holistic understanding of a situation or phenomenon. It means that the design is merely relevant when the focus of the study is on exploring in-depth understanding on a given phenomenon rather than confirming or quantifying it (Kumar 2011).

The relevance of choosing this method for Phase Two is because of its ability to describe a situation by understanding how and why certain events occur and build a plausible explanation based on the researcher's assessment of the surrounding condition of a given phenomenon (Tharenou, Donohue & Cooper 2007). Also, the data draws upon the sample's experiences and practices so it is seen to be strong in reality. In addition, the results may capture unique features that may otherwise be lost during the quantitative data collection in Phase One; and these unique data might hold the key to understanding the situation (Cohen et al. 2007).

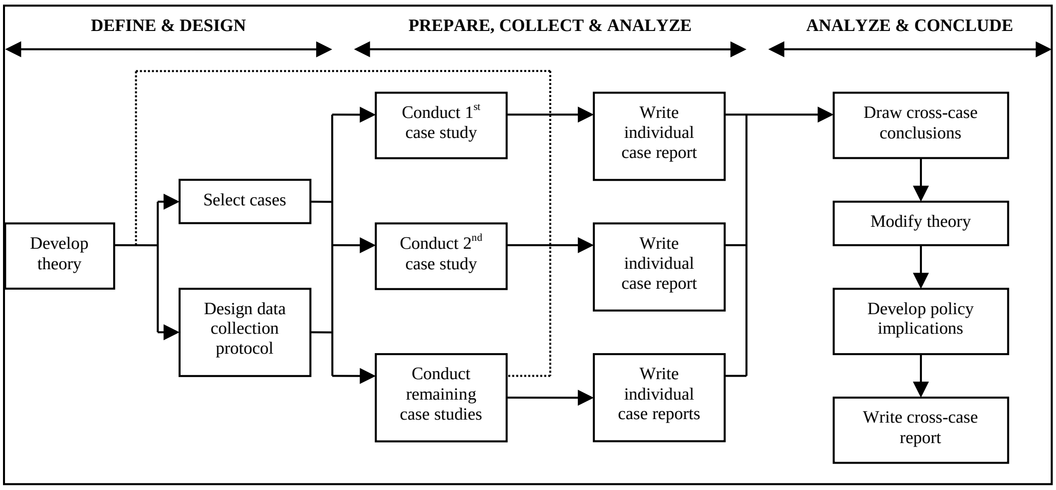

Figure 4.3: Multiple case study approach
Source: COSMOS Corporation (2000) as cited in Yin (2003)

In this phase, the study opts for multiple case studies in order to provide the richness and depth of the case description (Ivankova, Creswell & Stick 2006). Furthermore, multiple case studies hold the advantage compared to single case study and, as noted by Yin (2003), multiple case studies can increase the strength of generalisation. Figure 4.3 above illustrates the general features of a multiple case study approach. It shows step-by-step the processes to be considered by a researcher in conducting multiple case studies. Although researchers argue about the weakness of this method, for example, that it is prone to the problem of observer bias (Cohen et al. 2007) - the strength of applying this approach far outweigh potential drawbacks that may arise.

4.5.2 Case study protocol

This section generally discusses the protocol of data collection for the case study and explains the procedures to be followed during the interview session. As noted by (Rahim & Baksh 2003, p. 32), a case study protocol is a document that contains the methods, procedures, and general rules that will be followed in using instruments of data collection. The case study protocol acts as a guideline to the researcher by which it permits the researcher to detail the procedures and requirements in advance and thus sets the scope to be addressed during the data collection stage. Besides, the protocol is also a major way of increasing the case study reliability (Yin 2003) and the case study protocol in this research followed the recommendations by Yin (2003) which generally consists of overview of the case study project, field procedures, case study questions and a guide for the case study report.

a) Overview of case study project

The overview of the case study project covers the background and the objective of the research being studied. In this case, an appropriate strategy of inquiry is developed based on the conceptual framework derived from the literature review to answer the identified research question. The purpose of the case study is to gather information from individuals, as well as collection of any contextual data from the organisations they represent. The data is then analysed to check for any convergence-divergence from the area of interest and thus provide insight into the findings gathered from the quantitative sample.

b) Field procedures

Field procedures represent the operational task in collecting the data, for example, gaining access to key organisations or interviewees, sufficient resources while in the field, specifying a clear schedule of data collection activities, and expecting unanticipated events including availability of the interviewee (Yin 2003). In this study, written consent letters from each organisation were obtained before conducting the interviews. The steps taken before approaching these organisations is detailed in the sample selection sub-section (see 4.5.4). Potential individuals to participate in the interview were identified and all relevant documentation such as a full set of interview questions, ethical clearance from the university and supporting documents from the relevant body were prepared. The researcher also ensured that all the appropriate resources such as stationery and extra batteries for the voice recorder were obtained beforehand. Appointments with the target individuals in these organisations were scheduled in advance to minimise cancellations.

c) Case study questions

One of the common techniques of data collection is interview. This technique is chosen because it provides more focus and reliability and enables flexibility to encompass new insights that may emerge during the interview process (Maxwell 2005; Yin 2003). It also provides uniform information which assures comparability of data (Kumar 2011, p. 145).

Yin (2003) denote that the core of the case study protocol lies with the set of substantive questions reflecting the actual line of inquiry. He further suggests two general characteristics of case study questions. First, the questions must be posed to the investigator first not the interviewee as a reminder on the need for information to be collected and why. This notation is supported by Rahim and Baksh (2003) who suggest that the interview questions actually act as a guideline to the interviewer to ensure that the study focuses on the subject and facilitates the gathering of all the information needed in this study.

Second, the level of questions in the case study protocol should reflect the entire set of concerns from the initial design. The first level of questions is posed to the specific interviewees for answers. Meanwhile, the second level of questions is to be answered by the investigator himself during a single case. This level actually deals with a mental line of inquiry on what the course of an event in a given phenomenon might have been compared to a verbal line of inquiry - which is the question posed to the participant. The different thinking in these levels does not mean that they are contradicting each other; rather, they are complementary. The mental line of inquiry allows the researcher to investigate and raise questions from every possible angle to find answers on a given phenomenon. In the case study method, articulating the second level question is much more important than attempting to identify the level one question (Yin 2003).

The semi-structured interview question format is used to identify the technological capability aspect of the case organisation. The full set of interview checklist can be found in Appendix 3. For technological capability construct, the questions focus on the verifying the existence of technological dimensions (production, investment and linkage) by looking into issues regarding firm’s activities in production, research and development, staff training, and technology policy. Other issues such as technology equipment upgrades and the use of technology on new product development activity are also included.

Relationships between the case organisation and their major suppliers in terms of the company’s power and trust are also examined. For power construct, the interview questions are design to describe the types of power (refer to Table 2.3 on sources of power) which has been recognised in the literature review section that may exist in the relationship. So as to trust construct, interview questions are derived base on common dimensions of trust (see Table 2.4 on the trust theory sub-section 2.3.4).

Meanwhile, for the inter-firm relationship construct, the questions are design to monitor the flow of their relationship performance as a result of possessing technological capability. The questions are designed to measure both dimensions in this construct i.e. business performance and new product development. In terms of business performance dimension, the case study organisations are observed on their capacity in generating profit due to the impact of technology, power and trust in the relationship. So as to new product development dimension, the interview questions are derived to confirm the role of the major suppliers in developing new product as a result of the relationship.

d) Guide for case study report

This section discusses the reporting format of the case study after the data collection. Yin (2003) describes this section as often missing in case study research as the researcher neglects to plan the outline or format of the case study report. He emphasizes the need to have at least a tentative reporting format to be included in the case study protocol as it will facilitate the collection of relevant data in an appropriate format and thus reduce the possibility for a return visit to the case study site. He further suggests that the initial format should not be rigid, but to apply some flexibility as changes can be made depending on the result of the data collection. This strategy can be used to the advantage of the case study if exercised properly without bias.

In this study, the tentative format is planned in advance in order to tailor the information gathered with the case study reporting format. Nonetheless, as suggested by Yin (2003), the outline of the report is not fixed and changes can be made as the need arises to facilitate unnecessary rework or site revisit. The provisional format of the report includes case by case write up followed by cross case analysis.

4.5.3 Pilot study

Following the case study protocol, a pilot test was conducted to ensure that case study protocol and data collection were operationalised and the desired research outcome could be expected from the analysis. As pointed out by Yin (2003, p. 79), the pilot case study will help the researcher to refine the data collection content by developing relevant lines of questions and provide clarification on operational procedures to be followed. In this phase, the pilot study data is collected from individual interviews.

Initially, four case organisations were selected and their key personnel interviewed to predetermine the suitability of the questions, wording and explanations. The feedback from the interviews highlighted the criteria of choosing key personnel as participants. The test drew on the managerial level, including low to high, in various departments such as marketing, logistics, vendor development and service parts. During the pilot study, the low level manager had difficulties in providing answers to the questions and often lacked ability in providing in-depth information, especially on issues involving the major supplier interrelationship. Middle to high level of managers, regardless of their departments, demonstrated their understanding of the questions being asked and were able to provide an in-depth explanation on every query. As a result, the study determined to choose at least middle to high level of managers since it would be at par with the level of information required by the study.

4.5.4 Sample selection

In this phase, five personal interviews within different organisations were conducted to gather the qualitative data and the non-probabilistic sampling procedure utilised. Non-probabilistic sampling is defined by Babbie (2007) as a sampling technique in which the samples are selected in some way not suggested by probability theory. The non-probabilistic sampling design is commonly used since the main objective of the qualitative study is to explore and try to understand a given phenomenon (Sekaran 2000).

Babbie (2007) further explains that purposive (judgmental) sampling falls under this category. Purposive - also known as judgmental - can be described as a type of non-probability sampling method in which the units to be observed are selected on the basis of the researcher's judgement about what will be most useful or representative (Babbie 2007, p. 184). A purposive sampling procedure is chosen since it enables selection of appropriate participants who have experience with the key concept being explored (Creswell & Clark 2007).

Organisations listed under the Federation of Malaysia Manufacturing (FMM) Directory 2009 were targeted as the case study population. Sample selection then focused on the organisations that responded to the last page of the survey questionnaire used in Phase One, which focuses on the intention to participate in a follow-up interview (refer to Appendix 2). Therefore, organisations that agreed to participate in the follow-up interview were listed and marked as potential case study participants. These organisations were then contacted via telephone, mail and email to confirm and obtain their agreement to participate in the interview session.

Firstly, telephones calls were made to all the selected organisations involved seeking formality in obtaining permission to conduct the interview and identifying the appropriate personnel who would potentially be involved as a participant. Then, a formal letter on the intention of conducting the interviews and seeking their participation to represent their organisation was sent to the identified personnel in the organisation.

Follow-up telephones calls were made to gain their response and if permission was not given, their organisation was excluded from the potential sample list. Although their anonymity and confidentiality on all business information given was assured, some organisations, citing company policy prohibiting them from disclosing their business practices, declined to participate in this study. Out of 13 organisations, only five agreed to participate. Table 4.7 below summarises the characteristics of the case study organisations involved in this phase.

Table 4.7: List of organisation participating in the case study

Organisation	**Industry**
CsA	Automotive
CsB	Automotive
CsC	Packaging
CsD	Electronics
CsE	Pharmaceutical

(Source: developed for the study by the author)

The above organisations were again contacted via telephones calls and emails to arrange for interviews appointment. The target participants for these interviews are the key management personnel who hold unique positions in their organisations with valuable knowledge on the area of this study. They have the sufficient knowledge on the organisation's supply chain operations and most are involved in the decision making within their company. Prior to the interview appointment, a set of interview questions were emailed to the target participants to shed light on the information needed from them during the interview session.

4.5.5 Data collection

This study adopted the tactic of using multiple sources of evidence during the data collection stage in order to increase the construct validity of the study. The evidence came from semi structured interviews and documentation. The semi structured interview was the main data collection sources for Phase Two and was conducted with key personnel in selected case organisations. In the meantime, the supporting documents from the case organisation were gathered during the first contact with the case organisation before the interview session. The information gathered included company size, turnover, company policy and procedures, as well as production data. Some case organisations provided the researcher with their business statistics, while some were unable supply any hardcopy evidence due to business secrecy policy despite being assured of information confidentiality.

The interview started with the circulation of the information and consent form to the interview participant. This form provides an overview of the study, the permission to audio-tape the interview session to assist the transcription of the responses, the confidentiality of assurance on all information and clarifying the participants' right to withdraw their consent and discontinue participation in the interview at any time. The participants were asked to read the content of the form carefully to ensure that they understood the interview protocols and their rights before signing and returning the form to the interviewer. The returned form was then counter-signed by the interviewer to acknowledge receipt.

The interviewer followed the interview protocol outlined by Creswell (2009) by reading the heading, opening statement, instructions to the interview participants and the research question before probing the key questions to the participants. The researcher then recorded the information using an audio-tape recorder with the permission of the participants. As the use of multiple sources to collect evidence for case study has been recommended by many authors (for example Creswell 2009; Yin 2003) in the event that recording equipment fails, the researcher also took notes during the interview as a backup plan. In addition, some of the interview participants seemed to be uncomfortable with the audio-taped conversation and some did not consent to its use. As a result, in these instances the tape recorder was switched off as, for unknown reasons, they preferred not to have any part of the conversation recorded. Each interview sessions lasted around 20 to 30 minutes on average. The recorded conversations were then reviewed by the interviewer for accuracy and content.

4.5.6 Data analysis

Analysing the evidence is the most difficult part of case study analysis. The objective of the analysis is to address the case study's initial preposition while treating the evidence fairly (Rahim & Baksh 2003). This study adopted recommendations from Creswell (2009) for its data analysis procedures. He recommends six steps to be taken in conducting the analysis of the qualitative data.

First, the analysis should begin with organisation and preparing the data for analysis. This includes organisation of documents and transcribing the text. Second, read all the data to obtain a general sense of the information, as well as to reflect on its overall meaning. This includes identifying general ideas and overall impressions on the depth and credibility of the data. Third, the data proceeds with the coding process to organise the materials before bringing meaning to them. Fourth, the coding process is used to identify specific themes or patterns. Fifth, these themes or patterns are represented in the qualitative narrative passage which conveys the findings of the analysis. The sixth and final step in this data analysis is to interpret the meaning of the theme by providing a valid argument for choosing it (Creswell 2009).

In this stage, Aronson (1994) recommends that the researcher should first focus on reading the related literature since it allows the researcher to make inferences from the interview session. Subsequently, the researcher can develop a story line from the theme statement. Once there is interweaving between the theme and the literature, the story line is one that stands with merit.

Meanwhile, Rahim and Baksh (2003, p. 34) suggest that once these analyses have been completed, a cross-case analysis among all the case organisations should be conducted. The findings on technological capability, company power and trust elements and how they affect manufacturers' and their major suppliers' inter-firm relationship performance from each individual case organisation are then examined in further detail in order to compare similarities and differences among them. From here, the most common issues impacting on the manufacturer-major suppliers' relationship performance are then identified. After the completion of the cross-case analysis procedure, the researcher can make generalisations relating to the studied phenomenon.

4.5.7 Validity and reliability

The issues of validity and reliability are important to both quantitative and qualitative design. As this phase involves qualitative design, there are aspects in relation to validity and reliability of the case study design that need to be addressed. Both validity and reliability have been named by Yin (2003) as design tests to judge the quality of the research design. Basically, there are four tests that need to be performed in any empirical social research, namely, construct validity, internal validity, external validity and reliability. Table 4.8 below illustrates the study case tactics for these four design tests; and discussions on all the tests plus adoption of various tactics to improve validity and reliability of this research can be found in the following section.

Table 4.8: Case study tactics for four design tests

Tests	**Case Study Tactics**	**Phase of research in which tactics occurs**
Construct validity	• Use multiple sources of evidence • Establish chain of evidence • Have key informant review draft case study report	Data collection Data collection Composition
Internal validity	• Do pattern matching • Do explanation building • Do time series analysis	Data analysis Data analysis Data analysis
External validity	• Use replication logic in multiple case studies	Research design
Reliability	• Use case study protocol • Develop case study database	Data collection Data collection

Source: COSMOS Corporation (2000) as cited in Yin (2003)

a) Construct validity

An investigator's failure in developing a sufficient operational set of measures and subjective judgement when collecting data is said to be the critical point that contributes to the issue of construct validity in case study research (Yin 2003). Authors define construct validity as the process of establishing correct operational measures for the concept being studied (Rahim & Baksh 2003; Yin 2003).

Nonetheless, there are three tactics available to increase the construct validity in the case study research context (Yin 2003) and this study adopted these tactics to overcome this issue. The principle tactics adopted in this study are: the use of multiple sources, maintaining a clear chain of evidence and reviewing case study report.

The first tactic is the use of multiple of evidence during the data collection process. This study adopted two sources of evidence, namely, semi structured interview and documentation. The semi structured interview is the primary data collection source and was conducted with key personnel within selected case organisations. Meanwhile, the organisational documents were gathered during the first contact with the case organisation prior to the interview session. The information gathered includes company size, turnover, company policy and procedures, as well as production data.

The second tactic is to maintain a clear chain of evidence. This principle not only has the potential to increase the construct validity, but the reliability of the case study as well. This tactic enables the observer to trace clear cross referencing of the case study process ranging from the research question, methodological procedure and up to the conclusion, and vice versa. Finally, the third tactic is to have the informants to review the draft case study report. In this stage, the draft write-up of the case study was presented to all the interview participants for review and their feedback was used to improvise the final version.

b) Internal validity

The second test is to validate the process of establishing a causal relationship between constant and variables, and this test is also known as internal validity (Rahim & Baksh 2003). Determining causal or explanatory relationships in a case study occurs when a researcher tries to find whether one event led to another. In verifying the association, if the researchers mistakenly concludes the causal relationship between two events without knowing the third force that may affect the results of the case study, the research design is then under severe threat of internal validity (Yin 2003). The other threats of internal validity in case study research emerge through researchers' interpretations since they may be influenced by their own biases and assumptions (Tharenou, Donohue & Cooper 2007). Nevertheless, the issue of interval validity in this study has been resolved by the use of various data analysis techniques. This study adopted the suggestion made by Tharenou et al.(2007) by capitalising on the strength of the data triangulation technique through the use of mixed method analysis since it can assist the researcher to establish defensible causal relationships. Meanwhile, the application of pattern matching technique, as suggested by Burns (2000), was also adopted in conducting data analysis since it has been proven to strengthen internal validity in the case study approach.

c) External validity

The third test raised by Yin (2003), is to know whether the findings of case study can be generalised beyond the study itself - also termed as external validity. He identify that this test is a major problem for any case study, particularly single case design since it offers a poor basis for generalising. The statement of lack of generalisability of case study findings to a wider population is seconded by many authors (Burns 2000; Tharenou, Donohue & Cooper 2007). However, researchers may increase generalisability by undertaking multiple case studies of the phenomena interest (Sommer & Sommer 1991 cited in Tharenou, Donohue & Cooper 2007). Therefore, multiple case studies is adopted and, in the meantime, by providing detailed and transparent processes in the context of this study, this study will allow other researchers to replicate the processes and their context to arrive at analytic generalisation. After all, case study seeks analytic generalisation rather than statistical generalisation (Tharenou, Donohue & Cooper 2007; Yin 2003).

d) Reliability

The fourth test is reliability. Yin (2003) argue that reliability relates to the ability of the research design to be replicated later by other researchers who follow the same procedures conducting the same research study all over again can yield the same findings and conclusions. The main objective of reliability is to minimise errors and biases in a study. Rahim and Baksh (2003) share the same views on reliability by stressing the need to establish the procedures and steps involved in a study which can allow repetition by others and, if exactly repeated, will result in the same findings. They also stress that the reliability check can be performed by the reader of the case study by reviewing every protocol employed in the study. Therefore, all procedures and protocols in this study are documented and reviewed in order to achieve the goal of reliability which is to minimise error and bias, while at the same time increase the repeatability of the study.

4.6 Chapter summary

This chapter provided a detailed explanation on the research methodology used in this study. The research design section has provided an overview both of quantitative and qualitative approach, together with the rationale for incorporating mixed method design for this study. Sequential explanatory design, which is a sub-section in the mixed method approach, has been chosen to guide the methodology section. Quantitative approach takes place as a first phase in the data collection and all the details regarding the tools used in this phase have been clarified. The discussion continued with the second phase whereby it is the turn of the qualitative approach to accumulate data using the case study method. This chapter also integrates the issues of ethical considerations, together with reliability and validity to the discussion. Next, the following chapter will uncover the findings on both phases of the study.

CHAPTER 5: QUANTITATIVE DATA RESULTS

5.1 Introduction

The previous chapter provided discussion on the research design, data collection processes and data analysis procedures used to answer the research question. As the study involves mixed method research, the findings are divided into two phases; Phase One and Phase Two. This chapter provides the results for phase one which concentrates on the quantitative procedures involving both data analysis techniques and statistical procedures. The chapter begins with the study's population overview together with response rate and data. Testing of the basic statistical assumption is then described followed by description of demographic data. The result of reliability analysis on the measurement items is discussed together with the results of dimension reduction through factor analysis. Results of PLS two-step approach which involves assessment of the entire model and structural model evaluation is followed by a description of testing of the study's hypotheses and an assessment the mediating effects for both power and trust.

5.2 Population overview

All the organisations involved in this study are listed under the Federation of Malaysian Manufacturers (FMM) Directory 2009. FMM is an economic organisation established in 1968 representing more than 2000 Malaysian manufacturers and industrial services companies. It bridges the two-way communication between manufacturers and the government in relation to mutual benefit issues. Due to its strong presence in the industrial scene, FMM has been recognised as the official industrial voice for one of the most important economic sectors in Malaysia that contribute to the national economy (FMM 2008). As this research project requires the participation of Malaysian manufacturing companies, regardless of their size, legal structures and subsectors, the FMM Directory list is a must-have publication since it provides a pool of manufacturing population that can enable sufficient samples to be extracted from it.

5.3 Response rate and data screening

The data for this phase was collected via paper-based survey questionnaire administered to over 800 manufacturing companies in Malaysia. As mentioned in the previous chapter, various strategies were adopted in order to increase the survey response rate. These include attaching the cover letter with the university letterhead, provision of postage-free self-addressed return envelope and some small token of appreciation including table calendars and book vouchers. As a result, 132 responses were received which signifies a response rate of 16.5 per cent. All data was manually checked and coded into the SPSS software to prepare for further analysis.

Subsequently, the data was screened for the existence of missing values and outliers. In general, missing data are expected and part of the research design. In this case, the missing data can be termed as ignorable missing data which means that specific remedies for the missing data are not required because the allowances for the missing data are inherent in the technique used. The justification for this allowances is that the missing data is occurring at random (Hair et al. 2006). During the data screening process, a total of 6 respondents were identified as not completing almost half of the demographic items and other sections of the survey. The reasons for the non-response items occurrences are rarely known beforehand. Patterns of the missing data are examined to ensure that the correct remedies can be taken. After further investigation, it is found that the missing data are scattered randomly throughout the observation. As these cases occur in random pattern, the most efficient solution was to delete the affected cases as suggested by Hair et al.(2006). Therefore, these responses were omitted from the database, leaving a total of 126 valid responses for the final analysis signifying a response rate of 15.75 percent.

Additionally, during the data screening process it was noted that three respondents failed to complete some items in Section B (technological capability), as well as Section D (trust), of the survey. Given that the total responses gathered are relatively small, further deletion of these responses will reduce the power of the statistical test (Hair et al. 2006). Therefore, those three responses are retained and one of the valid options is to replace the missing case with the estimated values based on the available information. Hair et al.(2006) recommend the use of mean substitution as it is the most widely used method for missing case replacement. In this method, the missing value is replaced with the mean of the particular variable based on the overall valid responses. Therefore, the study adopts this method by replacing these missing values with the mean of the variable to ensure that the overall mean are unaffected by the new value.

Meanwhile, the data was also screened for any outliers that may exist. The data in this study was diagnosed from the perspective of univariate and multivariate. The result of outliers' detection for univariate methods is shown by Table 5.1.

Table 5.1: Univariate outliers
Cases with standardised residual value (z – score) exceeding ± 3.0

Variable	**Cases**
Technological Capability	120
Power	None
Trust	110
Inter- firm relationship performance	110

As discussed in the previous chapter, the threshold value for designation of outliers for this study has been set out at ± 3. The above table shows that few observations exceed the threshold value on a single variable. Next, the data was tested for outliers from a multivariate perspective.

Multivariate outliers are detected using Mahalanobis D^2 measure. Mahalanobis distance is calculated through linear regression and Appendix 4 describes the Mahalanobis value (D^2), degree of freedom (*df*), D^2/df value and significance level for individual cases. Recall, the threshold level of significance is suggested at $p < 0.001$ and the rule of thumb of D^2/df value is set at ± 2.5. Therefore, any D^2/df value exceed 2.5 can be designated as outliers. It is noted that with threshold value of ± 2.5 and significance level below 0.001, five observations (67, 97, 106, 110 and 120) are identified. The results shows that observation 110 and 120, which seen earlier in univariate analysis, appear again in multivariate test which indicates that they are unique in both single variable and in combination.

After further investigation on these cases, it was found that there was no procedural error in data entry. The outlier cases are simply extraordinary observations which are unique and markedly different from others. Therefore, it was decided that all these cases be retained as they do portray a representative element of the population. This decision is in accordance with Hair et al.'s (2006) stand when they indicate that outlier cases need to be retained to ensure generalisability to the entire population unless there is proof that they are truly peculiar. After screening the missing values and outliers, the data was tested for compliance with basic statistical assumption underlying the multivariate techniques which includes the test of normality, homoscedasticity and linearity.

5.4 Basic statistical assumption

The test of normality in this study is determined through the assessment of skewness and kurtosis. Both of these indices are calculated via SPSS (see Appendix 5) and the rule of thumb in examining the minimal violation of the assumption of normality is that if the absolute value is below $|3.00|$ for skewness and absolute value of kurtosis lower than $|8.00|$, the distribution can be assumed normal (Kline 2005). Both Kolmogorov-Smirrnov and Shapiro-Wilk statistics report insignificant value which reflects the data are statistically insignificantly different from a normal distribution. In addition, all the scores of the skewness and kurtosis indexes in this study do not exceed the suggested minimal violation values for both skewness and kurtosis, hence, it can be concluded that the assumption of the normality of the data is not violated and deemed acceptable.

The test of homoscedasticity was conducted through graphical examination to assess the variance dispersion of dependent variable across the range of independent variables. The scatterplots (refer Appendix 6) of data point for the studied variables visually exhibit normal distribution patterns which represent equal variance dispersion across all data values and thus conclude the presence of homoscedasticity relationship between dependent variable and independent variables.

The final statistical assumption under multivariate techniques is the assessment of the data's linearity relationships. The test of linearity is conducted through visual inspection of the relationship as it is the most common way to determine linearity relationship (Hair et al. 2006). The scatter plots of all independent variables against the dependent variables visually exhibit no occurrences of any apparent nonlinearity relationship and thus conclude the presence of linearity relationship (Appendix 6). Nonetheless, this assumption was rechecked again for the entire model to examine the residual value in order to confirm the existence of linearity in this study.

5.5 Demographics

5.5.1 Manufacturing sub-sector

The first section of the survey questionnaire (Section A) sought to collect details on the respondent's organisation background. Therefore, this sub heading describes an overview of the individual's demographic structure that responds to the mailed survey questionnaire. The descriptive statistic reports that the highest responses are recorded from the manufacturers of metal products and machinery equipment sub sectors with 28 companies; followed by food, beverages and tobacco represent by 21 companies. The electrical and electronics sub sector witness 17 responses; while petroleum and chemicals represent by 13 respondents (see Table 5.2). The combination of these four major subsectors accumulates over 62 percent of the total returned survey questionnaires. Wood, furniture and paper products, with 11 respondents, and plastics and non-metallic products records 9 and 7 participating organisations respectively. Manufacturers other than mentioned above are grouped under 'others' which accumulated 20 responses. These include medical and pharmaceuticals organisations, rubber products, as well as textile, clothing and footwear sub-sectors.

Table 5.2: Manufacturing sub-sectors

Sub-sector	**Frequency**	**Percentage**
Metal & machinery	28	22.2
Food, beverage & tobacco	21	16.7
Electrical & electronics	17	13.5
Petroleum & chemicals	13	10.3
Wood, furniture & paper	11	8.7
Plastics	9	7.1
Non-metallic	7	5.6
Others*	20	15.9
Total	126	100

**Others represent manufacturers from medical and pharmaceuticals, rubber products, as well as textile, clothing and footwear sub-sectors.*

5.5.2 Organisation legal structure

Table 5.3 describes the manufacturer's legal structure in both number of responses and percentages. The analysis reports that the highest rate of return is recorded by the local company structure with 106 responses. Other legal structures such as joint venture has recorded 14 responses, while multi-national organisations fall short of 8 responses compared to prior returns when they only accumulated a total of 6 responses. Overall, the local company structure, which holds 84.1 per cent, is largely represented by the data as compared to the rest of structure.

Table 5.3: Organisation legal structure

Legal structure	**Frequency**	**Percentage**
Local company	106	84.1
Joint venture	14	11.1
Multinational	6	4.8
Total	126	100

5.5.3 Paid up capital

The descriptive analysis on demographic data also a report on the manufacturer's paid up capital structure (see Table 5.4). Manufacturing organisations with paid up capital equal to RM10 million and below accumulated 55 responses or 43.7 per cent. Meanwhile, the number of manufacturers with paid up capital ranging from RM11 million to less than RM25 million is slightly higher than manufacturers with more than RM25 million paid up capital by over 2 per cent. Both categories record 37 and 34 responses respectively.

Table 5.4: Paid up capital

Paid up capital	Frequency	Percentage
Up to RM10m	55	43.6
RM11m to RM25m	37	29.4
Above RM25m	34	27
Total	126	100

5.5.4 Year of establishment

To understand the relationship strength between manufacturers and their suppliers, the information regarding the manufacturer's year in business is also collected. Table 5.5 shows how the data is segregated by the duration of the manufacturer's establishment (in years). From the table, it is noted that the majority of the respondents are from manufacturers with above 25 years in business which gathered 52 responses. Manufacturers with 11 to 15 years in business record the second highest number of responses with 29 responses, in excess of 9 responses as compared to the subsequent group with 16 to 20 years in business, which is ranked in third place. The fourth highest response falls in the 5 to 10 years of establishment category with 16 responses and the least number of responses is recorded by the less than 5 years category with only 9 responses.

Table 5.5: Year of establishment

Duration	Frequency	Percentage
Less than 5 years	9	7.1
5 – 10 years	16	12.7
11 – 15 years	29	23
16 – 20 years	20	15.9
Above 21 years	52	41.3
Total	126	100

5.5.5 Annual sales turnover

Next, the data is segregated according to the annual sales turnover category. From Table 5.6 it can be clearly noticed that 51 responses or slightly above 40 per cent of the manufacturers have recorded an annual sales turnover of less than RM10 million. There are 41 responses recorded for the RM10 million to RM25 million category, in excess of 13 responses as compared to the last category (above RM26 million).

Table 5.6: Annual sales turnover

Sales	Frequency	Percentage
Less than RM10m	51	40.5
RM10m to RM25m	41	32.5
Above RM26m	34	27
Total	126	100

5.5.6 Number of major suppliers

In understanding the relationship between the manufacturer and their supplier, the information regarding numbers of major suppliers is gathered. Table 5.7 shows the number of major suppliers for the studied organisation. The figure indicates that in percentage terms, manufacturers with more than 16 major suppliers represented 73% of responses. This figure may reflect the manufacturer's power in a relationship and the level of trust they have on their major suppliers. In category 5 to 10, and 11 to 15, the number of suppliers has recorded a slightly identical percentage which is around 11 percent. Manufacturers with less than 5 major suppliers have the least responses with only 4 per cent.

Table 5.7: Number of major suppliers

No of major suppliers	**Frequency**	**Percentage**
Less than 5	5	4
5 to 10	14	11.1
11 to 15	15	11.9
Above 16	92	73
Total	126	100

5.5.7 Annual research and development, training and development, and new technology expenditures

The last three demographics category in section A deals with the manufacturer's annual expenditure on research and development (R&D) activities, staff training and development and allocation in acquiring new technology. It can be noted from Table

5.8 that most manufacturers fall in the ‘below RM5 million’ cluster for all three demographic categories, R&D, training and development, as well as allocation on acquiring technology. For instance, 105 manufacturers or 83.3 per cent spent below RM5 million for their annual R&D expenditure as shown in Table 5.8. It is a similar situation for annual training and development expenditure which recorded 114 responses or 90.5 per cent. This pattern continues with the annual allocation on acquiring new technology, with 115 responses or 91.3 per cent. These figures most probably reflect the fact that these manufacturers are committed to improving their innovation and sharpening their human resources skills, as well as upgrading their technology.

Table 5.8: Annual R&D expenditure, training and development expenditure and allocation on acquiring new technology

	R&D		**Training & Development**		**Acquiring New Technology**	
Amount	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
None	12	9.5	2	1.6	2	1.6
Below RM5m	105	83.3	114	90.5	115	91.3
6m to 10m	9	7.1	10	7.9	9	7.1
Total	**126**	**100**	**126**	**100**	**126**	**100**

5.6 Reliability

As mentioned in the previous chapter, reliability is the extent to which a variable is consistent in what it is supposed to measure (Hair et al. 2006). Reliability of the items in this study is assessed by determining the items’ coefficient alpha. Koufteros

(1999) highlight that the most widely used measure in evaluating reliability is Cronbach's alpha. As suggested by many authors, the generally acceptable level of Cronbach's alpha is above 0.70 and it may decrease to 0.60 in exploratory research (Hair et al. 2006; Robinson, Shaver & Wrightsman 1991). Meanwhile, Kline (2005) highlights that reliable coefficients above 0.90 are regarded as excellent, around 0.80 as very good, and 0.70 level as adequate. The scores of reliability coefficient for this study is calculated using SPSS software and the result can be found in Table 5.9. During the measurement purification, two items measuring technological capability construct (TC15 and TC16) records Cronbach's alpha below 0.6 and were thus removed from further analysis. Meanwhile, measurement items for other constructs were retained since the coefficients cannot be improved significantly via dropping of items.

Table 5.9: Reliability coefficient for the measurement items

Measures	**Cronbach's alpha**
Technological capability (TC1-TC14)	0.893
Power (PWR1-PWR8)	0.827
Trust (TR1-TR12)	0.895
Inter-firm relationship performance (IFR1-IFR10)	0.890

5.7 Dimension reduction: Factor analysis

An exploratory factor analysis was used to reduce the dimensionality of the data set into more manageable new sets of dimensions. This analysis is essential since it can detect patterns from the original data and extracted them into more meaningful underlying dimensions, known as factors (Jolliffe 1986). In other words, it allows the researcher to identify separate dimensions and further permits understanding as to what extent the construct is explained by each dimension (Hair et al. 2006). The common method of factor extraction is the principal component method.

This method of extraction is generally used to reduce the data into a smaller set of components by seeking the total variances and derive factors that contain a small proportion of unique variance (Hair et al. 2006). In other words, it seeks sets of factors that can account for all common or unique variances in a given set of variables (Lu, Lai & Cheng 2007). Hatcher (1994) argues that the minimum adequate sample size required to run this procedure is at least 100 observations and this argument is supported by Hair et al. (2006) when they assert that the preferable sample size should be 100 or larger. The analysis was conducted to each and every individual latent constructs and the results of the analysis are described in the next sub-section.

5.7.1 Factor analysis results

First, the results of principle component analysis highlight that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value is above 0.80 which indicates around 80 per cent of variance of the data is common variance. The KMO value measures the sampling adequacy and the value is far more than 0.6 which is the rule of thumb in conducting this analysis (Coakes, Steed & Ong 2010). Meanwhile, Bartlett’s test of sphericity is significant which denotes the presence of correlations among the variables (Hair et al. 2006). A summary of these tests is shown in Table 5.10.

Table 5.10: The KMO and Bartlett's test of sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Bartlett's Test of Sphericity	Approx. Chi-Square	3779.814
	df	861
	Sig.	.000

Further, it was also established that 10 factors have been identified from the rotated component matrix (see Appendix 7) using varimax rotation with suppressed absolute value below 0.5. Following the suggestion from Capafons et al. (2004), six items (TC12, PW4, PWR7, PWR8, IFR9 and IFR10) that do not have a high load on the factors are retained because they are important items that measure the constructs and fulfil theoretical criteria. This result is then compared with the total variance explained for each construct. From this information, the number of factors for each construct is extracted by using their eigenvalues. A summary on the number of factors to be retained is shown in Table 5.11 below.

Table 5.11: Summary on the results of factor analysis

Construct	**No. of factors**	**Factor**	**Eigenvalue**	**Percent of variance**
Technological Capability	3	1	2.980	7.095
		2	1.566	3.729
		3	1.541	3.670
Power	2	1	1.265	3.012
		2	1.045	2.488
Trust	3	1	2.090	4.977
		2	1.821	4.336
		3	2.058	4.900
Inter-firm relation performance	2	1	1.163	2.769
		2	14.602	34.767

As can be observed from Table 5.11 above, the analysis derived several common factors that could be extracted from the given sets of data. Technological capability, as well as inter-firm relationship performance, has extracted 3 common factors respectively followed by power with 2 factors and trust with 3 factors. The next step is to identify the common theme that loads onto the same factor by looking at the content of the survey questionnaire. After cross checking with the content of the survey questionnaires, common themes among highly loadings measurement items were identified and represented by Table 5.12 below. These new themes will be known as dimensions that represent their constructs and will be used extensively in the next part of quantitative analysis.

Table 5.12: Dimensions of the constructs based on the results of factor analysis

Construct	**No. of factors**	**New Dimensions**
Technological Capability	3	Production
		Investment
		Linkage
Power	2	Expert
		Referent
Trust	3	Contractual
		Competence
		Goodwill
Inter-firm relation	2	New Product
performance		Development
		Business Performance

5.8 Two step approach of PLS analysis

After running the descriptive statistics and identifying dimensions of the construct through factor analysis, the analysis proceeds with more serious statistical procedures. In this section the data was analysed using Partial Least Square (PLS) method and SmartPLS 2.0 software was used to test the research model and thus answer all the research hypotheses.

Figure 5.1 illustrates the measurement model of the study to be tested using SmartPLS software. The model consists of outer model and inner model separated by the dotted rectangle. The outer model consists of all first order dimensions associated with the relevant constructs; meanwhile the inner model is represented by four second order constructs, namely, technological capability, power, trust and inter-firm relationship performance.

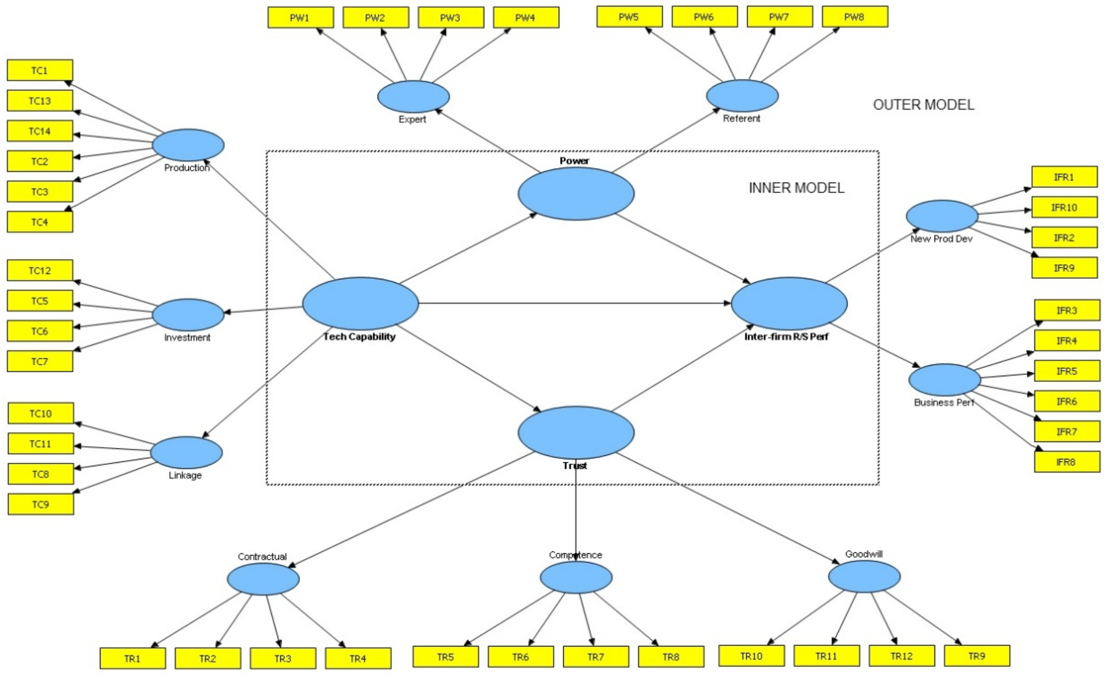

Figure 5.1: The measurement model of the study

5.8.1 Step 1: Assessment of the outer model

In this analysis, SmartPLS software is used to perform PLS CFA to inspect unidimensionality and whether the observed variables are well represented by the assigned measurement factors both in outer and inner model. The test of unidimensionality is performed through a series of analyses by determining its convergent validity and discriminant validity (Henseler, Ringle & Sinkovics 2009). The next sections discuss the test results from these examinations on the outer model.

Figure 5.2 below illustrates the outcome of PLS analysis on the overall measurement model. The main focus of this analysis is on the outer model that resides outside the dotted rectangle line. A discussion on the output of this analysis can be found in the next section.

a) Convergent validity: 1st criterion

Convergent validity is assessed by three different criteria as described in the previous chapter. The first criterion to be assessed is the outer loadings generated from the CFA procedure in SmartPLS 2.0 software. Table 5.13 depicts the outer loadings for all items of the constructs. The recommended cut off value of outer loadings is set at 0.70. This recommendation is in line with the view of many scholars that the value of 0.70 and above can be considered adequately high in assessing the convergent validity of the constructs (Ghozali 2008; Henseler, Ringle & Sinkovics 2009; Hulland 1999; Nunnally & Bernstein 1994). Based on these outer loadings, each outer model is assessed against the cut off value of 0.70.

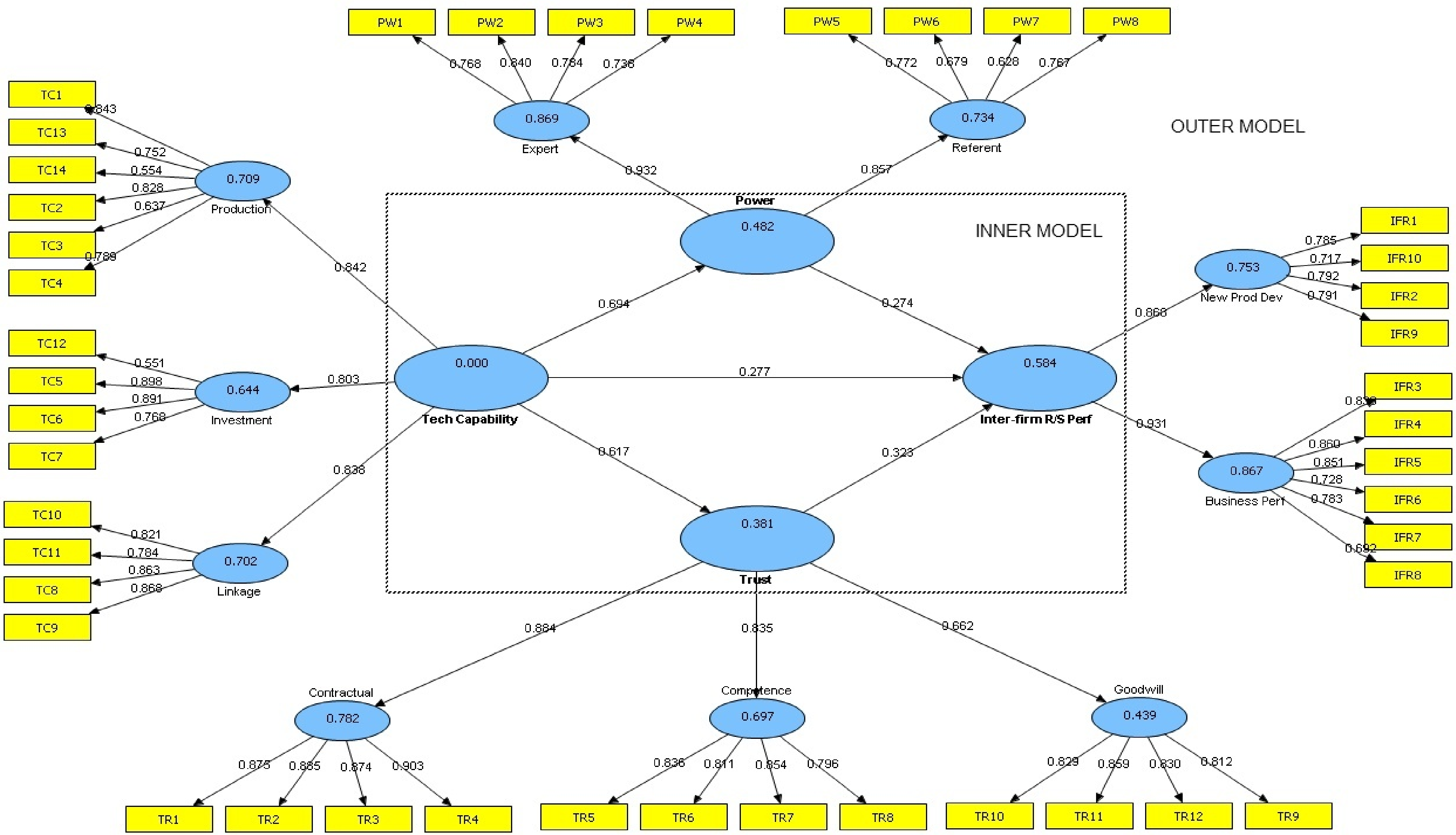

Figure 5.2: Initial result of PLS analysis on the measurement model

Table 5.13: Initial values of outer loadings

Items	Loadings	Items	Loadings
TC1	0.8433	TR1	0.8749
TC2	0.8283	TR2	0.8850
TC3	0.6371	TR3	0.8739
TC4	0.7892	TR4	0.9027
TC5	0.8978	TR5	0.8361
TC6	0.8910	TR6	0.8107
TC7	0.7679	TR7	0.8536
TC8	0.8628	TR8	0.7964
TC9	0.8685	TR9	0.8117
TC10	0.8211	TR10	0.8289
TC11	0.7843	TR11	0.8585
TC12	0.5511	TR12	0.8298
TC13	0.7511	IFR1	0.7845
TC14	0.5538	IFR2	0.7915
PW1	0.7704	IFR3	0.8383
PW2	0.8369	IFR4	0.8596
PW3	0.7789	IFR5	0.8513
PW4	0.7435	IFR6	0.7276
PW5	0.6901	IFR7	0.7829
PW6	0.5645	IFR8	0.6917
PW7	0.7432	IFR9	0.7907
PW8	0.8181	IFR10	0.7169

i. Technological capability outer model

The validation of the technological capability measurement construct is required in order to determine its impact on inter-firm relationship performance. Theoretically, this construct is measured by 14 measurement items (TC1 to TC14). Three dimensions were identified from the previous factor analysis procedure, namely production, investment, and linkage. All these dimensions are modelled as first-order constructs, while technological capability as a whole is being known as a second-order construct. From the initial run, three items (TC3, TC12 and TC14) from production dimension were dropped from the final model due to low outer loadings (refer Table 5.13). All other items from other dimensions were retained for a re-run of the final model.

ii. Power outer model

The second outer model that needs to be assessed in terms of outer loadings criterion is power construct. This construct is theoretically measured by two dimensions identified during the previous factor analysis procedure, namely expert and referent. Expert power is measured by four items (PW1-PW4), while referent power is also represented by four items (PW5-PW8). The initial run (refer to Table 5.13) recorded two items that fall below the cut-off point of 0.70 (PW5 and PW6). Nevertheless, after dropping PW6, the loading of PW5 increased significantly above the cut-off point. Therefore, this study decided to retain item PW5, while dropping PW6 from the measurement model. The outer loadings for expert dimensions are all above 0.70, thus eliminating the need to drop any measurement items under this dimension.

iii. Trust outer model

The third outer model that needs to be assessed in terms of outer loadings criterion is trust construct. This construct is theoretically measured by three dimensions identified during the previous factor analysis procedure, namely contractual, competence, and goodwill. Each of these dimensions is represented by four measurement items respectively (TR1-TR12). Based on the given outer loading factors from the initial run (see Table 5.13), it was decided that all measurement items under this construct be retained for the final run since all the outer loadings values are well above the cut-off point of 0.70.

iv. Inter-firm relationship performance outer model

The last outer model in this study needing to be assessed in terms of outer loadings criterion is inter-firm relationship performance construct. This construct is theoretically represented by two dimensions, namely, new product development and business performance. This construct is represented by ten measurement items whereby new product development dimension is represented by four measurement items, and business performance dimension with six measurement items. The initial run of PLS detected that one measurement item (IFR8) has outer loadings below the threshold value of 0.70 (refer to Table 5.13) and, thus, these items were dropped from the final model.

v. Final model assessment

All the identified items (TC3, TC12, TC14, PW6 and IFR 8) were dropped from the measurement model consecutively and the model re-run after each drop accordingly. As detailed in the methodological chapter, items were deleted with careful discretion, with the composite reliability coefficient taken as the point of reference. The end result is illustrated as per Figure 5.3 below.

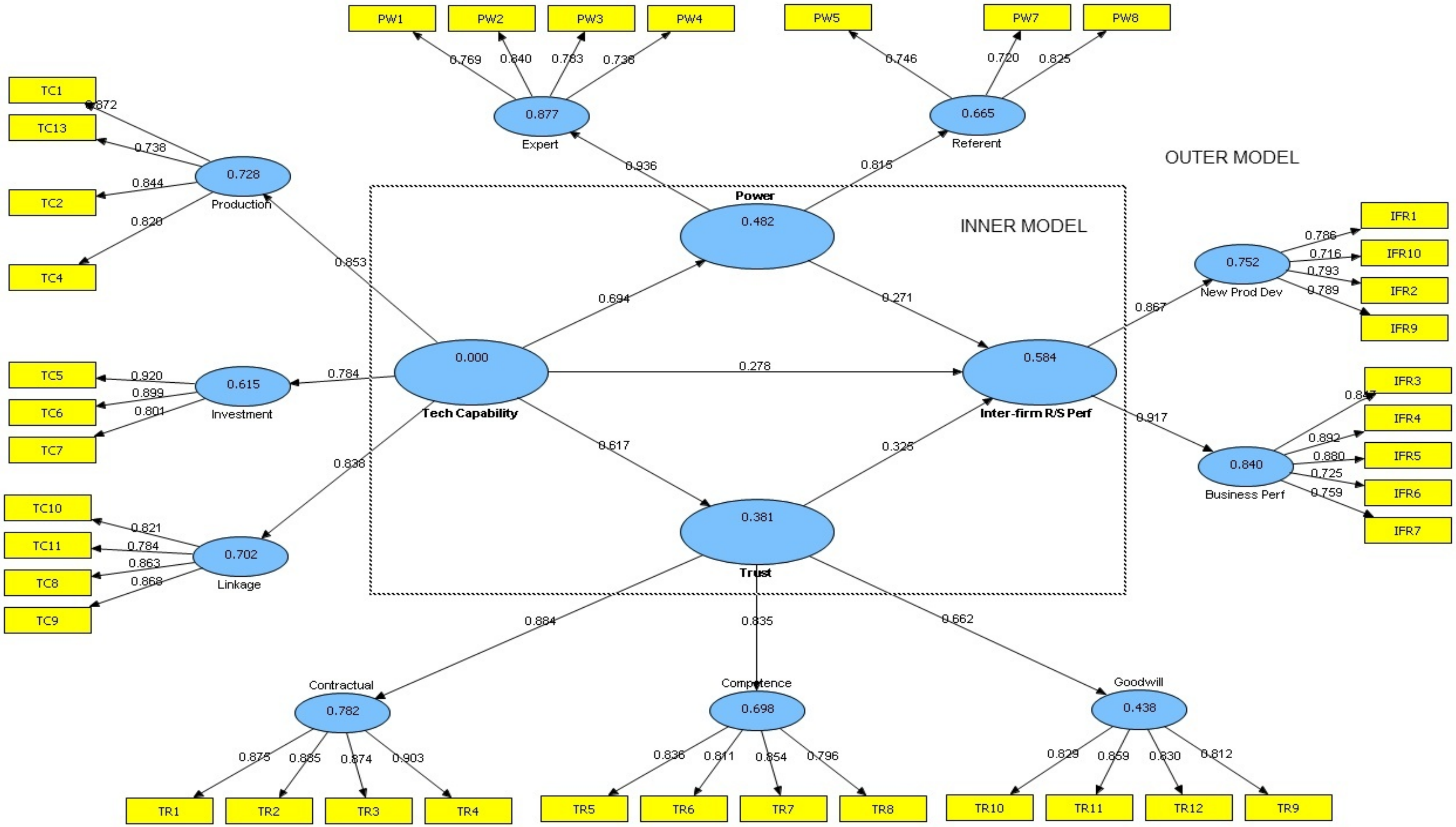

Figure 5.3: Result of PLS analysis on the measurement model after final run

Table 5.14: The values of outer loadings after final run

Items	Loadings	Items	Loadings
TC1	0.872	TR3	0.8739
TC2	0.8444	TR4	0.9027
TC4	0.8203	TR5	0.8361
TC5	0.9201	TR6	0.8107
TC6	0.8993	TR7	0.8536
TC7	0.8011	TR8	0.7964
TC8	0.8629	TR9	0.8117
TC9	0.8684	TR10	0.8289
TC10	0.8210	TR11	0.8585
TC11	0.7843	TR12	0.8298
TC13	0.7385	IFR1	0.7858
PW1	0.7689	IFR2	0.7928
PW2	0.8398	IFR3	0.8471
PW3	0.7829	IFR4	0.8917
PW4	0.7378	IFR5	0.8804
PW5	0.7463	IFR6	0.7251
PW7	0.7204	IFR7	0.7593
PW8	0.8253	IFR9	0.7894
TR1	0.8749	IFR10	0.7158
TR2	0.8850		

Overall, all items outer loadings are close to or above the recommended threshold value. This is confirmed by Table 5.14 that depicts all items outer loadings are higher than 0.70. Therefore, in general, it can be concluded that the items have adequately satisfied the first criterion of the convergent validity test. Next, an explanation of the first criterion on each outer model involved in this study is provided.

b) Convergent validity: 2nd criterion

The second criterion of convergent validity assessment is to test the internal consistency reliability of the outer model. Prior to the execution of SmartPLS 2.0

software, the reliability of the measurement construct was determined through reliability coefficient of Cronbach's alpha through SPSS program. In this analysis, the internal consistency reliability is estimated using composite reliability and Cronbach's alpha coefficient. The rule of thumb for both composite reliability and Cronbach's alpha is above 0.70 to indicate an acceptable internal consistency reliability (Henseler, Ringle & Sinkovics 2009).

Table 5.15 below denotes the composite reliability, and Cronbach's alpha for the dimensions of all constructs in the outer model. As for technological capability outer model, all of its dimensions have recorded composite reliability above 0.70 with the highest recorded by investment dimension of 0.9071. Meanwhile, the Cronbach's alpha coefficient also well above the threshold value of 0.70 which indicates that the dimensions of the technological capability construct have demonstrated the presence of good internal consistency reliability.

Table 5.15: Composite reliability and Cronbach's alpha for dimensions in their respective outer models

Outer models	**Dimensions**	**Composite Reliability**	**Cronbach's Alpha**
Technological Capability	Production	0.8913	0.8376
	Investment	0.9071	0.8497
	Linkage	0.9018	0.8544
Power	Expert	0.8636	0.7889
	Referent	0.8087	0.6485
Trust	Contractual	0.9348	0.9070
	Competence	0.8946	0.8428
	Goodwill	0.9002	0.8548
Inter-firm R/ship Performance	New Product Dev.	0.8546	0.7728
	Business Performance	0.9127	0.8798

Table 5.15 also signifies the dimensions of power construct's composite reliability and Cronbach's alpha coefficient. Expert dimension has 0.8636 on composite reliability and 0.7889 of Cronbach's alpha. Meanwhile, composite reliability for referent dimension is 0.8087, but this construct recorded a mediocre value of Cronbach's alpha of 0.6485.

As for dimensions in the trust construct, contractual has the highest value for composite reliability with 0.9346, followed by goodwill and competence with 0.9002 and 0.8946 respectively. Table 5.15 also reports the Cronbach's alpha coefficient for all trust dimensions. Contractual lead with 0.9070, while competence has 0.8428 and goodwill 0.8548

Lastly, Table 5.15 reports the inter-firm relationship performance outer model's internal consistency reliability. Both dimensions of this construct have the value of composite reliability above 0.85. The Cronbach's alpha for both of the dimensions are also acceptably high with new product development recorded at 0.7728 and business performance 0.8798.

Meanwhile, the internal consistency reliability for the entire constructs is also available for inspection. Table 5.16 below denotes the composite reliability and Cronbach's alpha for all the studied constructs.

Table 5.16: Composite reliability, Cronbach's alpha and R^2 among constructs

Construct	**Composite Reliability**	**Cronbach's Alpha**
Technological Capability	0.9101	0.8894
Power	0.8664	0.8201
Trust	0.9067	0.8835
Inter-firm R/ship Performance	0.9033	0.8769

The above table reveals that the technological capability construct has recorded a composite reliability value of 0.9101 and 0.8894 respectively, followed by the power construct with 0.8664 of composite reliability and 0.8201 for Cronbach's alpha. The trust construct recorded 0.9067 in terms of composite reliability and 0.8835 in Cronbach's alpha value. Meanwhile, inter-firm relationship performance has 0.9033 in composite reliability and Cronbach's alpha value 0.8769.

In short, all the dimensions in their respective outer models (except referent power) and their individual constructs have exceeded the recommended threshold value of 0.70 for composite reliability and Cronbach's alpha coefficients. Therefore, it can be concluded that all dimensions in their respective outer models and their individual constructs have passed the second criterion in determining the construct validity by having sound internal consistency reliability.

c) Convergent validity: 3rd criterion

After validating the outer loadings and the internal consistency reliability for all dimensions in the outer models and their constructs, the analysis then focussed on the third criterion to determine the convergent validity of the outer models. Fornell and Larcker (1981) suggest the use of average variance extracted (AVE) indicator as a criterion of convergent validity. AVE indicates the meaning of how much, on average, a latent variable is able to explain the variance of its indicator, and AVE value of above 0.50 indicates sufficient level convergent validity (Henseler, Ringle & Sinkovics 2009). The results of AVE analysis are illustrated in Table 5.17.

Table 5.17: Average variance extracted (AVE) for dimensions in their respective outer models

Outer models	**Dimensions**	**AVE**
Technological Capability	Production	0.6729
	Investment	0.7657
	Linkage	0.6970
Power	Expert	0.6134
	Referent	0.5857
Trust	Contractual	0.7818
	Competence	0.6798
	Goodwill	0.6929
Inter-firm R/ship Performance	New Product Development	0.5954
	Business Performance	0.6780

Table 5.17 shows the AVE of all dimensions in the outer model. For technological capability outer model, investment dimension has the highest AVE of 0.7657 followed by linkage and production with 0.6970 and 0.6717 respectively. As for power outer model, the value of AVE is topped by expert dimension with 0.6134 while referent dimension is 0.5857. All dimensions within the trust outer model have AVE values of above 0.65, with the contractual dimension the highest at 0.7818. The final outer model also recorded an impressive value of AVE. The inter-firm relationship performance outer model met this third criterion with both of its

dimensions recording AVE of above the threshold value. Meanwhile, the AVE for the entire constructs are also available for assessment. Table 5.18 denotes the AVE for all the studied constructs.

Table 5.18: Average variance extracted (AVE) among constructs

Construct	**AVE**
Technological Capability	0.5052
Power	0.4828
Trust	0.5120
Inter-firm R/ship Performance	0.5216

The above table reveals that almost all constructs have recorded AVE of above the recommended level of 0.50. The inter-firm relationship performance construct has the highest at 0.5216, followed by the trust construct with 0.5120. Meanwhile, technological capability has AVE of 0.5052, while power construct recorded a mediocre value AVE, but still acceptable at only minimally below the 0.50 level.

Therefore, all the dimensions have sufficiently fulfilled the third criterion in assessing convergent validity. This can be verified as all the dimensions have recorded AVE values of near or above 0.50. At the construct level, all values of AVE are close to 0.50 level and these indicate that more than half of the variances observed in the items are accounted by their factors and thus satisfy the third criterion of convergent validity. In summary, the analysis of the three criteria shows that all the dimensions within their respective outer models exhibit sufficient convergent validity. This section completes the assessment on convergent validity of the outer models. Next section provides an examination on discriminant validity.

d) Discriminant validity

Discriminant validity is a complement to convergent validity and can be considered present when variance shared by a construct with its indicator is higher than other constructs in a given model (Fornell & Larcker 1981). It is also measured using AVE and Ghozali (2008) recommends that the AVE needs to be square rooted (√AVE) then compared with inter-construct correlation. The value of √AVE needs to be higher than the inter-construct correlation before confirmation of the existence of discriminant validity can be made. Table 5.19 shows the matrix of the square root of AVE and the correlation of the dimensions. Correlations between dimensions are displayed in the lower left of diagonal elements in the matrix. The value of √AVE (bold) in the table is compared to the values of correlation beneath it (or to the same row for the far right √AVE) and should be greater to demonstrate the existence of discriminant validity.

For instance, the square root of AVE for production (0.8203) is higher than the correlation of investment and production (0.5695). This figure is also higher than the correlation of production with other dimensions such as linkage (0.4991), expert (0.6521), referent (0.5131), contractual (0.4168), competence (0.3785), goodwill (0.5157), new product development (0.4904) and business performance (0.4997). Therefore, it meets the stringent test outlined by Fornell and Larcker (1981) in providing evidence of discriminant validity for the all the dimensions in the study.

As for the construct level, Table 5.20 illustrates the matrix of the square root of AVE and the correlation of the constructs. Likewise, for technological capability, power, trust and inter-firm relationship performance, all the square root of AVE values are greater than the correlations with other construct and thus reflect evidence of discriminant validity. This test denotes the end of step one of the two-step approach of PLS analysis.

In conclusion, step one of the PLS two-step approach involves PLS CFA analysis to determine the presence of unidimensionality on the studied constructs by examining every outer model's convergent and discriminant validity. Convergent validity is assessed by three different criterions: outer loadings, internal consistency reliability and average variance extracted (AVE). Each outer model has exhibited sufficient evidence of convergence validity when meeting the requirement outlined by the rule of thumb of the respective criterions. Meanwhile, discriminant validity is gauged by comparing the square root of AVE values with the correlation between dimensions or constructs. The analysis reports an adequate level of discriminant validity when all the square root AVEs are greater than their inter-dimensions' or inter-constructs' correlations.

Table 5.19: AVE, square root AVE and correlation of dimensions

		Dimensions	AVE	1	2	3	4	5	6	7	8	9	10
Dimensions	1	Production	0.6729	**0.8203**									
	2	Investment	0.7657	0.5695	**0.8750**								
	3	Linkage	0.6970	0.4991	0.5394	**0.8349**							
	4	Expert	0.6134	0.6521	0.4909	0.4608	**0.7832**						
	5	Referent	0.5857	0.5131	0.5305	0.4429	0.6238	**0.7683**					
	6	Contractual	0.7818	0.4168	0.3400	0.4681	0.4886	0.4649	**0.8842**				
	7	Competence	0.6798	0.3785	0.3889	0.4572	0.3959	0.4483	0.5474	**0.8245**			
	8	Goodwill	0.6929	0.5157	0.4634	0.3659	0.5432	0.5328	0.4538	0.4416	**0.8324**		
	9	New Product Dev	0.5954	0.4904	0.5448	0.5005	0.5115	0.6139	0.4746	0.4235	0.4737	**0.7716**	
	10	Business Perf	0.6780	0.4997	0.4599	0.5140	0.5256	0.5027	0.5408	0.5435	0.5029	0.6234	**0.8234**

Note: diagonal is a square root AVE value (in bold)

Table 5.20: AVE, square root AVE and correlation of constructs

		Constructs	AVE	1	2	3	4
Constructs	1	Technological Capability	0.5052	**0.7108**			
	2	Power	0.4828	0.6943	**0.6948**		
	2	Trust	0.5120	0.6170	0.6278	**0.7155**	
	4	Inter-firm Relationship Performance	0.5216	0.6670	0.6683	0.6670	**0.7222**

Note: diagonal is a square root AVE value (in bold)

5.8.2 Step 2: Structural model evaluation

The previous section investigates the outer model via PLS analysis that signifies the relationship between latent variables with their dimensions and measurement constructs. The investigation involves determining the unidimensionality of the construct by assessing its internal consistency reliability, convergent validity and discriminant validity. The reliability and the validity of the outer model further allows an assessment of inner path model estimates (Henseler, Ringle & Sinkovics 2009).

Next, the quantitative analysis continued with Step 2 in the PLS two step approach by assessing the inner models of the study via path analysis which further permits the testing of the research's hypotheses. In this study, the inner model consists of relationships between technological capability with power, trust and inter-firm relationship performance. The dependent construct is the inter-firm relationship performance with new product development and business performance as its dimensions. This section evaluates the structural model based on the criterion outlined in Chapter 3 which focuses on inspecting the model on two main criterions:

- The variance explanation of the endogenous (dependent) construct; and
- The significance of path coefficients.

a) Variance explained

Hulland (1999) states that the primary objective of PLS analysis is minimization of error or equally, maximization of variance explained. He further suggests that researchers using PLS analysis should report the R^2 value of all the endogenous constructs since the degree to which any PLS model can achieve this objective is to report this value. Therefore, the first criterion to assess the structural model is to determine the variance explained by inspecting R^2 value of the endogenous construct. The R^2 value measures the 'variance proportion of the endogenous dependent variable about its mean that is explained by the independent (exogenous) variable. The value varies from 0 to 1 and the higher the value; the greater the explanatory power on the structural model and thus provide better prediction the dependent variable' (Hair et al. 2006, p. 143).

Table 5.21 illustrates the R^2 value for power, trust and inter-firm relationship performance. Overall, the R^2 values for all the endogenous constructs are strong. It can be seen from the table that 58.4% of the variance in inter-firm relationship performance is explained by technological capability, power and trust constructs. Meanwhile, 48.2% of the variance in power construct and 38.1% variance in trust construct are explained by the technological capability construct.

Table 5.21: R^2 value of the endogenous construct

Construct	$\mathbf{R^2}$
Power	0.482
Trust	0.381
Inter-firm relationship performance	0.584

In summary, the first criterion in evaluating the structural model has been satisfied by determining the R^2 values for all the endogenous constructs. All the dependent constructs have recorded strong R^2 values and, in fact, inter-firm relationship performance has very strong R^2 values when the construct is explained by more than 50% by all other constructs in the model. The next section describes the analysis to test the second criterion which is to determine the significance of the path coefficient by employing the bootstrapping procedure.

b) Analysis of path coefficients

The previous section provided an evaluation of variance explained or R^2 values of the endogenous construct which is the first criterion in evaluating the structural model. This section offers the assessment of the second criterion which is to determine the significance of the path coefficients based on t-statistics derived from the bootstrapping technique. Bootstrapping is a procedure that generates random samples repeatedly for a specific number of times from the original data set (Hair et al. 2006). In this study, a bootstrap re-sampling procedure of 126 samples was employed, based on the same amount of the original sample as recommended by Henseler et al. (2009) to assess the significance of the path coefficient. One tailed t-tests were used to identify the significance level since the study's hypotheses are one-directional in nature. Table 5.22 illustrates the path coefficients, t-values and significance for the constructs. An explanation of the table is provided in the next section, together with the test of the study's hypotheses.

Table 5.22: Path coefficient, t-value and significance

Path	Direction	Path Coefficient	T Value	Sig
Technological Capability → Inter-firm relationship performance	+	0.2782	4.2837	**
Technological Capability → Power	+	0.6943	13.8337	**
Technological Capability → Trust	+	0.6170	12.1014	**
Power → Inter-firm relationship performance	+	0.2710	2.7384	*
Trust → Inter-firm relationship performance	+	0.3252	3.8890	**

* Significant at p<0.005 (one tailed)
** Significant at p<0.001 (one tailed)

5.9 Test of hypotheses

The result from the PLS path analysis, illustrated in Table 5.22, permitted the testing of the study's hypotheses. Based on the path coefficient and its t-value derived from the bootstrapping procedure; conclusions on whether the hypotheses are supported or rejected by the data are made.

H1: Technological capability has a positive impact on inter-firm relationships performance.

The path coefficient shows a positive and significant relationship (0.2782; $p<0.001$) between technological capability and inter-firm relationship performance. Therefore, this hypothesis is supported by the data.

H2: Technological capability is positively associated with power.

Technological capability has demonstrated a significant positive association with power (0.6943; $p<0.001$). Therefore, this hypothesis is supported by the data.

H3: Power has a positive impact on inter-firm relationship performance.

The path coefficient and significance shows that relationship power has a significant positive impact on inter-firm relationship performance (0.2710; $p<0.005$). Therefore, this hypothesis is supported by the data.

H4: Technological capability is positively associated with trust.

Technological capability has demonstrated a significant positive association with trust (0.6170; $p<0.001$). Therefore, this hypothesis is supported by the data.

H5: Trust has a positive impact on inter-firm relationship performance.

The path coefficient and significance reveals that level trust has a significant positive impact on inter-firm relationship performance (0.3252; $p<0.001$). Therefore, this hypothesis is supported by the data.

From the above, assessment on the relationship strength can be made. The analysis shows that there is a strong direct relationship between:

- technological capability and inter-firm relationship performance
- technological capability and power
- power and inter-firm relationship performance

- technological capability and trust
- trust and inter-firm relationship performance

After determining the direct association between the construct, the next section provides an assessment on the mediating effects of the intervening variables (the level of power and trust) on the relationship between technological capability and inter-firm relationship performance.

5.10 Assessment of mediating effects

On top of determining the direct relationship between constructs reported in Table 5.23, the test of indirect relationship was also investigated since there is a construct in the model being mediated with two intervening variables. Hypotheses 6 and 7 seek to determine the mediating effects of power and trust on the positive association between technological capability and inter-firm relationship performance.

As described in the previous chapter, the test of mediation begins with the causal steps approach followed by the calculation of Sobel test in order to determine whether the intervening variables significantly mediate the influence of independent variables towards a dependent variable. First, the association between technological capability and inter-firm relationship performance was assessed without the introduction of both intervening variables (power and trust). The regression coefficient is recorded (refer to Table 5.23).

After the completion of steps 2 to 3 (drawing the direct link between independent variable to both of the intervening variables and from the intervening variables to the dependent variable) the full model was run using SmartPLS software to generate the regression coefficient needed to complete the causal step approach. The final step was to compare the regression coefficient generated from step one (before the introduction of intervening variables) with the regression coefficient generated after the introduction of both intervening variables. Both values were compared (refer to Table 5.23) and it was found that the regression coefficient for the association between technological capability and inter-firm relationship performance after the insertion of the intervening variables was slightly lower than before.

Table 5.23: Regression coefficient before and after the insertion of the mediators.

Path	**Direction**	**Regression Coefficient**	**Standard Errors**
Before the introduction of the mediators			
Technological Capability → Inter-firm relationship performance	+	0.6675	0.040
After the introduction of the mediators			
Technological Capability → Inter-firm relationship performance	+	0.2782	0.065
Technological Capability → Power	+	0.6943	0.05
Technological Capability → Trust	+	0.6170	0.051
Power → Inter-firm relationship performance	+	0.2710	0.099
Trust → Inter-firm relationship performance	+	0.3252	0.0836

In order to confirm mediating effects, Sobel test was performed to examine the significance of the mediating variables. As mentioned in Chapter 3, the Sobel's test of mediation is calculated using formula revealed in Chapter 3 and coded into Microsoft Excel 2007. The associations between technological capability→power→inter-firm relationship performance and technological capability→trust→inter-firm relationship performance were tested and the results of this test are shown in Table 5.24.

Table 5.24: Test of mediation

Path	**Direction**	**Sobel test statistic (z)**	**p-value (one tailed)**	**p-value (two tailed)**
Technological Capability → Power → Inter-firm relationship performance	+	2.652	0.004	0.008
Technological Capability → Trust → Inter-firm relationship performance	+	3.703	0.000	0.000

The *z* values were then cross checked with the *z* table to determine the significance (p value). It was found that both intervening variable are significant at $p < 0.01$ (two tailed). In fact, the mediation effect of trust is highly significant at $p < 0.001$ (two tailed) compared to the effect of power as the mediator. Therefore;

H6: Power mediates the positive association between technological capability and inter-firm relationship performance

It was found that the regression coefficient between technological capability and inter-firm relationship performance has been reduced after the introduction of the intervening variable (power construct) and the Sobel test statistic signifies a p-value below 0.01. This denotes that the power construct is significantly mediates the positive association between technological capability and inter-firm relationship performance. Thus, the hypothesis is supported by the data.

H7: Trust mediates the positive association between technological capability and inter-firm relationship performance.

There was a reduction in the regression coefficient between technological capability and inter-firm relationship performance after the introduction of the intervening variable (trust construct) and the Sobel test statistic is significant at $p < 0.001$. This signifies that the trust construct significantly mediates the positive impact of technological capability on inter-firm relationship performance. Therefore, the hypothesis is supported by the data.

5.11 Chapter summary

This chapter provides the empirical results based on the steps mentioned in the research methodology chapter. The data was screened and tested for multivariate assumption which includes test of normality, homoscedasticity and linearity. Subsequently, the reliability of the measurement items was assessed whereby two measurement items (TC15 and TC16) are dropped to increase the reliability. Next, this study conducts factor analysis to identify possible dimensions in each constructs. The analysis continued with the first step of the two-step PLS approach by checking the outer models to determine convergent and discriminant validity. The second step was to assess the structural model and focused on inspecting the variance explained and the analysis of path coefficients. The chapter continued with testing of hypotheses and the assessment of the mediating effects. It is found that all the hypotheses have been supported by the data. Interestingly, the findings also reveal that both power and trust constructs have significantly mediate the positive association between technological capability and the inter-firm relationship performance as suggested by the related theories. The next chapter present the results for Phase Two, which concentrates on the qualitative findings.

CHAPTER 6: QUALITATIVE DATA RESULTS

6.1 Introduction

The previous chapter provided findings on Phase One which involved quantitative analysis and test of hypotheses. This chapter presents the results for Phase Two which concentrates on the case study interviews designed to explore the interconnection between technological capability, power, trust and inter-firm relationship performance. Details of the result in this chapter were gathered via face-to-face interviews with the key informant in the participating organisations. This chapter starts with an overview of the case study whereby details on the participating organisations and their representative is given. Next, it offers the findings of qualitative method gathered through the interviews with the participants. Subsequently, the chapter continues with cross-case analysis whereby discussions on the findings are provided before concluding it with a summary.

6.2 Overview of the case study

In this phase, organisations listed under the Federation of Malaysia Manufacturing (FMM) Directory 2009 that responded to the last page of the survey questionnaire used in Phase One, which focuses on the intention to participate in a follow-up interview (refer to Appendix 2), were short listed. These organisations were then contacted to confirm their consensus to participate in the interview session. The confidentiality of all business information given, as well as their anonymity, was assured and, as a result, five organisations agreed to participate in this study. The list of organisations that agreed to participate in this phase can be found in Table 6.1. These organisations are from the manufacturing sector with two from automotive industry and one from packaging, electronics, and pharmaceuticals respectively.

Table 6.1: List of organisations participating in the case study

Manufacturer	**Industry**	**Participant Designation**
Case Study A (CsA)	Automotive	Executive Vice President
Case Study B (CsB)	Automotive	Senior General Manager
Case Study C (CsC)	Packaging	Senior Manager
Case Study D (CsD)	Electronics	Chief Operating Officer
Case Study E (CsE)	Pharmaceutical	Senior Manager

Meanwhile, interviews were been conducted with appropriate key management personnel that hold unique positions in the organisations with valuable knowledge relating to the area of this study. They needed to hold sufficient knowledge of their organisation's supply chain operations and most were involved in decision making within their company. As shown in Table 6.1, the case study organisations are represented by Executive Vice President (CsA), Senior General Manager (CsB), Senior Manager (CsC), Chief Operating Officer (CsD) and Senior Manager (CsE). A set of interview questions were emailed to them prior to the interview session to give them some idea of the information needed during the interview session. The interviews were conducted within the period of May 2010 and August 2010. Details of the findings are discussed in the next section which provides in-depth analysis of all case organisations before combining them in a cross-case analysis to compare similarities and differences among them.

6.3 Case study A

6.3.1 Background

Case study A (CsA) is a local manufacturer that produces various automotive air conditioning parts and accessories. The company's main products include condenser fan and motor, blower and radiator motor, accumulator, filter drier, hose and fitting assembly, and expansion valve. These products have been marketed domestically and their main customer is one of the national car manufacturers. The company's products are also distributed to the local automotive supply parts distributor, as well as most Asean countries and the company plans to export their product to other Asian countries as well as to Europe and Australia in the near future. In order to support their production lines, the company has invested in a wide range of manufacturing facilities. The company is also actively involved in R&D activity to focus on improving production, processes and services. The company has been awarded ISO 9001:2008 by Moody International by certifying its quality management system which reflects its commitment to providing total customer satisfaction by producing quality products at a competitive price, and aims to achieve zero defects in its production. The main competitors in this industry are PATCO and Nippon Denso which also manufacture the same line of products. The interview was conducted with the CsA's executive vice president (operations).

6.3.2 Technological capability

Since being established in 1989, the company's business has been growing rapidly. In line with the business expansion, CsA has been continuously upgrading their manufacturing plant to increase their production capability. The executive vice president of CsA reveals that the company has invested a substantial amount of money in its production lines to meet the demand of its product. He discloses that:

> *'In order to meet the increasing demand from both domestic and international customers, we need to continuously upgrade our manufacturing capability. The company has invested in a wide range of manufacturing facilities and up to now, we have nine different facilities in our production lines which include plastic injection moulding, metal stamping, painting and welding, mould and die facility, and cold forging'.*

Meanwhile, in order to stay competitive in the market, CsA believe that they need to be strongly market driven and continuously advancing with technology to satisfy their customers' needs. To cope with its customers' expectation, the company has established its own R&D facility with the focus on producing high quality products at a competitive cost. Its R&D team is equipped with the latest technology to improve products, processes and service. The executive vice president added:

> *'The R&D team is capable of designing prototype, developing and experimenting with the aid of 2D and 3D CAD/CAM application. The R&D team also work closely with their suppliers and their main customers to*

> *produce high quality products especially in designing and manufacturing customise products'.*

As the company's mission is to continuously innovate, most of its plants are equipped with advanced manufacturing technology. CsA realise that it also needs to upgrade employees with technology-related knowledge and skills continuously. On this notion, the executive vice president stresses that:

> *'We recognise that our employees are important assets to the company. Therefore, we regularly send our staff for training to sharpen their technical skills and knowledge to meet the performance standard. This is vital to ensure that all the machinery can be fully utilised to the optimum level. Importantly, the training increases high level of awareness on the safety requirements in order to avoid accidents since the working environment involves lots of machineries usage'.*

The interview session also provided evidence of the importance of integrating its technological resources with both suppliers and customers. For example, the supply chain is equipped with an e-procurement system (web base ERP), as well as a vendor managed inventory (VMI) system to manage and monitor all the orders and inventories. This is important since its major customer adopts Just-In-Time (JIT) strategy and therefore all the orders and level of inventories need to be monitored closely to ensure smooth manufacturing operations within the supply chain.

6.3.3 The role of power

The relationship power perspective is examined by observing CsA's tendency to influence their supplier in their relationship within the supply chain. The executive vice president initially noted that the use of coercion to influence their partner is low. A plausible explanation is that although CsA considers itself as a technology driven company, it wanted to portray its image as a friendly partner in the supply chain. Nevertheless, he does not deny the possibility of exercising coercion in the relationship in order to protect his company's interests. In metaphorical note he added that:

> *'Power (coercive) is like sugar, take a bit and it will your make coffee taste better, but when you consume too much, then you will have a risk of getting diabetic'.*

CsA believes that the use of coercion will damage their relationship with both suppliers and customers in the long run. But there is a situation where the coercive power is useful in its relationship. He indicates that:

> *'We only use bit of coercive stimuli not to offend but to defend our stand, the quality of our product and our rights especially in negotiating new contracts with our suppliers. We exercise it (such power) because we believe that the consequences of such action will benefit both parties in the future'.*

Meanwhile from the observation, the non-mediated power base in the form of expert power also exists in its relationship with the suppliers. CsA believes that in order to produce a high quality product, it requires high standard materials from its suppliers. The executive vice president explains that:

> *'We can continuously innovate to improve our process, production and services through technology, but we cannot guarantee to maintain in producing of high quality product if we use low quality material. It is simple like garbage in garbage out philosophy. Therefore, we always persuade our suppliers to maintain high standards in supplying quality materials to us'.*

From these statements, the study concludes that power exists in a relationship as a result of owning technological capability. CsA confirms that both mediated (in the form of coercive power) and non-mediated powers exist side by side and both are an important source of control available for the firm to exercise. This case study also reflects firms may exercise different kinds of power to similar parties (in this case suppliers) in order to achieve different business objectives.

6.3.4 The role of trust

CsA maintain a web-based electronic resource planning (ERP) system with all of its regular suppliers and major customers. The adoption of this system was actually initiated by its major customer who is the largest national car manufacturing company in Malaysia. After realising the benefits of this system in terms of order efficiency and cost savings, CsA has extended this system to its regular supplier. The executive vice president explains that:

'We have provided training to our suppliers by sending our IT staffs to their facilities and from the feedback received; our suppliers have found our services as very supportive. This system has allowed us to share more information on purchase orders, production forecast and the current inventory level accurately'.

The benefits of technological capability are also revealed during the interview session. CsA perceive that the technology has contributed towards quick response in orders, high accuracy, and sharing of updated information which encourages the formation of trust in the relationship. He further added that:

'The rate of errors in orders have been reduce significantly, orders can be verified and handled almost immediately, the information on ETA (estimated time of arrival) of materials is supplied since the system provide a real time information on order tracking'.

These statements reveal that IT which part of firm's technological capability in a supply chain is able to reduce costs, increase accuracy, response time, and information sharing. It also shows that manufacturers are willing to share their knowledge and competency in technology because they know that these, in turn, will benefit them in the future. Therefore, it can be concluded that technology increases competency and that the perspective of trust can be derived from a partner's capability.

Meanwhile, CsA's relationship with its supplier is bound by inter-organisational trust. It has been told by its supplier that they are comfortable in venturing business with CsA rather than its competitors. The executive vice president reveals that:

> *'We strive to maintain long term relationship with the suppliers and we truly believe that trust is an important element that can bind this relationship. That is why we promote trust in our transaction because we believe that both parties need each other for survival. Our suppliers also inform us on how important we are in their business and they like doing business with us and would also like to maintain longer relationship'.*

From CsA point of view, it can be concluded that the relationship between CsA and its supplier is promoted through trust. The next subsection provides evidence on the relationship between technological capability, power and trust with inter-firm relationship performance.

6.3.5 Inter-firm relationship performance

The executive vice president was also interviewed in relation to the impact of technological capability on inter-firm relationship performance. Inter-firm relationship performance focuses on the possible benefits that can be derived when a manufacturer enters into a relationship with their suppliers. The literature has acknowledged that firms may reap benefits in terms of better business performance and possible future cooperation in new product development. The executive vice president explains:

‘As to our suppliers, we also maintain a good relationship with our major client. Almost half of our revenue is generated through business transaction with our major client. Due to immense competition in the automotive industry, our client has strived to be cost competitive and this vision is also being passed to us. Technology has helped us to be competent, innovative and cost cautious. Thanks to all the staff, especially the R&D team who keep on looking and improving the processes, we manage to handle this issue and make it efficient. Meanwhile, close collaborations in R&D with our suppliers have indirectly contributed to the increments in our revenue. We always persuade them to deliver high quality, defect-free materials and parts on time and at competitive prices. They are also invited in giving input especially in developing and designing stage of a new product. This is all happening in a high trust environment because we believe that they will not leak this information to our competitors. And in the end, I would say technology and close relationship based on trust ties have contributed towards improving our business performance and new product development.”

The above concluding statement from the executive vice president of CsA shows the interrelationship between technological capability, power (through persuasion), trust and inter-firm relationship performance. The next section continues by investigating association of these constructs within the perspective of another manufacturer (CsB).

6.4 Case study B

6.4.1 Background

Case study B (CsB) is the second largest local automotive manufacturer and was established in 1992. It focuses on the compact car segment with the spirit of helping the nation achieve industrialised nation status by the year 2020. Its factory is located in an industrial estate in West Malaysia with a built up area of sixty-four thousand squares metres. CsB produced its first car in 1994 and since then it has successfully produced nine different models in collaboration with its main engineering partner, Corporation X. Historically, there is no technology transfer or research and design (R&D) capability existing in its plant. Most of its models are reproduced using the existing models of its engineering partner.

Nevertheless, after Corporation X bought the company's controlling stake a decade ago, the technological transfer started to kick-in and CsB has been equipped with a state-of-the-art R&D facility which enabled it to produce cars from sketches, as well as upgraded its manufacturing capability to the fullest. CsB's most successful model, 'MyVi' which was introduced in 2005 has not only been the top selling model for five consecutive years in Malaysia, but also marked CsB's excellence in its R&D program. In 2003, dozens of CsB's R&D engineers' joint counterparts – Corporation X and Corporation Y engineers - participated in a collaborative engineering design to produce a new shared platform for a new model.

As a result, this collaboration has successfully created a new model for Corporation Y called 'Passo', and Corporation X with its model known as 'Boon', followed by CsB with its 'MyVi'. Ever since, the Myvi has been the cash cow for the company and, to date, CsB has sold nearly half a million of this model alone. In total, CsB has sold 1.8 million cars domestically since incorporation and exports to more than 7 countries worldwide. In the near future, it plans to invest in building the nation's first Electronic Automatic Transmission plant at a cost of RM250 million which will help to create more jobs and, importantly, spearhead technological transfer to the locals.

6.4.2 Technological capability

As described by its senior general manager, CsB is fully aware of the importance of technological capability, particularly in the automotive industry. The company has set aside substantial amounts of money on technological capability related activities which include upgrading its production capabilities, investment in R&D, and training and development as part of the continuous effort to provide cross-functional linkage within and outside of the organisation. The senior general manger explains that:

> *'After the controlling stake has been changing hand few years ago, the company has seen tremendous changes in its capability as well as expenditure in R&D activities. Our capability in this activity has increased and now we are actually capable of designing our own model from start to finish. The company has also increased the number of its engineers in this department and bringing in new R&D equipment to stimulate the R&D activities. Before this, it was quite limited as we only have a small unit that is responsible in this area'.*

Their capability in doing R&D is recognised by their sister companies, Corporation X and Corporation Y. This includes their capability of styling and modelling new cars, developing concept cars and conducting major facelifts for all models near maturity stage. The R&D division is actively involved in conducting research on localising the service parts of their cars, continuously testing the engines in their own engine test lab, and conducting test drives on their couple of kilometres long test track. As a result, CsB's R&D engineers have been constantly invited by their sister companies to collaborate in designing new cars.

Currently, CsB has approximately 10 different integrated production facilities (called shops): press shop, body shop, assembly shop, casting-machining-engine assembly shop, paint shop, training/quality audit centre, pre-delivery inspection, logistics, stockyard and parts warehousing. As part of the company's continuous improvement mission, CsB also constantly upgrades their manufacturing capabilities in order to produce quality cars for their customers. For example, the company has installed robotics arms in most of its production lines to increase productivity and reduce costly errors. It also adopts full e-procurement technology that directly links their material requisition planning (MRP) with their supplier via a web-based MRP system. This allows CsB to monitor its orders, as well as its level of inventories. CsB also plan to have a new plant that has a capacity to produce Malaysia's first Electronic Automatic Transmission fitted in its new vehicles. The senior general manager discloses that:

> '*Our sister company (*Corporation X*) has supported the idea of setting up a new plant that will produce a high-tech product called Electronic Automatic Transmission (E-AT). This product is nothing new in the automotive industry*

> *but we will be the first in Malaysia to produce it. I would like to stress that in the next couple of years, we will be ready to produce E-AT. Please take note that the production process of E-AT involves very sensitive controls and thus requires highly skill workers to attend it'.*

> He also added that: *'We have substantially invested in information technology related materials such as the latest software as well as bringing in the best brains available in the market not only for our R&D department but also to other crucial department and shops'.*

This statement can be translated into two different views: firstly, it reflects the company's continuous efforts to upgrade their manufacturing facility and, secondly, it shows that the company is also investing in staff training and development to ensure that they are capable of handling the machinery properly. CsB recognises the importance of investing in human capital as it has an impact on productivity and organisational performance. The senior general manager explains:

> '*We value our workforce in this organisation. Our staffs are our key assets and they are as important as our physical assets if not more. For your information, we are continuously investing in human capital development because we believe that collective knowledge, skills and abilities will have positive outcomes in terms of increment in productivity. For example, we send our engineers as well as administrative staff for in-house training periodically and some of them even have the opportunity to do an internship with our sister company (*Corporation X*) in Japan'.*

According to this manager, CsB may have all the machinery and equipment, but it is the staff that will provide the linkage to realise the mission and objectives of the company.

6.4.3 The role of power

On the notion of power in a relationship with its suppliers as a result of its technological capability, the senior general manager responds that:

> *'Of course it will give us some power in the relationship but rather, I would prefer to look it in a positive manner. We might have the power to instruct our suppliers at least to listen and take action on our suggestion particularly when it comes to the issue of quality of a material being requested. We want them to know that they need us as much as we rely on them, but that is not the practice in here. We do not want our suppliers feel like [they are] being oppressed or threatened by our technical superiority'.*

This statement shows that CsB has gained mediated power out of this capability. Nevertheless, exercising it is another issue. The company believes in 'prosper thy neighbour' policy in maintaining relationships with their suppliers by supporting their business without using force for mutual benefit. He further added that:

> *'The power we gained from having this capability is more on knowledge and expertise, and we would be keen on sharing them with our suppliers. Therefore, we always lend our expertise to our suppliers especially when*

they are having difficulties in fulfilling our request to manufacture new components. This is actually a win-win situation for both parties; where they can learn new things from us and we are there to monitor our interest in producing components that are up to our standard'.

From these two statements, it can be concluded that there are two types of relationship power existing due to superiority in technological capability. CsB has also been continuously providing this support especially to the local suppliers under the auspices of the in-house vendor development program. Most of these suppliers are small-medium enterprises with very limited technological resources. It is believed that their suppliers are voluntarily accepting CsB's offer to extend their support by stationing their expertise since it is worth it to do business with CsB and therefore there are no issues on the use of mediated power in accepting it.

6.4.4 The role of trust

CsB relies on hundreds of suppliers providing most of the materials and components for their production. It only maintains small number of inventories at the plant as the company is applying a full Just-In-Time (JIT) delivering technique. Therefore, it is necessary to ensure that all the suppliers are able to send the requested materials promptly. He explains that:

'Technology such as e-procurement or web-based MRP system is essential to help us manage and monitor the order and level of inventories systematically. Nevertheless, we also keep some stock on those materials and

are ready for any unforeseen circumstances. Orders of component are usually subject to the purchase agreement that have been agreed upon and we trust that they will adhere to in fulfilling the contract'.

He claims that most of the suppliers are seasoned suppliers who have been with the company for a while, therefore, the relationship between them is built on goodwill and trust. He further clarifies that:

'We have trust in our supplier, they have been very cooperative and committed. We have no problems with the orders and the shipments are on-time. Glitches in receiving the pre-ordered materials did happen but most of them are from new suppliers and the numbers are not very alarming. Furthermore, they always keep us inform in advance if they can't fulfil our request so that we have ample time to switch to another vendor'.

Both of the statements above show evidences that CsB's relationship with its suppliers is bounded by contractual and goodwill trust. CsB relies on its suppliers' accountability for fulfilment of orders; while on the other hand, suppliers are responsible for supplying the required materials as per purchase agreement. The senior general manager also added that their suppliers highly recognise CsB's competency in technology and efficiency in manufacturing processes and, therefore, they ensure that any material supplied must meet the specification and strict quality requirement, must arrived at the stipulated time and in accordance with the exact quantity ordered.

6.4.5 Inter-firm relationship performance

This final sub-section is related to the impact of technological capability on inter-firm relationship performance. The senior general manager insists that CsB is making the right decision by continuously upgrading its technological capability and maintaining healthy relationships with its suppliers. He discloses that:

> *'Technology is surely one of our core competencies because it helps us to be more efficient while reducing wastage. Our capability in technology has allowed us to produce up to 240,000 cars per annum. Nevertheless, relentless effort by our suppliers in producing high quality, cost effective components has also helped us in keeping the manufacturing cost at bay. These are very important aspects especially if we want to stay competitive in the market'.*

He insists that the tremendous growth of CsB is partly backboned by technological capability and relationship performance aspects. He further reveals that:

> *'Producing cars are tough business, but producing quality cars with reasonable price tag that can be accepted by the market are even harder. But the combination of technology and suppliers effort has made it possible for our workforce to manufacture high quality cars with reasonable price'.*

As a result of this, CsB has outperformed the market by dominating almost 30 per cent of the total industry volume and most of its cars have won and retained several awards such as *Best Model of the Year*, *Value-for-Money Car of the Year* and *Asian*

Auto Fuel Efficiency Awards. When asked on other benefits on retaining successful relationships with their suppliers, the senior general manager asserts that:

> *'There is no doubt in our R&D capability but we believe in strong teamwork spirit. Technology has brought us closer with the suppliers. They are very important to us because apart from supplying the materials, we also need their ideas, recommendations and advices particularly during new product development procedures to ensure that we get a favourable result and later share the cake with them'.*

Therefore, this statement has provided support on the impact of technological capability on inter-firm relationship performance and the involvement of their suppliers in new product development activity and offer proof of inter-firm relationship performance.

6.5 Case study C

6.5.1 Background

CsC was established in 1974 as a publicly listed company in Bursa Malaysia which engages in manufacturing high quality boxes. The company produces various types of boxes which include corrugated carton boxes, die-cut trays, wrap-around cartons, point of purchase, and paper palette for packaging industrial use. Currently, CsC is the major manufacturer for corrugated carton boxes and die-cuts trays in Malaysia and accounts for 15 percent of the total market share. These products are the main contributors to its revenue and they are distributed to both local and international markets. Meanwhile, CsC has positioned itself in a niche target market of the food and beverage industry. Their major customers include Nestle, Unilever and Guinness Anchor and these customers' account for up to 75 percent of its total turnover. Their major competitors in the market are Propak, Maypak, Sime Rengo and Guolene Paper Products. Meanwhile, CsC receives its supply of raw material in terms of paper reels from its upstream supply chain which consists of several paper mill factories such as Muda Paper Mills and Sabah Forestry Industries. As part of their expansion program, CsC has invested in upgrading its manufacturing facility to increase its production capacity. It has also set up a carton plant in China jointly with its local counterpart in order to tap into the booming market on the mainland. An interview was conducted with the senior manager (operations) and below is some of the outcomes of the transcript recorded in the interview session.

6.5.2 Technological capability

Since incorporation, the company has upgraded its machinery from used corrugated machines that could only managed to produce single wall cartons to highly sophisticated, fully computerised corrugated machines. The machines, costing almost RM30 millions, are imported from Japan and the USA. The combination of new technology and these new machines has made CsC among the most modern carton plant in the Asia Pacific region. Apart from this, the senior manager explains that:

> '*We strive to be the market leader in this industry by producing high quality packaging solutions. That is why we keep on investing in capital expenditure*

> *by acquiring and updating the physical equipment. In fact, [in the] last three years we have installed four units of Flexo Printing In-Line and a Die-Cut Printing machines to our lines and followed by installation of a fully automated PLC Control Sheetboard Conveyor System early this year. These equipments have made this company among a sophisticated corrugated plant in Malaysia'.*

CsC reported that its production capacity has a maximum output of 45,000 metric tons per annum since it started its operations some decades ago. Running on two shifts, the current production output is about 28,000 with total manpower of 250. The senior manager divulges that:

> *'I think we nearly reach our optimum level of production. Although it seems like our facility is underutilised but given the current market conditions we are quite comfortable with this figure'.*

Nevertheless, the company is short of R&D activity. The senior manager reveals they still cannot afford to set-up their own research and development team due to cost constraints. Most of its process improvement is done through brainstorming activity with its entire staff during the company's annual retreat session. However, the company has yet to abandon the idea of setting up its own R&D division in the near future. The senior manager explains that:

> *'We have to agree that R&D is crucial in today's business because of its closer link to innovation and hope that one day we can realise it. But setting up the team is not cheap; and I would say it is actually an opportunity cost to*

> *us on whether to choose on upgrading our production line or investing on R&D team since we cannot afford to have both'.*

Although CsC is financially constrained in its budget for R&D purposes, it does not affect the company's commitment in human capital investment. The senior manager agrees that the company's workforce is important and acknowledges it as one of its strategic resources. He discloses that:

> *'Improving technical skills, knowledge and safety awareness are our main objectives in providing training to staff. We identify these as the core criterions necessary to improve our business capacity. We admit that there are lots of things need to be done since the business is still struggling to integrate its technology with its strategic intent. That is why we stress on the importance of training the workforce so that we can bridge this gap by providing the linkage'.*

From these statements this study concludes that technological capability exists in CsC. The company is aware of the importance of upgrading its production capability, albeit without the support of extensive R&D activities. Its continuous investment in both machinery and human capital reflects its consciousness on the importance of these elements in building its firm's level of technological capability. The final statement from the senior manager also reveals why linkage capability is needed in measuring technological capability since it provides integration of knowledge, especially in technology, to the whole system within the organisation.

6.5.3 The role of power

The senior manager, in the interview session, disagreed that technological capability of CsC creates coercive power in its relationship with its suppliers. Nevertheless, he agrees that possessing technical skills might contribute towards non-mediated power in its supply chain relationship. He explains that:

> *"No, we don't believe that our suppliers [are] being threatened by our technical skills. This is based on the feedback we received from them. We also never interfere in their decision making process. They (the suppliers) acknowledge our competency in technology but rather look at it in a positive manner. They are comfortable dealing with us but sometimes they seek our advice on how to improve the supply chain in terms of improving material quality and delivery time'.*

This statement demonstrates that CsC has disqualified the existence of a mediated power base as a result of having technological capability in a relationship. Nevertheless, the statement also reflects a certain level of dependency on its suppliers and this study concludes the existence of a non-mediated power base in CsC when the suppliers require expert advice from the company.

In the interview session, the senior manager was also questioned on the probable impact of power on inter-firm relationship performance. He provides information that non-mediated power generated from CsC's technological capability is crucial in maintaining business relationships with its suppliers. As required by most of its regular suppliers from time to time, CsC always uses its expertise by providing useful input, especially in the material quality aspect; and this has spurred close collaboration between both parties. The commendable earning growth recorded by CsC is evidence of the relationship performance despite stiff competition in the market. As remarked in the interview, the senior manager concludes that:

> *'Increase in our earning is part of the whole value chain efforts. We receive fewer complaints on our product quality and the product return rate [is] at its minimal. This has increased customer confidence on our product and thus reflects it in our earnings growth'.*

6.5.4 The role of trust

As mentioned in the previous sub-section, CsC has provided technical inputs as and when required by its suppliers. These inputs include information sharing and technical support in relation to material quality improvement. It is perceived that these reflect the confidence of the suppliers in its technical competency. The senior manager supports this perception by noting:

> *'We are fully aware of our suppliers' perception on our competency. Our willingness to share vital information with them is also being perceived as relationship sincerity. We are glad that they found our advice is useful to their business. And we are not surprised that this has resulted in closer relationship with them'.*

The above statement confirms that CsC's technological capability has impacted its suppliers trust. In this sense, CsC technical competency has been accepted by its suppliers and this has created trust in the relationship. This statement also reflects the technological perspective of trust has resulted in closer inter-firm relationships. Other evidence on the existence of trust in the relationship is reflected through the next statement made by the senior manager:

> *'We don't have any e-procurement system practice in this supply chain. This simply means that we have to manually monitor the purchasing orders made to the suppliers. Nevertheless, we are comfortable with this practice and never faced any shortage in raw materials. As we have good reputation and commitment, our suppliers have given their assurance in supplying any grades and quality of materials requested on time'.*

From these two statements, this study concludes the existence of trust in CsC relationship with its suppliers. First, it shows how technological competency of CsC has been accepted by its suppliers and creates trust in the relationship. Second, its goodwill and commitment in a relationship has led to assurance from its suppliers and this has resulted in uninterrupted supply of materials to the company.

6.5.5 Inter-firm relationship performance

The interview with the senior manager of CsC so far reveals its technological capability, and the association between it with power, trust and the inter-firm relationship. In this sub-section, the impact of technological capability, power and trust on inter-firm relationship performance is observed. The senior manager responds that:

> *'The main reason on why we upgrade our manufacturing plant and technical staff expertise is to increase our production capacity and efficiency in order to meet the market demand. However, we later found that these capabilities not only bring in revenues but have also impacted our relationship with suppliers in a good way'.*

This statement is consistent with the findings from the previous sub-sections that suggest the CsC's technological capability creates non-mediated power and trust in the relationship with its suppliers. The combination of these two has affected positively towards CsC's bottom line. As disclose by the senior manager:

> *'The increase in revenue is partly due to the effectiveness of word-of-mouth marketing strategy when satisfied customer tells other prospect how they like and adhere CsC products. Our end products are found to be higher in quality and the prices are competitive in the market. This can only be achieved through the combination of our suppliers' raw materials and relentless effort from the manufacturing team'.*

Overall, CsC confirms that technological capability has impacted on power, trust and inter-firm relationship performance. The company's technical competency has evidenced the creation of non-coercion power and competency trust. The interview also reveals that these constructs are associated with the inter-firm relationship and further improve the company's business performance.

6.6 Case study D

6.6.1 Background

Case study D (CsD) is a wholly owned subsidiary company of one of the public listed conglomerates in Bursa Malaysia. Since 1997, CsD has been in the semi-conductor manufacturing business, with a vision to be a world class player in its field. CsD offers the widest spectrum of semiconductor products compared to its competitors. Its products consist of a range of various leaded packages high technological chips which include Dual Flat-pack No-Lead (DFN), Plastic Dual In-Line Package (PDIP), Plastic Leaded Chip Carrier (PLCC), Small Outline Integrated Circuit (SOIC), Quad Flat-pack No-Lead (QFN), Think Shrink Small Outline Package (TSSOP) and Smart Card Module chips. Besides producing high technology chips to the market, CsD is also a world class turnkey semiconductor contractor for packaging (chips) design, assembly, test and distribution. Four months after its incorporation, production kicked off with the first order received from its major customer, AMTEL Corporation.

The materials for its products are procured mostly from international suppliers that include Sumitimo Electric’s Compound Semiconductor, Dow Corning Silicones, Tanaka Precious Metal, Ablestik-Henkel and Markem-imaje. The customer portfolio expands as the company grows, with International Rectifier National Semiconductor, EM Microelectronics and AMTEL-Rousset among its major customers. Meanwhile, its major competitors in the local market include Globetronics, Unisem, Carsem and Dominant Semiconductors. The company places emphasis on maintaining high quality standard and excellence. In line with its stringent quality assurance policy, it has been certified with the ISO9002:1994 and QS9000 by Lloyd's Register Quality Assurance. These certifications have made CsD a Quality Endorsed Company in terms of assembly and test of semiconductor integrated circuit devices. The interview was conducted with the company's Chief Operating Officer and the next sub-sections reveal the findings of the interview session.

6.6.2 Technological capability

As a manufacturer of high technology devices, CsD always ensures that the company is at the forefront of technology. The company has invested vast amounts of money to improve their process technology and manufacturing system. Its production facilities can be divided into two categories: clean rooms, and production support and operations. In the clean rooms facility, CsD has two types of lines: Class 10k Frontline Assembly and Class 100k Backend Assembly. Production support consists of a calibration laboratory, cold storage, tool and die machine shop, tester platform, and reliability and failure analysis platform. These high technology facilities require constant attention and upgrading. The Chief Operating Officer explains:

> *'Our major clients are all high in profiles and leaders in world technology development. Therefore, we need to keep up the pace by being the front runners in technology. We have constantly invested in the latest state-of-the-art technological equipment both in assembly and tester facilities. To ensure that our production capability is up to date, we have setup a special task force known as Packaging Development and Engineering which is a subset to the R&D in functionality to oversee the current production processes and*

assessing our manufacturing technology. In other words, they are responsible to foresee future assembly techniques and the latest technological development in the market before making suggestions and action plans to the management on the possibility of improving the production process and the manufacturing technologies'.

The above statement reflects CsD commitment to maintaining technological capability advantages. The statement reveals the evidence on investment capability of CsD which is part of the technological domain. As CsD is a subsidiary company, all the funding for investment purposes is pumped through its parent company. The chief operating officer explains that CsD has been the jewel in the whole corporation since almost 60 per cent of the parent company revenue is generated by CsD. Therefore, the parent company has allocated a substantial portion of funding to CsD in order to maintain its technology capability.

In terms of production capability, CsD products are prepared based on orders received from their major clients. The company works on a two-shift system and it has just celebrated its 10 million productions of QFN and 1 million of copper wire product. Management is planning to increase the production capacity by an additional 30 percent due to the introduction of a new product known as Radio Frequency Identification (RFID) chip.

Meanwhile, CsD is committed to providing training for its staff. Since technology has a short life cycle, new knowledge integrated chip manufacturing helps the company to stay ahead of its competitors. Training also promotes linkages between departments in the organisation. As mention by the Chief Operating Officer:

> *'We have a pool of integrated circuits technology experts at our disposal and we have picked the best brains available in the market. But it does not mean that we can skip staff training and development. The life cycle of semiconductor product is relatively short. Therefore continuous training programs are important in order to stay alert on what is the in-thing happening in the market. Meanwhile, training also helps staff to understand more on the company's operations, help to increase their mobility and enhance intra-organisation communication'.*

From the above statements it is concluded that technological capability exists in CsD. Evidence from the interview session reveals that CsD has outstanding technological capability. The next sub-section reveals the findings from the interview on the role of power in a relationship as a result of possessing distinctive technology.

6.6.3 The role of power

In this sub-section, the existence of power in a relationship between CsD and its major supplier due to the impact of CsD's technological capability is investigated. Although CsD is a high tech company with a substantial level of technological capability, the chief operating officer reveals that CsD does not enjoy such privilege in its relationship with its suppliers. He explains:

> *'We receive our supply of materials mostly from international suppliers located in Japan, and the US. And they are also supplying the same materials*

> *to other chip manufacturers from all over the world. In this industry, technology is common, but the raw materials such as silicon, gold or copper are rare in nature. These commodities have been sought for other purposes and not only used within this industry. So our relationships with the suppliers are purely based on what has been stated in the procurement contracts. I don't think that we have relationship power to direct our suppliers. And I believe none of the player in this industry can'.*

Interestingly, the above statement shows that neither CsD nor other chip manufacturers in this industry has a mediated or non-mediated power base in their relationships with their suppliers. This means that CsD cannot direct the suppliers either through coercive force or persuasion to gain benefit from the relationship. The evidence indicates that in the electronics industry, technology is a must and all industrial players possess nearly the same level of capability and thus cannot be considered unique in nature. The party who control the scarce resources in this industry is the supplier and therefore, relationship power might possibly reside at the supplier's side rather than the manufacturer itself. The next sub-section continues with the findings on the role of trust between CsD and its suppliers.

6.6.4 The role of trust

As mentioned earlier, the relationship between CsD and its suppliers is purely based on contracts agreed by both parties. This indicates the existence of contractual trust in the relationship. The chief operational officer elaborates that CsD maintains a close relationship with its supplier. This is to ensure that the supply of materials to the company is uninterrupted. He also added that:

> *'Eventually the quality of product spoke for itself. It brings together the brand and image of this company. If the quality is good, then it would give us good image in front of the customer. Not only will it reflect on us, other parties, for example, our suppliers, may also enjoy the goodwill of our products since their brand name are mentioned under the bill of material (BOM) specifications. Therefore, the element of trust is important in this relationship because the outcome has an impact on both sides'.*

The above statement shows that both supplier and CsD realise the importance of goodwill and trust in their relationship. Each product carries not only CsD's brand image, but also their supplier's. This means that CsD's product may increase or decrease the image of CsD as well as its supplier. Thus, the suppliers have to place high trust in CsD's technological capability in producing the chips with the perception that it is capable of producing high quality products.

6.6.5 Inter-firm relationship performance

The evidence from the interview with the chief operating officer established the technological capability of CsD, the non-existence of relationship power between CsD and its suppliers, and high suppliers' trust in the relationship. In relation to the impact on relationship performance, the chief operating officer reveals that:

'At the end of the day, the most important thing in doing business is profitability. We can have all the policy on investment and superior technological knowledge but if these cannot be translated into dollars and cents then the whole things is useless. Internally, our R&D team has made a tremendous job in improving our manufacturing processes by keeping the cost to the minimum. However, external factors such as the fluctuations on the commodity prices, especially gold, have lead into volatility in production cost. Luckily our suppliers are flexible in adhering to the existing contracts and our long term commitment with them have made it easier for us in negotiating the existing and new contracts in terms of quality, quantity, fair pricing and delivery time. These combinations have made our products competitive in terms of pricing and quality, and thus lead into better business performance."

The above statement shows that the blend of technological capability and close relationship has increased CsD's business performance. The statement is also consistent with the previous sub-section and confirms the element of contractual trust that exists in the relationship. Meanwhile, the chief operating officer elaborated that CsD has invited all the suppliers into the process of developing a new product. Their input and commitment is required in order to improve the new product before being passed for mass production. He explains:

'We always involve our suppliers in developing new products. We welcomed their valuable comments and inputs and often found them very constructive. They believe in the technology we had and the success of introducing the final product to the market actually reflects the paramount achievement of

> *this collaboration. For example our suppliers advised us to switch from the usage of gold to copper wire due to the ever increasing gold price. As a result, most of our new products are now copper wire-based and we received positive feedback from our clients on the chips performances. Due to the conversion, our profit margin has increased significantly while the risk of escalating gold price has been reduced'.*

From the above statement it is concluded that CsD involves suppliers in its product development process. This collaboration shows that both CsD and its suppliers benefit from the relationship and thus there is evidence of the existence of inter-firm relationship performance. The next section continues with the interview findings from the final case study.

6.7 Case study E

6.7.1 Background

Case study E (CsE) is one of the major players in the pharmaceutical industry in Malaysia. Incorporated in 1980 and registered with Health Ministry's Drug Control Authority, it engages in manufacturing generic pharmaceutical products. Historically, it began its operations as a contract manufacturer supplying generic products to the Ministry of Health in Malaysia. As the business grew, CsE expanded its horizons by venturing into over-the-counter products and prescribed products. Currently, CsE has a wide range of products that includes antibiotics, cough syrups, diabetic medication, health supplements and more. These products are manufactured in the form of tablets, creams, capsules and syrups. CsE's production facilities need to comply with strict local and international goods manufacturing practice (GMP) guidelines in manufacturing these products. This is a standard requirement outlined by the World Health Organisation (WHO) to safeguard the health of users, as well as to ensure the quality of the final products. CsE has been accredited with ISO9001, ISO14001, ISO9001:2000 and OHSAS18001 certifications in recognition of its sound quality management.

Its main customers include government hospitals under the management of Ministry of Heath, private hospitals, private clinics and pharmacy stores. For the time being, CsE controls over 30 percent of Malaysia's pharmaceutical market share and it enjoys 15 years of concession agreement with Malaysia's Ministry of Health. Their major competitors in the market are local players that include CCM Pharmaceuticals Sdn Bhd, Kotra Pharma Sdn Bhd, Duopahrma Sdn Bhd, and Hovid Bhd. CsE has at least 10 major suppliers locally and internationally but, due to business policy, the interviewee requested non-disclosure of the list of its suppliers in this dissertation. The interview was conducted with its senior manager at CsE's premises.

6.7.2 Technological capability

CsE is equipped with state-of-the-art manufacturing facilities at its plant. All the manufacturing facilities in this plant comply with the GMP guidelines, as well as the stringent requirement outlined by the International Pharmaceutical Inspection Cooperation Scheme (PIC/S). Over the years, the company has constantly upgraded its manufacturing facility to enhance production capacity to meet the sudden surge in demand for generic pharmaceutical products. The company has invested more than

RM10 million in the last few years to upgrade existing machinery and install additional machinery to increase its manufacturing capacities. The senior manager elaborates that:

> *‘To cope with the increasing demand of our products, we have upgraded and installed new machineries at our existing production facilities. For example, we have installed additional tablet coating, counting and filling machines in our plant, as well as reconstructing our penicillin plant to increase its capacity. As part of our 5 year expansion plan, we have built a new plant and acquired US based manufacturing technology that cost RM4 millions to produce sterile cephalosporin antibiotics and the plant is fully operational after recently receiving approval from the National Pharmaceutical Control Bureau’.*

It can be ascertained from the above statement that CsE has continuously invested in cutting edge technology to upgrade its production capability. This reflects the investment capability of CsE in attaining manufacturing technology. As a result of this, CsE’s manufacturing capacity has increased nearly 20 percent and, as advised by the senior manager, currently CsE manages to produce approximately 60 different products from three plants located all over the country. Currently, CsE is annually producing approximately 400 million coated tablets, 60 million tablets, 50 million capsules and almost a million packs of powders.

In the meantime, CsE is also heavily involved in R&D activities. The company has allocated 10 percent of its annual pre-tax income for R&D purposes. As quoted by the senior manager, R&D is the backbone of innovation in the company. The company is highly capital intensive and spends nearly RM4 million a year for R&D purposes. The senior manager asserts that:

> *‘We depend heavily on R&D to increase our product portfolio, speed up the product development and produce it in a cost effective manner without sacrificing its quality. In addition, R&D also helps us to be able to introduce new products faster than our competitors’.*

Meanwhile, CsE is part of the integrated supply chain system that connects its suppliers, warehouses and customers (hospitals). The system called Pharma*Net increases the efficiency of the supply chain by providing real time inventory data, order processing, warehousing and logistics information. The senior manager explains that:

> *‘“We have spent a great deal of money in developing information technology to strengthen the supply chain. We took the initiative to integrate everybody in the entire supply chain in order to provide uniformity and to reduce hiccups in orders. We have experts in this field often provide training to the B2B members in the supply chain in order to increase its efficiency’.*

The statement above shows that CsE has linkage capability by integrating all the members within the supply chain. In conclusion, the interview collectively provided evidence on the existence of technological capability in CsE by satisfying all the three dimensions as acknowledged in the literature. The next section describes the role of power in CsE’s relationship with its suppliers as a result of possessing a high level of technological capability.

6.7.3 The role of power

In this sub-section the relationship between technological capability and relationship power is investigated. The findings from the interview conducted with the senior manager of CsE reveals that mediated power base does not exist in the relationship with its suppliers. He clarifies this with the following statement:

> *'It's very true that the technology we have might influence our relationship with the suppliers. For example, we never push the suppliers to invest extra cash in installing Pharma*Net infrastructure and we never had such power too. In fact, they approach us to be part of this system after realising the benefits of having strong supply chain via integrated information sharing. We welcome them with open hearts and provide the supports needed especially in the earlier stage of installation'.*

The above statement by the senior manager can be viewed from two different perspectives. First, it shows that CsE has no possession of a mediated power base in its relationship with suppliers, even though the company has technological capability as its distinctive competency. A plausible explanation on the non-occurrence of mediated power is that there is intensive competition between pharmaceutical manufacturers to secure their raw materials at a competitive price. Therefore, manufacturers refrain from exerting unnecessary pressure on their suppliers in order to enjoy an uninterrupted supply of materials.

Second, it shows that the suppliers depend on the technical knowledge and skills of CsE and this reflects the occurrence of expert power and referent power in the relationship. Apart from the procurement system that reflects the referent power of CsE, the senior manager also confirms that its suppliers often work closely with CsE's R&D personnel to ensure that quality of the supplied chemical materials are always at par and meet safety regulations set by the authorities. Therefore, it is concluded that CsE's technological capability creates non-mediated rather than mediated power in the relationship with its suppliers. The next sub-section provides findings on the role of trust in CsE's relationship with its suppliers.

6.7.4 The role of trust

This section reports the findings on the interrelationship between technological capability and trust in CsE. The interview with the senior manager reveals that technical support provided by CsE has been seen as the company's commitment towards maintaining the relationship. Further, it also reflects superiority of CsE's technological competency in the eye of the suppliers. He elaborates that:

> *'We strive to make this supply chain efficient and that is why we introduced the use of information technology to provide integration among the parties in the chain. The feedback we received from the suppliers is very encouraging. The technology has enabled us to react quickly and thus increase the supply chain efficiency'.*

Information technology through the use of Pharma*Net has mainly provided procurement and inventory management solutions to members of the chain. This system provides real time information sharing and thus encourages the formation of trust in a relationship.

As mentioned in the previous subsection, CsE's R&D experts have often been invited to provide technical advice on how to increase the quality of materials by suppliers, especially during the new product development process. As explained by the senior manager:

> *'The suppliers are fully aware on the stiff competition in the generic pharmaceutical products. Therefore, they want to help us in producing quality medicine or food supplements by supplying high quality raw materials'.*

The close cooperation between CsE and its suppliers shows the existence of trust in the relationship. The above statement reflects that suppliers also want to play their part in helping CsE to produce high quality products. This concept is equivalent to benevolence trust whereby the suppliers are willing to give more than what has been stipulated in the procurement contract and, therefore, it can be concluded that contractual trust, as well as benevolence trust, are co-exist in the relationship between CsE and its suppliers.

Briefly, these statements show that technological capability leads to a closer interrelationship between CsE and its suppliers. The findings also reveal three types of trust exist in CsE's relationship with its suppliers as a result of having technological capability: competency trust, contractual trust, and benevolence trust.

The next sub-section provides the findings on how CsE's technological capability affects inter-firm relationship performance.

6.7.5 Inter-firm relationship performance

This sub-section provides the findings on the impact of CsE's technological capability on inter-firm relationship performance. The interview with the senior manager from CsE to this point identified the technological capability of CsE, and the elements of power and trust that exist in the relationship. In this sub-section the senior manager was asked about the possible impact of technological capability on inter-firm relationship performance. He explains that:

> *'Expanding our manufacturing capacity via installation of new technology is important because it allows us to capture the growth in the pharmaceutical market. Being big permits greater economics of scales and thus leads to more competitive in pricing and better business performance. Meanwhile, installation of appropriate technology such as Pharma*Net has also bring [brought] close cooperation with both suppliers and customers. They put high trust in this relationship because they know that we are sincere in sharing the related information within the supply chain, and technical advice that we provide as requested by them from time to time. As far as I am concerned, the technology has made the supply chain more efficient in the long run and we believe that the benefits can now be realised by all of us in terms of higher in profitability'.*

In a nutshell, the above statement confirms that the combination of technological capability, non-mediated power, and trust has led to a closer relationship between CsE and its suppliers. The statement is consistent with the findings from the previous sub-sections that reveal the connection between technological capabilities with non-mediated power when CsE is often requested by suppliers to provide technical advice in order to improve the quality of materials. Meanwhile, the association between technological capabilities with trust is also emphasised in this statement, whereby the relationship between CsE and its suppliers is governed by trust and, as highlighted in the previous sub-section, there are actually three types of trust that exist in the relationship: contractual, competency and benevolence.

Finally, the senior manager agrees that technological capability, together with the elements of power and trust, has resulted in a closer relationship between CsE and its suppliers and thus led to enhanced inter-firm relationship performance, and higher business performance. As mentioned in the previous sub-section, CsE also closely collaborates with its suppliers during any new product development process. This is provides further evidence of inter-firm relationship performance benefits by CsE as a result of maintaining a good relationship with its suppliers. Therefore, from these findings, it can be concluded that both CsE and its suppliers benefit from the close relationship and thus improves inter-firm relationship performance. The next section provides a cross-case analysis of the findings.

6.8 Cross case analysis

Having analysed all the five individual case studies to identify the impact of technological capability on power, trust and inter-firm relationship performance; the next step is to identify the area of convergence and divergence, as well as to identify any emerging issues. This section provides a cross case analysis of the findings of the case studies and relates them to the study's research questions outlined in Chapter 1.

6.8.1 Technological capability

Based on the findings from all case studies, this research suggest that technological capability is represented by three different dimensions, namely, investment capability, production capability and linkage capability. Table 6.2 presents the locus of technological capability based on the findings from this phase.

From the interviews, all five case studies perceived that technological capability is represented by three individual dimensions, namely, investment capability, production capability and linkage capability. During the analysis of all the cases, it is clear that these three dimensions are interrelated and thus provide strong evidence of their representation in measuring the technological capability construct. This finding is consistent with the technological capability literature that suggest the multidimensionality of this construct (Coombs & Bierly 2006; Lall 1992; Ratnasingam 2005; Tsai 2004).

Table 6.2: Summary on technological capability's construct

Firms	Industry	Technological capability dimensions	R&D facility	Reasons for technological capability
CsA	Automotive	• Investment capability • Production capability • Linkage capability	• Yes	• Increase production capacity • To stay competitive in the market • To cope with customer expectation • Improve processes, products and services via innovation activities • Upgrading staff technical knowledge and skills • To integrate resources within and outside organisation
CsB	Automotive	• Investment capability • Production capability • Linkage capability	• Yes	• Stimulating R&D activity • Improving capability in modelling new cars • To integrate production facilities • Maintaining quality of the products • Increase firm's productivity via training and development • To reduce costly errors • To attract the best brains in the market in joining them
CsC	Packaging	• Investment capability • Production capability • Linkage capability	• No	• Diversifying their product offerings • To produce high quality products • Increase firm's production capacity • Improving technical skills, knowledge and increase safety awareness

				• Integrating technology with strategic intent via training and development
CsD	Electronics	• Investment capability • Production capability • Linkage capability	• Yes	• Improving processes technology and manufacturing system • To keep in pace with the front runners in the industry • To increase production capacity • Promoting linkages between department in the organisation • Attracting experts to join the company's workforce • Enhancing staff mobility and communication via training and development
CsE	Pharmaceutical	• Investment capability • Production capability • Linkage capability	• Yes	• To enhance production capacity • Creating new line of product • Nurturing innovative culture through extensive R&D activities • Speed up new product development • Maintain product quality and achieving cost effective production • Increase supply chain efficiency by promoting suppliers' integration via information technology

Meanwhile, all case studies firms were questioned on their R&D activities as these are closely related to technological capability and mentioned in a numbers of previous studies (Corsten & Felde 2005; Hsieh & Tsai 2007; Wang et al. 2006). During the interviews, four case studies (CsA, CsB, CsD, and CsE) revealed that they have the R&D facilities within their organisations and have invested some percentage from their revenue to promote R&D activities. These case studies organisations agree that R&D can improve their processes, products or services, as well as nurture an innovative culture within their organisations. CsE believes that technological capability through R&D can speed up their new product development and thus create new line of products. Only one case study (CsC) reported that it has no R&D facility due to financial constraints. Nevertheless, CsC agrees in relation to the advantage of having such facility and has included it as part of their future strategic intent.

During the interview sessions, the case studies organisations were queried on their reasons for having technological capability. Typically, manufacturers concentrate on upgrading their production capacity in order to meet the increasing demand. The strongest reference to this aspect comes from four manufacturers (CsA, CsC, CsD and CsE) as they are contract manufacturers cum distributors of their own products, rather than being involved solely in manufacturing tasks as displayed by manufacturer CsB.

Technological capability is also found to provide linkages between departments in the organisation, as well as to other parties such as suppliers outside the organisation. All five case study organisations agree that technological capability can provide horizontal and vertical integration in the supply chain. They believe that technology may increase the efficiency of the supply chain and promote close collaboration between suppliers and manufacturers.

Another important observation from the interviews lies in the perception of the manufacturers as to how technological capability affects the quality of products. Three case studies (CsB, CsC and CsE) provide evidence that technological capability assists them to maintain product quality; while CsB and CsE believe that it may also help them to achieve cost effective production by reducing errors in the manufacturing process.

The findings also reveal that technological capability promotes human capital development within the organisation. CsA, CsC, and CsD believe that technical skills and knowledge is as important as the physical equipment since it will help them in applying the knowledge to operate high technology equipment and increase their mobility in the organisation.

Other interesting findings observed in this sub-section is that manufacturers invest in technological capability to attract experts in their field to join their workforce. This situation can be seen within CsB and CsD. The plausible explanation behind this occurrence is that both companies are involved in high-tech industries (car manufacturing and semi-conductors assembler) whereby technical skills and knowledge is a must in order to cope with the working environment.

Technological capability is seen by these companies as a point of attraction to lure the best brains available in the market to strengthen the firms' workforce. Although they have their own training and development program, employing new talent brings in fresh ideas to the companies and thus maintains their pace in the innovation process. The next section provides a cross-case analysis of the role of power as a result of a manufacturer's technological capability.

6.8.2 The role of power

This sub-section provides a cross-case analysis of the emergence of power in the relationship between the manufacturer and its suppliers as a result of having technological capability. Table 6.3 summarises the findings from all five case studies based on the role of power that exists in the relationship.

As observed from Table 6.3, all case studies organisations except CsD agree that power exists in the relationship as a result of technological capability possession. Based on the interviews, it is found that two types of power emerged as a result of having technological capability: mediated power base and non-mediated power base.

The strongest references on this finding came from two case studies organisations in the automotive manufacturing category, namely, CsA and CsB. This finding is actually consistent with previous studies which found a power base existed in the relationship between manufacturers and their suppliers as a result of technological capability owned by one party (Ke et al. 2009; Ratnasingam 2000; Ryssel, Ritter & Gemunden 2004).

Interestingly, some case study organisations report only one power base that emerged in their relationship with suppliers. CsC and CsE reveal the existence of non-mediated power base in the relationship and thus counter earlier findings that suggest the existence of both power bases in the relationship. This finding confirms the theoretical debate by many researchers on the type of power base that may exist resulting from technological possession (Benton & Maloni 2005; Maloni & Benton 2000; Zhao et al. 2008).

Meanwhile, CsA has been using both mediated (especially coercive type) and non-mediated power in their relationship with suppliers. The same power bases have also been found in CsB and, therefore, it can be concluded that manufacturers from the automotive industry possess both types of power on their suppliers. This is consistent with the contention by Wagner and Hoegl (2006) that manufacturers in the automotive industry tend to have both types of power base as a result of being the dominant partner in the supply chain. Nevertheless, CsB has opted not to exercise coercive power on its suppliers because the company believes that it may harm the relationship in the long run.

As manufacturers, CsC and CsE perceive that only a non-mediated power base exists and use it in their relationship; manufacturer CsD believes that it possesses no power in its relationship with suppliers. A plausible explanation for this situation is that CsD's technological capability is considered common among other semiconductor players and thus cannot be claimed unique or scarce in the industry. Therefore, as mentioned by the chief operations officer of CsD, the party that controls the limited resources in the semiconductor industry is the suppliers and thus, hypothetically, power may possibly reside with the suppliers' side in this relationship.

Table 6.3 also reveals the types of power under each power base consumed by the manufacturers. Apart from coercive power, expert power has been identified and used by most of the case studies. CsA, CsB, CsC and CsE confirm that they have experienced expert power in their relationship with suppliers. Meanwhile, CsB and CsE also recorded another non- mediated power base in their relationship - referent power.

In short, it can be concluded that both mediated and non- mediated may exist in the relationship as a result of technological capability. Nevertheless, this conclusion should be taken with caution because coercive power is only recorded under certain industrial sectors and under some circumstances; there are no power bases recorded in the relationship. The next section provides a cross case analysis of the role of trust in the relationship between manufacturers and their suppliers as a result of having technological capability.

Table 6.3: Summary on the role power

Firms	Industry	Mediated power based	Non- mediated power based	Exercise of mediated power	Exercise of non-mediated power	Type of power
CsA	Automotive	• Yes	• Yes	• Yes	• Yes	• Coercive – exercised during new contract negotiation • Expert – persuade suppliers to maintain materials quality
CsB	Automotive	• Yes	• Yes	• No	• Yes	• Coercive – CsB opt not to use it • Expert – provides expert advice to suppliers when needed • Referent – acts as a point of reference to the small suppliers who have very limited technological resources
CsC	Packaging	• No	• Yes	• No	• Yes	• Expert – providing inputs on how to improve the material quality and delivery time
CsD	Electronics	• No	• No	• No	• No	• Not applicable as CsD confirms that it has no relationship power in dealing with suppliers
CsE	Pharmaceutical	• No	• Yes	• No	• Yes	• Expert – Works closely with the suppliers in ensuring the quality of the chemical materials are at par and meet safety regulations. • Referent – suppliers volunteer to join the Pharma*Net infrastructure due to the influential characteristics of CsE

Table 6.4: Summary on the role trust

Firms	Industry	Type of trust	Perceived level of trust
CsA	Automotive	• Competence – provide technological support to suppliers • Goodwill – good faith in doing business	• High
CsB	Automotive	• Contractual – based on agreed term and condition in the purchase agreement • Goodwill – full cooperation and commitment from the suppliers • Competence – technical competency is highly recognised by the suppliers	• High
CsC	Packaging	• Competence – offering technical advice to the suppliers • Goodwill – suppliers respect the manufacturer's reputation by giving full commitment	• High
CsD	Electronics	• Contractual – entirely based on procurement contract • Goodwill – maintain product quality to uphold both parties good name	• High
CsE	Pharmaceutical	• Competence – implying trust through technology infrastructure • Contractual • Benevolence – both contractual and benevolence trust are co-exist as suppliers extend trust beyond contractual agreement	• High

6.8.3 The role of trust

This sub-section provides a cross case analysis of the emergence of trust as a result of manufacturers' technological capability. Table 6.4 summarises the findings gathered from the entire case study organisations through face-to-face interviews. The results from the table show that there is a high level of trust involved in the relationship between manufacturers and their suppliers. This can be seen when all case studies organisations unanimously perceived a high level of trust exists in the relationship. This finding is consistent with Abdullah (2009) which also found a high level of trust for both manufacturers and suppliers as a result of adopting electronic procurement infrastructure. Therefore, this study argues that technological capability increases the level of trust in an exchange dyad.

The most important observation that can be made from Table 6.4 is that technological capability creates various dimensions of trust in the relationship and thus confirms the multidimensionality of this construct. Interestingly, all the case study organisations reported different combinations of the trust dimensions resulting from manufacturers' technological capability and none have the same set of trust - which reflects the uniqueness of each case. Nevertheless, their responses converge on several themes that can be identified.

The first dimension identified from the interviews is competence trust. It is constructed based on another party's skill, expertise and operational abilities (Coulter & Coulter 2002; Das & Teng 2001; Keng & Zixing 2003; Mayer, Davis & Schoorman 1995; Schoorman, Mayer & Davis 2007); and, in this case, the technological capability of the manufacturers. In this study, four case organisations reflect the existence of competence trust in the relationship with their suppliers. Manufacturers CsA, CsB, CsC and CsE have experienced competence trust from their suppliers and the main source of this trust is from the technical skills and knowledge that they possess. This situation can be cross checked with their responses in the interview sessions which highlighted that manufacturers with technological capability tend to extend their expertise to suppliers as requested.

The second dimension of trust that can be detected is goodwill trust. As agreed by many researchers, goodwill trust is built upon a firm's high reputation, good faith, positive intention and high integrity among members within the supply chain (Das & Teng 2001; Sako 1991, 1998). The case studies recorded four manufacturers who have been experiencing goodwill trust in doing business with the suppliers. Manufacturers CsA, CsB, CsC and CsD collectively mentioned that the suppliers respect their good reputation and they (the suppliers) help by giving full cooperation and commitment to maintaining it.

The third significant dimension of trust that emerged during the interview sessions is contractual trust. To recap, contractual trust refers to the mutual understanding by firms to keep promises, and comply and respect the terms and conditions of a specified agreement (Dodgson 1993; Ireland & Webb 2007; Liu et al. 2008; Sako 1991, 1998). Three case studies (CsB, CsD and CsE) displayed evidence of this type of trust in their relationship with suppliers. From the responses, these case studies believe that suppliers have an obligation and take full responsibility in delivering all the materials required as stipulated within the agreed contracts. The role played by technological capability in enhancing this trust is in providing linkage between manufacturers and the suppliers via technology infrastructure such as e-procurement services.

The final dimension of trust detected from the case study investigation can be classified as benevolence trust. As defined in the literature review chapter, the act of benevolence trust happens when one party extends its cooperation to another partner aside from an egocentric profit motive (Mayer, Davis & Schoorman 1995). Out of five case studies, only one (CsE) manufacturer has experienced this type of trust in its relationship with suppliers. From the response given by CsE's representative, its suppliers voluntarily extend their cooperation beyond what has been agreed and stipulated in the contract. The occurrence of this type of trust is unique, but can be seen as an isolated case as it is only reported in one case study. In explaining this situation, a statement by Schoorman, Mayer and Davis (2007) can be made as a point of reference when they clarify that the act of benevolence trust exists but seldom happens in a relationship, especially at the macro level which involves inter-organisational interaction. Nevertheless, in a supply chain context, they believe that the act of benevolence between members is important in building inter-organisational trust.

In conclusion, there are four types of trust existing in the relationship between manufacturers and their suppliers as a result of technological capability. The case studies herein identified them as competence, goodwill, contractual and benevolence trust - and thus provide support for the multidimensionality of the trust construct that binds the inter-firm relationship. The next section provides a cross case analysis of how manufacturers' technological capability, power and trust affect inter-firm relationship performance with their suppliers.

6.8.4 Inter-firm relationship performance

This sub-section provides a cross case analysis of the impact of technological capability, power and trust on inter-firm relationship performance. Table 6.5 summarises the findings gathered from the interview sessions with the selected case study organisations. The findings indicate that most of the case studies, except CsD (recalling that CsD stated it has no relationship power), perceived that technological capability, power and trust has impacted inter-firm relationship performance. This finding is consistent with previous studies that tested the individual relationship between technological capability, power and trust with the inter-firm relationship performance construct (Ratnasingam 2005; Wang et al. 2006; Zhao et al. 2008). Therefore, it can be concluded that these three constructs are the possible antecedents of inter-firm relationship performance.

Table 6.5 also reveals the dimensions of inter-firm relationship performance. The case study analyses have identified two major dimensions of this construct that exist as a result of the impact of technological capability, power and trust. The first dimension is recognised as an improvement in business performance. The case study organisations believe that the combination of technology, power and trust bring close cooperation with their suppliers and, thus, leads to better business performance. The study has recorded four case study organisations that perceive the impact of these combinations on business performance.

CsA, CsB, CsC and CsE believe that their technological capability has helped improve their production capability in meeting market demand. In the meantime, they also perceive that technology creates relationship power, enhances trust and results in a closer relationship with parties in the supply chain. These, in turn, enhances closer cooperation between both parties, increases supply chain efficiency and improves business performance in the long run. It is worth noting that CsD also records similar findings on how closer relationship with suppliers leads to higher business performance, although it perceives it has no relationship power with its suppliers.

The second dimension of inter-firm relationship performance that emerges from the interviews with the case studies is identified as cooperation on new product development. Four case study organisations (CsA, CsB, CsD and CsE) displayed evidence of cooperation between manufacturers and their suppliers in terms of development of a new product. Before this, all case study organisations noted that technological capability, together with relationship power (except CsD) and trust, brings a closer relationship with suppliers.

As a result of this relationship, they intend to collaborate further with suppliers to work with their R&D team and, together, contribute ideas, recommendation and advice in developing new products. The success of a new product in the market is then shared among them and thus acknowledges the benefits of maintaining a close relationship. Another important observation that can be noted from table 6.4 below is the nonexistence of this dimension in CsC. The plausible explanation for this situation is the absence of R&D capability in CsC that hinders their efforts to nurture an innovative culture in the organisation.

Table 6.5: Summary on inter-firm relationship performance

Firms	Industry	Perceived impact from	Dimensions of inter-firm relationship performance
CsA	Automotive	• Technological capability • Power • Trust	• Better business performance • Cooperation in terms of new product development
CsB	Automotive	• Technological capability • Power • Trust	• Better business performance • Cooperation in terms of new product development
CsC	Packaging	• Technological capability • Power • Trust	• Better business performance
CsD	Electronics	• Technological capability • Trust	• Better business performance • Cooperation in terms of new product development
CsE	Pharmaceutical	• Technological capability • Power • Trust	• Better business performance • Cooperation in terms of new product development

6.9 Chapter summary

This chapter provides the Phase Two qualitative results gathered through face-to-face interviews with five selected case studies as described in the research methodology chapter. The current chapter started with an overview of the case study, details on background the background of each case study, findings on technological capability, the role of power, and trust, and the overall impact on inter-firm relationship performance. Subsequently, the chapter continued with cross-case analyses whereby discussion on the findings was provided, it is found that technological capability has impacted power, trust and the inter-firm relationship performance. The findings also confirm that the impact of technological capability manages to create mediated power based (for example coercive power) and benevolence trust in the inter-firm relationship. The next chapter presents the discussion and conclusion to the research study, based on the findings from both phases of the data collection.

CHAPTER 7: CONCLUSIONS AND IMPLICATIONS

7.1 Introduction

This thesis is aimed at assessing the impact of technological capability on power, trust and inter-firm relationship performance. Based on the research question outlined in Chapter One, seven hypotheses have been proposed. Mixed method approach was chosen to answer the research question, as well as to test the hypotheses. In this approach, data was collected in two phases: quantitative (Phase One) and qualitative (Phase Two). The previous chapter presented the qualitative findings of this approach. This chapter offers a discussion of the results, together with implications of the study. Finally, the thesis concludes by identifying the study limitations and key recommendations for future studies.

7.2 Discussion of major findings

This section provides a discussion of the results of both phases of the study. The following table (Table 7.1) shows the result of hypotheses testing conducted in Chapter 4. It consists of all proposed relationships, their direction and strength.

Table 7.1: Results of hypotheses

	Hypothesis	Support	Strength
H1	Technological capability has a positive impact on inter-firm relationships performance.	Supported	Strong
H2	Technological capability is positively associated with power	Supported	Strong
H3	Power has a positive impact on inter-firm relationships performance.	Supported	Strong
H4	Technological capability is positively associated with trust.	Supported	Strong
H5	Trust has a positive impact on inter-firm relationship performance	Supported	Strong
H6	Power mediates the positive association between technological capability and inter-firm relationship performance	Supported	Strong
H7	Trust mediates the positive association between technological capability and inter-firm relationship performance	Supported	Strong

7.2.1 Technological capability and inter-firm relationship performance

In general, technological capability has been acknowledged in prior studies as being one of the strategic resources that enable firms to achieve a competitive advantage, particularly in their industry (Hsieh & Tsai 2007; Ortega 2010; Tsai 2004; Wang et al. 2006). Firms with high technological capability are likely to secure greater value and rate of return as compared to their competitors in the industry. This is in line with the Resource Based View theory assumption that firms compete on resources and capabilities (Barney 1991; Barney & Clark 2007; Wernerfelt 1984) and they may gain superior performance out of their competitive advantage so as to differentiate themselves from other competitors (Wang et al. 2006).

Despite the attention given to the importance and understanding of technological capability, less has been directed to the impact of technology on firm performance (Tsai 2004). Therefore, this study has provided empirical evidence on the impact of technological capability on inter-firm relationship performance. The results from a survey of 126 manufacturers in Malaysia, as well as the results from the case study analysis, indicate that technological capability has a significant positive impact on inter-firm relationship performance across the size of the company and, therefore, H1 is supported. This strong relationship reflects that manufacturers with technological capability are likely to reap the benefits of inter-firm relationships. These benefits include better business performance and non-financial gain such as new product development.

This research developed and tested the hypotheses offered in Chapter 3 by employing the Resource Based View theory. The findings appear to be consistent with the argument of Resource Based View theory in explaining the association between technological capability as a competitive advantage and inter-firm relationship performance as the outcome gained by firms. As this study focuses on a developing country (in this case Malaysia), it suggests that the Resource Based View theory point of view can serve as a ground theory in expanding the impact of competitive advantage towards relationship performance.

In contrast to many other studies, this study has attempted to operationalise multiple perspectives of technological capabilities as opposed to a single dimensional construct. The estimation of this model, derived from the dimensions proposed by the literature (Dahlman, Ross-Larson & Westphal 1987; Jonker, Romijn & Szirmai 2006; Lall 1999; Lee, Kwon & Severance 2007) provides statistical evidence to show that, collectively, the dimensions of technological capability: production, investment and linkage capabilities; are important determinants of inter-firm relationship performance. In a similar vein, the qualitative results confirm the representation of production, investment and linkage capabilities in measuring technological capability. All five case study manufacturers converge on the same theme of technological capability and thus provide support on the multidimensionality of this construct.

Most previous studies have utilised single or more dimensional constructs of technological capability in examining its impact on other related constructs (Acha 2000; Afuah 2002; Aw & Batra 1998; Etemad & Lee 2001; Hsieh & Tsai 2007; Lee, Lee & Pennings 2001; Patrakosol & Lee 2009; Schoenecker & Swanson 2002). For example, the result of Tsai's (2004) study of 45 large companies quoted in the Taiwan Stock Exchange using secondary data over a period of 7 years from 1994-2000 based on companies' R&D expenditure as technological capability indicator, confirmed it has a positive impact towards business performance, which is also part of the inter-firm relationship performance indicator.

Meanwhile, Wang et al.'s (2006) study is currently the only known study to gauge technological capability in broader terms. They gauged technological capability using items that measured R&D activities, technological skills, training for technical skills, investment to upgrade technology standards, and integrating or linkage capability using in-house resources. Nevertheless, they group all these items into a single dimension of technological capability. This study views the multidimensional construct of technological capability - production capability, investment capability and linkage capability - as a first order construct before integrating them as second order constructs of technological capability. The unidimensionality of technological capability is then tested using the PLS CFA. Interestingly, the findings of this study is consistent with Wang et al.'s (2006) results: technological capability positively affects the relationship performance construct which is represented by business performance and new product development dimensions.

In addition, this study focuses on the association of technological capability and inter-firm relationship performance in the manufacturing sector in a developing nation. On the contrary, Wang et al.'s (2006) study focuses on investigating the impact of technological capability on business performance on a high-technology firm which is under the different business category. There are no known published studies that investigate the direct impact of these issues in a developing country such as Malaysia. Therefore, the empirical results of this study bridge the gap in the literature by providing an understanding of the impact of technological capability and inter-firm relationship performance from Malaysian manufacturers' perspective.

In short, this study found that technological capability has a significant positive impact on inter-firm relationship performance. The multidimensionality of the technological capability construct adopted in this study has enabled comprehensive measurement of this construct as compared to single dimensional measurement. The study also confirms that the Resource Based View theoretical perspective can be applied to the association between a firm's competitive advantage and relation performance in the context of a developing country such as Malaysia. The next section provides a discussion on the role of power.

7.2.2 The role of power

It has been argued in most prior studies that technology is one of the factors that can cause the existence of power in a relationship (Coughlan et al. 2001; Ratnasingam 2000; Vlosky, Fontenot & Blalock 2000). Firms equipped with technological capability are expected to create relationship power so as to signal their capability in technology. The role of power in this study is in alignment with the power dependency theory which assumes that power exists as a result of dependency of other parties due to the possession of a unique resource (Emerson 1962) and, in this study, it refers to technological capability.

As elaborated in Chapter 2, a review of the literature revealed the debate on the association between technological capability and the existence of a non-mediated power base. Path analysis using the PLS approach in this study confirms that technological capability has a significant positive impact on relationship power (H2). Therefore, the result is consistent with the assumption made under the power dependency theory and suggests that Malaysian manufacturers with high capability in technology may experience the creation of a non-mediated power base in their manufacturer- supplier relationship as compared to manufacturers with a low level of technological capability.

As mentioned in the above section, technological capability is grounded by the Resource Based View theory. Meanwhile, the concept of relationship power is governed by the theory of power dependency. This result also confirms that there is interconnection between the Resource Based View theory and power dependence theory, and this interconnection is applicable in the study of a developing country (in this case Malaysia) in relation to the inter-firm relationship performance context.

Specifically, the results show that firms with production capability, investment capability and linkage capability create dependency of other firms - creating power in the relationship. This result is also consistent with prior studies which found that instalment of technology related capability such as RFID, e-procurement or IT increases the dependency of one party on another and creates power in the relationship (Ke et al. 2009; Ratnasingam 2000; Ryssel, Ritter & Gemunden 2004). This result also confirms the notion that technological capability is closely related to the manufacturer's knowledge, expertise or skills, and these are actually non-mediated power based in nature (Benton & Maloni 2005; Maloni & Benton 2000; Zhao et al. 2008).

Interestingly, the qualitative results expose that technological capability also manages to create mediated power (especially coercive power) in the relationship. Both case studies from the automotive sector confirm that manufacturers with high technological capability tend to be the dominant partner in a relationship with their suppliers. This finding is supported by Wagner and Hoegl (2006) who found that firms in the automotive sectors tend to be dominant in their supply chain due to their possession of technology as compared to their suppliers. Nevertheless, the qualitative findings reveal that the firms prefer to use non- mediated power and opt not to exercise coercive power because they believe it will jeopardise their relationship with suppliers.

Therefore, it can be concluded that technological capability impacts the creation of power in a relationship. It is found from both the quantitative (Phase One) and qualitative (Phase Two) results that manufacturers with superior technological capability not only tend to create non-mediated power based in a relationship with their suppliers, but also mediated power (in the form of coercive power). Nevertheless, it is concluded from the findings of both phases that manufacturers tend to exercise the non-mediated type rather than the opposite to maintain their relationship with the suppliers.

Meanwhile, the association between non-mediated power and inter-firm relationship performance was also investigated in this study. The quantitative results reveal that non-mediated power has a significant positive impact on inter-firm relationship performance and thus H3 is supported. This relationship is also grounded by power dependency theory that perceives non-mediated power is able to enhance the attitude towards maintaining a healthy relationship among supply chain members in the supply chain (Zhao et al. 2008). Therefore, this result provides empirical support f the application of this theory in examining the relationship between non-mediated power and the inter-firm relationship performance construct within the domain of the manufacturing industry in Malaysia.

The results of regression analysis performed through the PLS procedure confirms the positive significant association of these two constructs. The empirical result is in line with most prior results conducted in this field (Benton & Maloni 2005; Corsten & Felde 2005; Maloni & Benton 2000; Yeung et al. 2009; Zhao et al. 2008). The qualitative result also supports this finding with the non- mediated power base found to be crucial in maintaining close inter-firm relationship. On one hand, the qualitative result also reveals that non-mediated power reduces conflict in the relationship and helps manufacturers receive an uninterrupted supply of material and helps them to perform better overall. On the other hand, the use of non-mediated power also attracts suppliers to collaborate closely with the manufacturers in designing and developing new products.

Therefore, it can be concluded that findings from both phases confirm the positive impact of non-mediated power towards inter-firm relationship performance. These findings support the third hypothesis (H3) and provide empirical confirmation of the power dependency assumption in it association to the inter-firm relationship performance construct within the Malaysian manufacturing sector.

This study also examines the mediating effect of non-mediated power in the association between technological capability and inter-firm relationship performance. Hypothesis 6 (H6) predicts that power mediates the positive association between technological capability and inter-firm relationship performance. The causal step approach proposed by Bontis, Booker and Serenko (2007) and Sobel test (Preacher & Hayes 2004) have been employed to test the mediating effects of power in the relationship between the two constructs. Both of the tests confirm the mediating effects of non-mediated power with $p < 0.05$ (two tailed) and thus support the hypothesis (H6). This again provides support for the interconnection between Resource Based View and power dependence theories in the context of the manufacturing domain in Malaysia.

To date, there are no known studies focusing on either marketing channel field or within the operational management boundary. Thus, this study claims to be amongst the earliest to examine the mediating effect of power in the relationship between technological capability and the inter-firm relationship construct. The significant result of the mediating effects can be explained theoretically by looking at the theoretical connection between Resource Based View theory, power dependency theory and the inter-firm relationship performance construct. On one hand, Resource Based View theory has identified technological capability as one of the competitive capabilities that can help firms to generate superior business performance as compared to their competitors (Ehigie & McAndrew 2005; Meyer-Stamer 1999; Tsai 2004; Tyler 2001). The relationship between technological capability and inter-firm relation performance investigated in this study (H1) is also found to be significant.

On the other hand, apart from being a competitive advantage to a firm, technological capability is also acknowledged as one of the sources that create a non-mediated power base in the relationship as predicted by the power dependency theory and validated not only in this research through the significant result of H2, but also by most prior studies (Benton & Maloni 2005; Maloni & Benton 2000; Zhao et al. 2008). The power dependency theory also assumes that the non-mediated base leads to a closer inter-firm relationship and thus expects firms to reap benefits through inter-firm relationship performance. This connotation is supported by hypothesis 3 (H3).

Therefore, there are linkages between technological capability → power → inter-firm relationship performance constructs; and this study believes that this interrelationship is more than direct relationships among the constructs. Further, the mediation test is conducted and found that there is a significant relationship as suggested by H6. Thus, it can be concluded that the non-mediated power (expert and referent) mediates the relationship between technological capability and inter-firm relationship performance. Next, the examination of the findings of this study continues by providing a discussion on the role of trust.

7.2.3 The role of trust

This study also incorporates the trust construct in examining the relationship between technological capability and inter-firm relationship performance. This study predicts that technological capability has a positive significant impact on trust (H4). Manufacturers with a high level of technological capability are expected to increase the trust of their suppliers in the relationship. This is in accordance with the Resource Based View theory that argues that a firm's competitive advantage is closely related to its core competency (Barney 1991; Barney & Clark 2007; Prahalad & Hamel 1990). Meanwhile, trust theory assumes that technological capability increases a firm's efficiency in production and their ability to produce high quality products and promote timely delivery. These accomplishments are perceived by their suppliers as competence and may promote a high confidence level in the relationship (Blomqvist 2002; Ryssel, Ritter & Gemunden 2004).

As expected, the path analysis perform by the PLS procedure confirms that technological capability has a positive significant impact on trust and thus supports hypothesis 4 (H4). The qualitative findings (Chapter 6) also provide support to this notion when all case studies organisation agreed that technological capability has impacted trust in the relationship with their suppliers. Interestingly, the case study analysis has recorded the possibility of benevolence trust occurrence in a relationship as a result of technological capability deployment.

Overall, this result is consistent with most prior studies conducted in this field (Bowersox, Closs & Stank 2000; Ryssel, Ritter & Gemunden 2004) . For example, Kwon and Suh (2005) found that investment in specific assets either in physical technology or human capital, including investment in intangibles such as R&D and firm specific knowledge, has a positive association with trust building. They also found that information system deployment by the manufacturers indirectly impacts on the level of trust within the supply chain. The qualitative result also supports this finding when technology deployment, technology related investment and linkage capability, especially involving cross organisational integration, are found crucial to reducing dissatisfaction and, thus, promotes trust in a relationship. This notion is also supported by other researchers (Heide & John 1990; Kwon & Suh 2005) who found a similar interconnection between the technological construct and the element of trust building in maintaining close inter-firm relationships.

Therefore, it can be concluded that technological capability impacts the level of trust in a relationship. The findings from both quantitative and qualitative analyses support the study's fourth hypothesis (H4). Further, it also provides empirical support on the interconnection between Resource Based View and trust theory theoretical assumptions, as well as the applicability of both theories in the study of a developing country (in this case Malaysia).

This study has provided empirical evidence on the impact of trust on inter-firm relationship performance. It proposes a positive association between the element of trust and inter-firm relationship performance (H5). The theory of trust assumes that a high level of trust leads to a healthy inter-firm relationship and this will further facilitate the creation of various business opportunities (Brewster 1998). Patrakosol and Lee (2009, p. 1234) argue that inter-firm relationship performance is recognised as performance resulting from an inter-firm relationship. The literature review section in Chapter 2 recognises business performance and new product development opportunity as the performance resulting from individual firms who perform the inter-firm task.

In general, trust has been acknowledged as one of the most important elements in the buyer-supplier research domain. This connotation has been supported by many previous studies (Barratt 2004; Das & Teng 2001; Gallivan & Depledge 2003; Inkpen & Currall 2004; Kwon & Suh 2005; Sengun & Wasti 2009). This study extends the concept of inter-firm relationship by investigating the performance resulting from this interrelationship and incorporating trust as one of the antecedents of inter-firm relationship performance.

The results from the regression analysis perform by SmartPLS software in this study indicates that trust has a significant positive impact on inter-firm relationship performance and, therefore, hypothesis 5 (H5) is supported. The strong positive relationship between these two constructs may suggest that trust is also an important determinant in inter-firm relationship performance. This result is consistent with prior studies which document that trust increases inter-firm relationship performance (Cheng, Hailin & Hongming 2008; Davis et al. 2000; Ratnasingam 2005; Sako 1998; Zaheer, McEvily & Perrone 1998).

The qualitative result also confirms that trust may help to bind the relationship between manufacturer and supplier. In this sense, the qualitative result has proved the importance of trust in building the buyer-supplier relationship. Trust is found to be the driver in encouraging manufacturers to invest further in maintaining a good business relationship with their supplier. As a result, manufacturers benefit from this relationship in terms of improved business performance, as well as the opportunity to collaborate with their suppliers in developing new products in the future.

Therefore, it can be concluded that findings from both phases confirm the positive impact of trust on inter-firm relationship performance. The findings from both quantitative and qualitative phases support the fifth hypothesis (H5) and provide empirical confirmation of the trust theory assumption in its association with the inter-firm relationship performance construct within the Malaysian manufacturing sector.

Meanwhile, this study also examines the mediating impact of trust on the association between technological capability and inter-firm relationship performance. Hypothesis 7 (H7) predicts that trust mediates the positive association between technological capability and inter-firm relationship performance. As to H6 (which examines the mediating role of non-mediated power), H7 also uses a similar process in determining the mediating effects by employing the causal step approach proposed by Bontis, Booker and Serenko (2007) and Sobel test (Preacher & Hayes 2004). Both of these tests confirm the mediating effects of trust with $p < 0.001$ (two tailed) and thus support H7. Again, this provides support on the interconnection between Resource Based View and trust theories and their applicability in the context of the manufacturing sector in Malaysia.

Most prior studies have recorded that trust mediates the relationship between various constructs of interest (Aryee, Budhwar & Chen 2002; Bart et al. 2005; Chen, Aryee & Lee 2005; Saparito, Chen & Sapienza 2004). Although theoretically the mediating effect of trust on the association between technological capability and inter-firm relationship performance is argued to exist, there are still limited studies examining this effect and thus this aspect needs further empirical support. Given the lack of empirical evidence justifying the relationship examined in this study, the research of Kwon and Suh (2005) could serve as a point of reference.

Kwon and Suh (2005) investigated the relationships between IT sharing, investment in asset, and the level of trust and commitment in a supply chain relationship. A comprehensive questionnaire was mailed to 1800 participants in the United States and a total of 171 (9.5 percent) valid returns were received. A path analysis was used to test a framework and the results suggest a positive association between specific assets investments in their supply chain partner with firm trust. IT sharing has an impact on reducing partners' uncertain behaviour that would improve the level of trust. Finally, there is strong relationship between the level of trust and commitment in a supply chain relationship. Although the study does not incorporate trust as a mediator, the study contributes to the general debate on the interrelationships of various variables to trust by using path analysis model.

Nevertheless, it should be noted that this study slightly differs from that of Kwon and Suh (2005) in terms of measuring technology and the relationship outcome (dependence variable). In addition, their research setting is also different as it is conducted in a developed country (USA).

Therefore, it can be concluded that there are linkages between technological capability → trust → inter-firm relationship performance constructs; and this study has confirmed the mediation effect of trust as suggested by H7. Further, this evidence enhances understanding of the possible interaction between Resource Based View and trust theories in investigating their impact on inter-firm relationship performance in a developing country setting. This finding also shows consistent results with comparable research and the empirical evidence gathered in this study may enrich the literature and shed light on the possible interaction of these constructs. Next, the section continues by providing a discussion on the contribution of the study towards the literature and practice.

7.3 Contribution of the study

7.3.1 Contribution to the literature

This study is one of the few attempts to provide empirical test on the association of technological capability with other influential constructs. Regardless, the need to confirm the results of other similar studies in different settings, the study offers several significant contributions towards the literature.

From a theoretical perspective, the findings of the study may contribute to enhancing further understanding on the Resource Based View theory by providing empirical support on how the use of technological capability helps manufacturing firms to benefit in their inter-firm relationship with their suppliers. It is also important to note that this research offers empirical evidence from a developing country viewpoint (Malaysia) and this may provide further insights to the Resource Based View literature since previous studies have, for the most part, been from the perspective of developed countries.

Another important contribution of this study is providing linkages between Resource Based View theory, power-dependency theory and trust theory. Previously, most technology related studies only looked at either power or trust as dependent variables (Abdullah 2009; Ryssel, Ritter & Gemunden 2004; Wang et al. 2006). This research expands the theoretical application of Resource Based View by examining the mediating effects of both power and trust in enhancing relationship performance outcomes. Theoretically, it is found that both power and trust co-exist in firm interrelationships and are closely related with a firm's technological capability. Nevertheless, prior empirical evidence does not provide any link between these constructs. Therefore, this study contributes to filling this gap by providing the missing link by incorporating these variables in one research study. In addition, this study incorporates both power and trust mediators which may enrich the current literature and provide a broader understanding on the relationship between Resource Base View, power-dependency and trust theories.

This study also contributes to the literature by extending the previous research on technological capability by shifting the traditional views on measuring the construct. In this study, technological capability is conceptualised as a multi-dimensional construct which consists of production capability, investment capability and linkage capability; as compared to other previous studies that depend on a single construct. The multi-dimensional construct has allowed broader definition of technological capability and enables the inspection of the interrelationship among these different dimensions. Their interrelationship and unidimensionality are tested in this study using CFA and the employment of PLS analysis to perform these analyses.

This study aimed to integrate the concept of power and trust in the model relationship between technological capability and inter-firm relationship performance. This conceptual model has been comprehensively tested using mixed method approach which involves quantitative (as Phase One) and qualitative (as Phase two) methods. This research has clearly explained the direct relationship between technological capability-power-inter-firm relationship performance, and technological capability-trust-relationship performance, as well as the mediating effects of both power and trust constructs in the relationship. Thus, this model has provided a reference and foundation for future research in this field.

This study also enriches the growing literature of PLS method in quantitative analysis by providing the association among the constructs of interest. This study opted to use PLS rather than other typical maximum likelihood based covariance structure analysis (for example CBSEM). The rationale for this is that CBSEM is found poorly suited to deal with small samples and can even produce a non-unique or improper solution (Fornell & Larcker 1981; Ghozali 2008; Hulland 1999). PLS was developed and utilised to overcome these limitations (Henseler, Ringle & Sinkovics 2009; Wold 1982). In short, PLS based analysis is gaining ground as a result of its ability to deal with latent construct and be uncontaminated with measurement errors (Wang et al. 2006); and this research provides further support to the growing literature on this type of analysis.

7.3.2 Contributions to practice

The study provides several useful contributions to practice and basically these can be categorised into two different classifications: policy makers and the industry. As for the policy maker, this study provides valuable information on the current status of technological capability of the manufacturing industry in Malaysia. The results of this research may help the government in planning the development of or reviewing current policy relating to the country's manufacturing sector. The Malaysian Government has proactively drawn various policies to strengthen technology-related activities in the manufacturing industry - for example, the latest Industrial Master Plan 3 (IMP 3) which covers the period 2006 to 2020. The objective is to achieve long term global competitiveness in manufacturing. Among the strategic thrust of IMP3 is to sustain the contribution of the manufacturing sector's growth via accelerating the shift towards high technology and capital intense activities (MITI 2010). While there are action plans, initiatives and policies concentrating on building and strengthening the manufacturing sector, the focus now should be more on the development of inter business relationships and technological capability in order to sustain a high level of business performance among manufacturers in Malaysia.

From this perspective, policy makers should be mindful of the importance of continuously providing support in high technology activities such as promoting the growth of R&D activities, which is closely related to the innovative culture. The government should also encourage manufacturing entities to strengthen their vertical supply chain inter-firm relationship which would impact positively on the role technological capability plays on inter-firm relationship performance. Meanwhile, the government also needs to provide encouragement to the manufacturing sector to join international trade associations and participate actively in international trade showcases that might enable them to collaborate with other suppliers and expand their supply chain to enjoy possible technological transfer in the future,

As for the business community in the manufacturing sector, the findings of this research may shed light on the understanding of a firm's level technological capability and how it relates especially to relationship performance. The results indicate that the dimensions of technological capability are positively related to the dimensions of inter-firm relationship performance. Therefore, scrutinising these individual dimensions made available in the conceptual model might furnish useful information to management on the advantages of possessing such capability - which can be the basis for making future investment decisions related to technological capability expansion.

For example, under the circumstances of having strong production capability, firms will be able to conduct crucial R&D activities since they are able to generate in-house process innovation and new product development. Close collaboration between buyers' firms and their key suppliers in this case are inevitably important, since suppliers can provide information and materials needed for innovation in producing high quality products. This collaboration, in turn, will create economic benefits for both parties.

Meanwhile, firms with a huge investment capability are able to upgrade their facilities and provide training to adequately equip their staff. Investment, particularly in allowing information sharing, will allow buyers and their key suppliers to exchange not only simple operational data, but also share important strategic information such as forecasting or design of new products in order to maximize inter-firm relationship performance within the supply chain (Kwon & Suh 2005).

Conversely, linkage capability will allow firms to absorb and transmit information within the organization more effectively. Beyond that, this ability permits technology transfer that would benefit both buyer and their key supplier in terms of stronger business relationships which, in turn, increases inter-firm relationship performance.

Meanwhile, this study provides evidence that technological capability has a strong positive impact on both power and trust; while power and trust both have a strong relationship towards inter-firm relationship performance respectively. In this sense, strong technological capability may result in relationship power, as well as affecting trust in relationships with their suppliers. These relationships are confirmed using the test of mediating effects of both power and trust in the association between technological capability and inter-firm relationship performance. The test confirms that both variables mediate this relationship.

Nevertheless, the dimension of power in the quantitative analysis only focuses on non-mediated power base. Qualitative findings reveal that technological capability might also give a mediated power base (in the form of coercive power) to the firms, and it is entirely the prerogative of firms to exercise the appropriate power base in their business relationship. Therefore, practitioners need to be extra cautious since high technological capability leads not only towards high non-mediated power and trust, but also creates coercive power in the relationship.

7.4 Limitations of the study

The previous section explains the implication of the research towards the theory and practice. Meanwhile in this section, limitations to the research are discussed and this research has identified several limitations that need to be acknowledged.

Firstly, in term of research design, it is noted from both of the phases that there are possibilities of social desirability biases in using self-reporting approach to get results. Socially desirable response is defined as the tendency of giving overly higher positive scores that depart from reality or without sufficient evidence (Paulhus 2002). For instance, the participants may answer the questions not in good-faith but rather to portray themselves or their organisations in a positive manner. Their responses might be exaggerated, missed pertinent information or even feeling emotional at the time they answer the questions. This is a huge limitation and the research design is unable to detect this anomaly.

Secondly, in term of methodology, the use of purposive sampling in Phase Two may spark the issue of representation which is important when claiming generalisability of the study. The employment of purposive sampling has made the conclusion more analytical as opposed to statistical generalisability towards the population. Phase Two only manage to collect data from single personnel from each five organisations with various sizes, number of suppliers and sub-industries. The duration of time spend on each interviews are also considerably moderate due to the set-up time allowed by each companies for the interview sessions. As a result of this, the current interview questions design is tailored to be more direct to suit the time frame given by the case study organisations. Therefore, these findings do not permit to claim generalisability since different perspective may also exist in other organisations within the same perimeter. It is suggested that the future research should take to minimise these limitations in order to increase the findings generalisability. Nevertheless, it causes little concern since the objective of qualitative data collection in Phase Two is to confirm and support the findings gathered by the quantitative data collection in Phase One rather than to draw statistical generalization.

Thirdly, the data for both phases is collected based on cross-sectional study. A cross-sectional study allows the researcher to collect data at a single time (Leedy & Ormrod 2005) and therefore only provides a snapshot at one particular moment. Thus, the results of this study may differ if another time-frame is chosen. For example, the data for both phases is collected between March 2010 and September 2010. In this continuum, most of the companies in the world are still crawling out of the economic downturn. Therefore, the assessment of investment in the technological capability as well as business performance and new product development can be misleading. As a result, the cross-section approach within this time frame may decrease the power to explain the association among the studied variables.

Finally, it is worth to note that the targeted population is the manufacturing organisations in Malaysia. The samples are drawn from the members of FMM that are listed under the FMM Directory 2009. There are numbers of manufacturing organisations in Malaysia that choose not to join FMM membership and thus, are not listed under this directory. Although their numbers are not substantials, obtaining responses from these manufacturers may yield different results.

In summary, the interpretations of the results need to account for spatial, temporal and methodological considerations. In example, the interpretation need to largely consider the country setting, length of time that the technological capability has been practice as well as the statistical approach. Therefore, all the studied hypotheses need to be tested in different empirical settings in order to further validate the results.

7.5 Direction for future research

This research sought to understand the impact of technological capability on power, trust and inter-firm relationship performance within the manufacturing supply chain in Malaysia. It is encouraging that further research can be undertaken by testing it in other empirical settings to validate and further improve the results by minimising the current limitations. Therefore, the researcher recommends several suggestions for future research.

First, this study has included a limited set of relationships among the constructs in its conceptual framework. For example, this research has considered the mediating effect of power and trust in the relationship. Therefore, it is suggested that future research investigates the moderating effect of these two variables that may exist in the framework. In a more advanced note, it may also be interesting to investigate both mediating-moderating effects of these variables in a single study to make a comparison between the two, and perhaps this will provide a sound academic contribution.

Second, it is suggested that this study be replicated in a different research setting in order to provide confirmation of this study’s results. This research has provided evidence on a developing country, in this case Malaysia. Nevertheless, each particular country or region is unique and may have different settings on the studied variables. Therefore, replication of this study to other developing nations is welcomed to confirm further support and validate the evidence.

Third, in order to reduce the effect of socially desirable responses, it is suggested that information within an organisation is gathered through a multiple source of informants. For example, information received from the previous interviewees can be verified by soliciting other informants within the same organisation who have equal access to the same information and may thus help minimise this bias.

Finally, it is suggested that this study be replicated in a different timeframe to confirm the impact of technological capability on the studied dependent variables. This study was conducted when most of the organisations were still trapped in the economic downturn and thus might affect their investment in technological development and/or relationship performance. Therefore, it will be intriguing to inspect the association of the studied variables in a different continuum to compare and provide further understanding of this issue.

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APPENDICES

Appendix 1: Ethical clearance

USQ
AUSTRALIA

University of Southern Queensland

TOOWOOMBA QUEENSLAND 4350
AUSTRALIA
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OFFICE OF RESEARCH AND HIGHER DEGREES
Ashley Steele
Ethics Officer
PHONE (07) 4631 2690 | FAX (07) 4631 1995
EMAIL steele@usq.edu.au

Friday, 26 February 2010

Nor Azrin Md Latip
1/330 Spring Street
Toowoomba
QLD 4350

Dear Nor,

Thankyou for submitting your project below for human ethics clearance. The Chair of the USQ Human Research Ethics Committee (HREC) recently reviewed your responses to the HREC's conditions placed upon the ethical approval for the below project. Your proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and full ethics approval has been granted.

Project Title	The impact of technological capability on power, trust and inter-firm relationship performance
Approval no	H10REA012
Period of Approval	03/02/2010 – 03/02/2011
HREC Decision	**Approved**

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the HREC;
(b) advise the HREC (email: ethics@usq.edu.au) immediately if any complaints or expressions of concern are raised, or any other issue in relation to the project which may warrant review of ethics approval of the project;
(c) make submission to the HREC for approval of any amendments, or modifications to the approved project before implementing such changes;
(d) in the event you require an extension of ethics approval for this project, please make written application in advance of the end-date of this approval;
(e) provide the HREC with a written "Annual Progress Report" for every year of approval. The first progress report is due 12 months after the start date of this approval (by **03/02/2011**);
(f) provide the HREC with a written "Final Report" when the project is complete;
(g) if the project is discontinued, advise the HREC in writing of the discontinuation.

For (c) to (f) proformas are available on the USQ ethics website: http://www.usq.edu.au/research/ethicsbio/human

Please note that failure to comply with the conditions of approval and the *National Statement on Ethical Conduct in Human Research* may result in withdrawal of approval for the project.

You may now commence your project. I wish you all the best for the conduct of the project

Yours sincerely

Ashley Steele
Ethics Officer
Office of Research and Higher Degrees

Toowoomba • Springfield • Fraser Coast usq.edu.au

Appendix 2: Survey questionnaire

USQ
AUSTRALIA
UNIVERSITY OF SOUTHERN QUEENSLAND

8 Dec. 2010

Dear Sir/Madam,

<u>SURVEY ON TECHNOLOGICAL CAPABILITY, POWER, TRUST AND INTER-FIRM RELATIONSHIP PERFORMANCE</u>

I am a PhD student of University of Southern Queensland, Australia. I am conducting a research on "The impact of technological capability on power, trust and inter-firm relationship performance: An empirical analysis of Malaysian manufacturers".

The purpose of this study is to identify the association between these constructs within the manufacturer-major supplier context which is becoming more important in today's competitive business environment. Your response is very important in understanding these important business issues.

I would appreciate it if you could spend some of your precious time to answer the attached survey questionnaires. ***Your feedback will remain anonymous and be rest assured that your responses will be kept strictly confidential and will be used for the purpose of this research only.***

Upon completion, please return it to me via the self addressed envelope provided. I would greatly appreciate if you can return this survey before **20th Dec 2010**.

Thank you in advance for your cooperation. Any question related to this study can be directed to me at 03-92877355 (O) or 019-2411355 (HP) or via email at nor.azrin@fpe.upsi.edu.my

Yours faithfully,

(NOR AZRIN MD LATIP)
Ph.D Candidate
Faculty of Business
University of Southern Queensland

SURVEY ON TECHNOLOGICAL CAPABILITY, POWER, TRUST AND INTER-FIRM RELATIONSHIP PERFORMANCE

SECTION A: COMPANY INFORMATION

1. Which type of industry is your company involved in?
   - ☐ Automotive
   - ☐ Electrical & Electronics
   - ☐ Household product
   - ☐ Medical & Health
   - ☐ Oil & Gas
   - ☐ Chemical product
   - ☐ Plastic product
   - ☐ Paper & Stationery
   - ☐ Textile & Garment
   - ☐ Computer related product
   - ☐ Food & Beverages
   - ☐ Telecommunication product
   - ☐ Others (Please specify):___________________

2. Which of the following type best describes your company?
   - ☐ 100% local company
   - ☐ Joint venture company
   - ☐ Multinational Company (MNC)
   - ☐ Consortia
   - ☐ Others (Please specify):__________________________

3. How many employees are there in your company?
   - ☐ 1 – 50
   - ☐ 51 – 150
   - ☐ 151 – 500
   - ☐ Above 501

4. What is your company's paid-up capital? (in RM Million)
   - ☐ Up to 50
   - ☐ 51 – 150
   - ☐ 151 – 1000
   - ☐ Above 1001

5. What is your company's approximate annual sales turnover?
   - ☐ Up to $10 million
   - ☐ $11million – $25 million
   - ☐ Above $25 million

6. Approximately how many major suppliers does your organization have?
   - ☐ Less than 5
   - ☐ 5 – 10
   - ☐ 11 –15
   - ☐ More than 16

7. What is your company's approximate annual Research and Development (R&D) expenditure?
   - ☐ None
   - ☐ $6 – $10 million
   - ☐ Below $5 million
   - ☐ More than 10 million

8. Approximately what is your company's annual allocation on staffs' training and development?
   - ☐ None
   - ☐ $6 – $10 million
   - ☐ Below $5 million
   - ☐ More than 10 million

9. What is your company's annual allocation on acquiring new technological infrastructure?
   - ☐ None
   - ☐ $6 – $10 million
   - ☐ Below $5 million
   - ☐ More than 10 million

SECTION B

Part 1: Technological Capability

This section deals with your opinion on the level of technological capability possess by your firm. If you strongly agree with the statement, tick '7'. If you strongly disagree, tick '1'. If your opinion is less strong, tick one of the numbers in the middle.

	Factors	What is **your perception** of the current rating in your business 1 (Strongly disagree) 7 (Strongly agree)						
TC1	Our firm uses technology to increase the company's productivity.	□1	□2	□3	□4	□5	□6	□7
TC2	Our firm uses technology to lower the cost of production.	□1	□2	□3	□4	□5	□6	□7
TC3	Our firm uses technology to develop a number of new products every year.	□1	□2	□3	□4	□5	□6	□7
TC4	Our firm uses technology to modify features and specifications of existing products	□1	□2	□3	□4	□5	□6	□7
TC5	Our firm always makes relatively heavy investment in Research and Development activities.	□1	□2	□3	□4	□5	□6	□7
TC6	On-the-job training is provided frequently in our firm to improve the technical skills of employees.	□1	□2	□3	□4	□5	□6	□7
TC7	Our firm is qualified to attract and motivate talented experts in R&D.	□1	□2	□3	□4	□5	□6	□7
TC8	Our firm has strong capability to integrate external technological resources with our in-house resources.	□1	□2	□3	□4	□5	□6	□7
TC9	Our firm has strong capability to integrate internal technological competency with other in-house resources.	□1	□2	□3	□4	□5	□6	□7
TC10	Our firm has the skills needed to transmit information, skills and technology to our major suppliers.	□1	□2	□3	□4	□5	□6	□7
TC11	Our firm is skilful in absorbing and applying new technology to problem-solving.	□1	□2	□3	□4	□5	□6	□7
TC12	Our firm is one of the leaders in our primary industry to establish and upgrade technology standards.	□1	□2	□3	□4	□5	□6	□7
TC13	Our firm always use new technology to do something unique.	□1	□2	□3	□4	□5	□6	□7

TC14	Our firm always use technology to create new knowledge and competencies unavailable elsewhere.	□1	□2	□3	□4	□5	□6	□7
TC15	Our firm has accumulated stronger and various technological skills.	□1	□2	□3	□4	□5	□6	□7
TC16	Our firm always leads technology innovation of the principle industry in which we operate.	□1	□2	□3	□4	□5	□6	□7

Part2: Power

This section deals with your opinion on the type of power by your firm towards major suppliers. If you strongly agree with the statement, tick '7'. If you strongly disagree, tick '1'. If your opinion is less strong, tick one of the numbers in the middle.

	Factors	What is **your perception** of the current rating in your business 1 (Strongly disagree) 7 (Strongly agree)						
PW1	Our firm is viewed as a dominant partner with lots of technical experience by our suppliers	□1	□2	□3	□4	□5	□6	□7
PW2	Using our firm's unique competency to make the suppliers accept our recommendations.	□1	□2	□3	□4	□5	□6	□7
PW3	Our major suppliers often request technical advice from our firm.	□1	□2	□3	□4	□5	□6	□7
PW4	Our firm had specially trained people who really knew what had to be done	□1	□2	□3	□4	□5	□6	□7
PW5	Our major suppliers really admire the way we run our business and try to follow our lead.	□1	□2	□3	□4	□5	□6	□7
PW6	Our major suppliers go along with our request because they have similar feelings about the way a business should be run.	□1	□2	□3	□4	□5	□6	□7
PW7	Our major suppliers always want to be similar with our firm's opinions and values.	□1	□2	□3	□4	□5	□6	□7
PW8	Because our major suppliers are proud to be affiliated with us, they often do what we ask.	□1	□2	□3	□4	□5	□6	□7

Part 3: Trust

This section deals with your opinion on the level of inter-organisational trust between your firm and its major suppliers. If you strongly agree with the statement, tick '7'. If you strongly disagree, tick '1'. If your opinion is less strong, tick one of the numbers in the middle.

	Factors	What is **your perception** of the current rating in your business 1 (Strongly disagree) 7 (Strongly agree)						
TR1	Our major suppliers do not breach agreements to their benefit.	□1	□2	□3	□4	□5	□6	□7
TR2	Our major suppliers are always sincere and do not alter facts to get what they desire.	□1	□2	□3	□4	□5	□6	□7
TR3	Our major suppliers always carry out work/provide services with the standards and performance as agreed.	□1	□2	□3	□4	□5	□6	□7
TR4	Our major suppliers always try to inform us if problems occur.	□1	□2	□3	□4	□5	□6	□7
TR5	Our major suppliers always provide the correct information we require.	□1	□2	□3	□4	□5	□6	□7
TR6	Our major suppliers always listen and seriously respond to our proposals.	□1	□2	□3	□4	□5	□6	□7
TR7	Our major supplier is trustworthy.	□1	□2	□3	□4	□5	□6	□7
TR8	Our major supplier is always looking after our interest	□1	□2	□3	□4	□5	□6	□7
TR9	Our major supplier has always been even-handed in negotiation with us.	□1	□2	□3	□4	□5	□6	□7
TR10	Our major suppliers are always cooperative.	□1	□2	□3	□4	□5	□6	□7
TR11	Our major suppliers always treat us kindly.	□1	□2	□3	□4	□5	□6	□7
TR12	Our major suppliers commit to maintain and develop our relationships.	□1	□2	□3	□4	□5	□6	□7

Part 4: Inter-firm Relationship Performance

This section deals with your opinion on the inter-firm relationship performance between your firm and its major suppliers. If you strongly agree with the statement, tick '7'. If you strongly disagree, tick '1'. If your opinion is less strong, tick one of the numbers in the middle.

	Factors	What is **your perception** of the current rating in your business 1 (Strongly disagree) 7 (Strongly agree)						
IFR1	The relationship with the supplier has helped us to lower costs during new product development procedures.	□1	□2	□3	□4	□5	□6	□7
IFR2	The relationship with the supplier has helped us to increase product quality during new product development procedure.	□1	□2	□3	□4	□5	□6	□7
IFR3	Firm's average net profit has improved as a result of association with the supplier.	□1	□2	□3	□4	□5	□6	□7
IFR4	Firm's average sales growth rate has improved as a result of association with the supplier.	□1	□2	□3	□4	□5	□6	□7
IFR5	The growth rate of firm's market share has improved as a result of association with the supplier.	□1	□2	□3	□4	□5	□6	□7
IFR6	The relationship with the supplier has helped us to improve operational efficiency and thus increase our firm's performance.	□1	□2	□3	□4	□5	□6	□7
IFR7	The relationship with the supplier has helped us to maintain a high profit margin.	□1	□2	□3	□4	□5	□6	□7
IFR8	Firm's overall performance has improved as a result of association with the supplier.	□1	□2	□3	□4	□5	□6	□7
IFR9	The relationship with the supplier has benefitted our firm in terms of increasing the speed of new product development.	□1	□2	□3	□4	□5	□6	□7
IFR10	This relationship has made it possible for us to collaborate and share knowledge and expert advice with the supplier during the new product development stage.	□1	□2	□3	□4	□5	□6	□7

Invitation for Follow-up Interview

Would you like to participate in an interview session for the purpose of this study?

( ) Yes ( ) No

If yes, please provide the contact details as follow:

Name: ____

Company: ____

Location: ____

Telephone: ____

E-mail address: ____

Your assistance and contribution to this research study is highly appreciated. Please return the questionnaire in the reply paid envelope provided.

THANK YOU

Appendix 3: Consent form and interview checklist

INFORMATION AND CONSENT FORM FOR INTERVIEW PARTICIPANTS

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

This research seeks to examine the impact of technological capability on power, trust and inter-firm relationships performance on Malaysia's manufacturing companies within the supply chain context. The study also intends to investigate the mediating effects of firm's power and inter-organisational trust on the relationship between technological capability and inter-firm relationship performance. Data will be collected through survey and interviews.

With your permission, audio-taping of the interview to assist with transcription of your responses may occur. Confidentiality of all business information is assured. No identifying information on any staff member from your business will be made at any stage in this research. No questions of a personal nature will be asked, and no inconvenience or discomfort is expected. You are free to withdraw consent and to discontinue participation in the interview at any time.

In the short term (up to one year), the information collected from this meeting will be stored in a locked filing cabinet in the researcher's office, and after one year it will be destroyed.

This research is part of PhD study program managed by the University of Southern Queensland, Toowoomba, Queensland 4350. Any question related to this study can be directed to either Dr Latif Al-Hakim on (07) 46311254; email: hakim@usq.edu.au or to USQ Ethics via Email ethics@usq.edu.au.

Your cooperation and generosity in participating in this study is highly valued and appreciated.

Consent

I, the participant, have read the information contained in this form, and any questions I have asked have been answered to my satisfaction. I agree to participate in this meeting, realising that I may withdraw at any time. I agree that information and research data gathered for this study will be used in the development of my thesis. No personal identifying data will be used.

Participant: ________________________ **Date: ______________________**

Researcher:__________________________ **Date: _______________________**

INTERVIEW CHECKLIST

1. What is your current position in this company?
2. Which type of industry is your company involved in?
3. Formal company structure (for example private, public, listed)
4. How many employees are there in your company?
5. What is your company's paid-up capital?
6. What is your company's approximate annual sales turnover?
7. How many years your organization practiced supply chain?
8. How many major suppliers does your organization have?

Interviewee general comments on:

9. The importance of technological capability to the firm.
10. The firm's investment in research and development
11. The firm's capability in conducting research and development
12. The firm's current production capability
13. The firm's future plan in upgrading its production capability
14. The adoption of e-procurement technology in managing its material requisition.
15. The firm's investment in training and development especially for technical staffs.
16. Describe the existence of power in the relationship with suppliers as a result of firm's technological capability
17. Describe the firm's tendency of using such power towards the supplier in the relationship.
18. The tendency of extending their expertise and advice to the suppliers when needed.
19. The impact of technology implementation (i.e. e-procurement) towards the existence of trust in the relationship. How and why?
20. The issue of confidentiality in using the technology that might affect trust in the relationship.
21. Your comment on suppliers' honesty in supplying information and shows accuracy in meeting datelines.

22. Do you perceived an increase in the level of cooperation in your suppliers?
23. Your perception on the firm's competency level due to its technological capability.
24. Do the firm ever receive recognition (formal/informal) from the suppliers on its competency level?
25. Long term trading relationship with your suppliers?
26. Suppliers are committed in fulfilling contracts and exhibit cooperation.
27. Has the firm's technological capability increase the inter-firm relationship?
28. If yes then how it affects the overall performance?
29. Has the firm's technological capability increase the overall business performance? How and why?
30. Do the firm's include the suppliers in the research and development project especially in developing new products?
31. Do the suppliers play an important role in developing new products? How and why?

Appendix 4: Identification of multivariate outliers

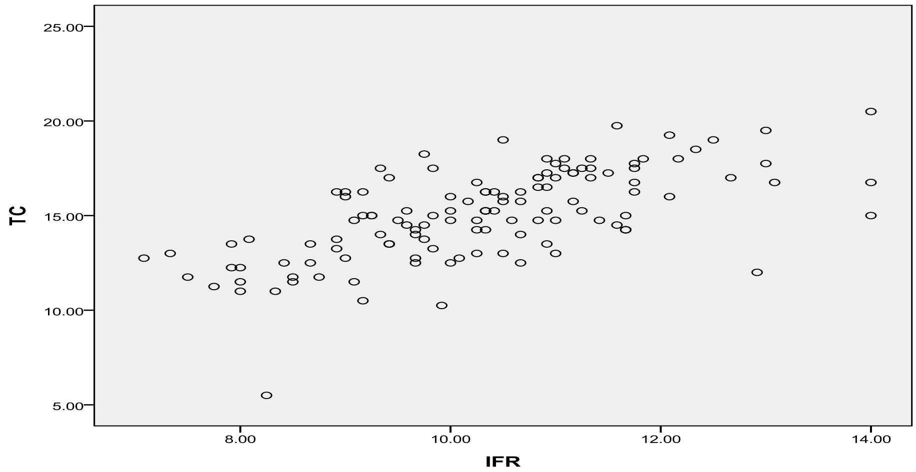
Case	D^2	*df*	D^2/df	*Significance*	Case	D^2	*df*	D^2/df	*Significance*
1	6.9341	11	0.6304	0.80	64	7.778	11	0.7071	0.73
2	5.431	11	0.4937	0.91	65	5.492	11	0.4993	0.91
3	14.109	11	1.2827	0.23	66	10.24	11	0.9314	0.51
4	7.2616	11	0.6601	0.78	**67**	**31.3**	**11**	**2.8452**	**0.00**
5	25.465	11	2.315	0.01	68	3.204	11	0.2913	0.99
6	3.8301	11	0.3482	0.97	69	2.676	11	0.2433	0.99
7	3.0803	11	0.28	0.99	70	11.04	11	1.0037	0.44
8	15.864	11	1.4422	0.15	71	12.08	11	1.0986	0.36
9	6.1772	11	0.5616	0.86	72	6.619	11	0.6018	0.83
10	9.3919	11	0.8538	0.59	73	11.72	11	1.0654	0.39
11	21.933	11	1.9939	0.02	74	4.848	11	0.4407	0.94
12	20.292	11	1.8447	0.04	75	7.549	11	0.6863	0.75
13	5.8881	11	0.5353	0.88	76	10.02	11	0.9112	0.53
14	7.8853	11	0.7168	0.72	77	6.059	11	0.5508	0.87
15	8.0586	11	0.7326	0.71	78	17.81	11	1.6195	0.09
16	11.888	11	1.0807	0.37	79	1.718	11	0.1562	1.00
17	12.653	11	1.1503	0.32	80	3.305	11	0.3005	0.99
18	16.618	11	1.5107	0.12	81	18.32	11	1.6658	0.07
19	3.9766	11	0.3615	0.97	82	10.47	11	0.9516	0.49
20	2.1982	11	0.1998	1.00	83	12.5	11	1.1362	0.33
21	3.3557	11	0.3051	0.99	84	2.366	11	0.2151	1.00
22	7.0207	11	0.6382	0.80	85	4.371	11	0.3973	0.96
23	8.2349	11	0.7486	0.69	86	6.558	11	0.5961	0.83
24	8.256	11	0.7505	0.69	87	17.54	11	1.5942	0.09
25	9.6337	11	0.8758	0.56	88	5.001	11	0.4547	0.93
26	5.342	11	0.4856	0.91	89	9.38	11	0.8528	0.59
27	5.217	11	0.4743	0.92	90	16.15	11	1.468	0.14
28	9.0952	11	0.8268	0.61	91	13.82	11	1.2566	0.24
29	6.3255	11	0.575	0.85	92	8.472	11	0.7702	0.67
30	9.0785	11	0.8253	0.61	93	6.872	11	0.6247	0.81
31	3.8298	11	0.3482	0.97	94	15.07	11	1.3699	0.18
32	7.7235	11	0.7021	0.74	95	17.53	11	1.5937	0.09
33	19.572	11	1.7793	0.05	96	25.33	11	2.303	0.01
34	10.447	11	0.9497	0.49	**97**	**37.76**	**11**	**3.4328**	**0.00**
35	6.2593	11	0.569	0.86	98	18.49	11	1.6806	0.07
36	10.644	11	0.9677	0.47	99	4.915	11	0.4468	0.94
37	8.5722	11	0.7793	0.66	100	4.521	11	0.411	0.95
38	10.5	11	0.9545	0.49	101	20.43	11	1.857	0.04
39	8.7692	11	0.7972	0.64	102	6.172	11	0.5611	0.86
40	20.65	11	1.8773	0.04	103	3.985	11	0.3622	0.97
41	6.3946	11	0.5813	0.85	104	4.43	11	0.4027	0.96
42	13.186	11	1.1987	0.28	105	7.235	11	0.6577	0.78
43	7.6115	11	0.692	0.75	**106**	**29.17**	**11**	**2.6518**	**0.00**
44	13.716	11	1.2469	0.25	107	9.528	11	0.8662	0.57
45	3.695	11	0.3359	0.98	108	14.99	11	1.3623	0.18
46	13.298	11	1.2089	0.27	109	11.6	11	1.0548	0.39
47	6.6756	11	0.6069	0.82	**110**	**35.61**	**11**	**3.2376**	**0.00**
48	9.486	11	0.8624	0.58	111	20.14	11	1.8312	0.04
49	17.587	11	1.5988	0.09	112	7.502	11	0.682	0.76
50	5.4352	11	0.4941	0.91	113	5.038	11	0.458	0.93
51	18.378	11	1.6707	0.07	114	3.729	11	0.339	0.98
52	15.611	11	1.4192	0.16	115	5.634	11	0.5122	0.90
53	11.023	11	1.0021	0.44	116	6.62	11	0.6018	0.83
54	7.0303	11	0.6391	0.80	117	10.28	11	0.9348	0.51
55	16.173	11	1.4702	0.13	118	2.672	11	0.2429	0.99
56	20.417	11	1.8561	0.04	119	5.159	11	0.469	0.92
57	12.16	11	1.1054	0.35	**120**	**31.09**	**11**	**2.8267**	**0.00**
58	3.0231	11	0.2748	0.99	121	6.767	11	0.6152	0.82
59	11.243	11	1.0221	0.42	122	9.673	11	0.8794	0.56
60	10.334	11	0.9394	0.50	123	5.284	11	0.4804	0.92
61	6.3578	11	0.578	0.85	124	25.83	11	2.3481	0.01
62	12.163	11	1.1057	0.35	125	19.97	11	1.8156	0.05
63	9.3877	11	0.8534	0.59	126	19.7	11	1.7913	0.05

Appendix 5: Distribution characteristic and test of normality

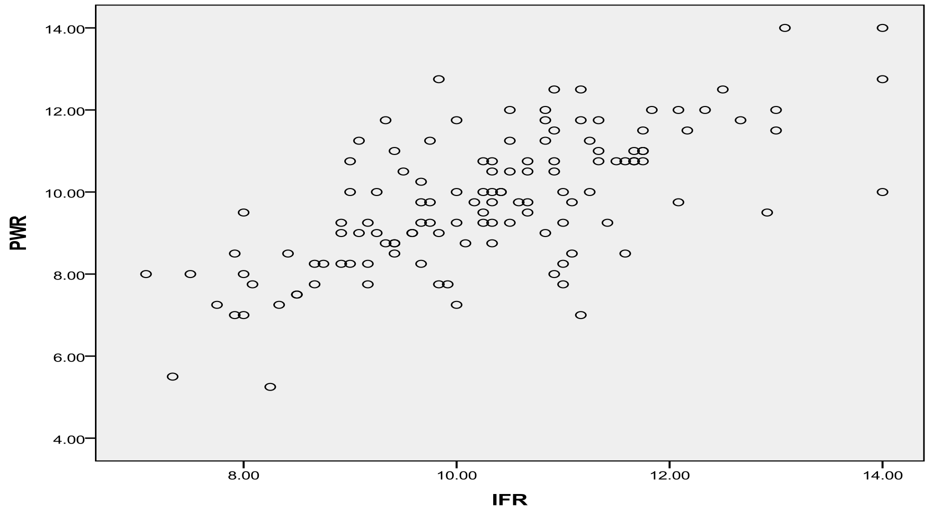
	Skewness	Kurtosis	Test of Normality				
Variable	**Statistics**	**Statistics**	**Kolmogorov - Smirnov**	**Significance**	**Shapiro-Wilk**	**Significance**	**Distribution's Description**
Technological Capability	-0.469	1.015	0.058	0.200	0.979	0.045	Normal distribution
Power	-0.019	-0.109	0.068	0.200	0.991	0.552	Normal distribution
Trust	-0.199	-0.116	0.052	0.200	0.994	0.840	Normal distribution
Relationship Performance	0.213	0.037	0.042	0.200	0.990	0.501	Normal distribution

Appendix 6: Homoscedasticity and Linearity Test

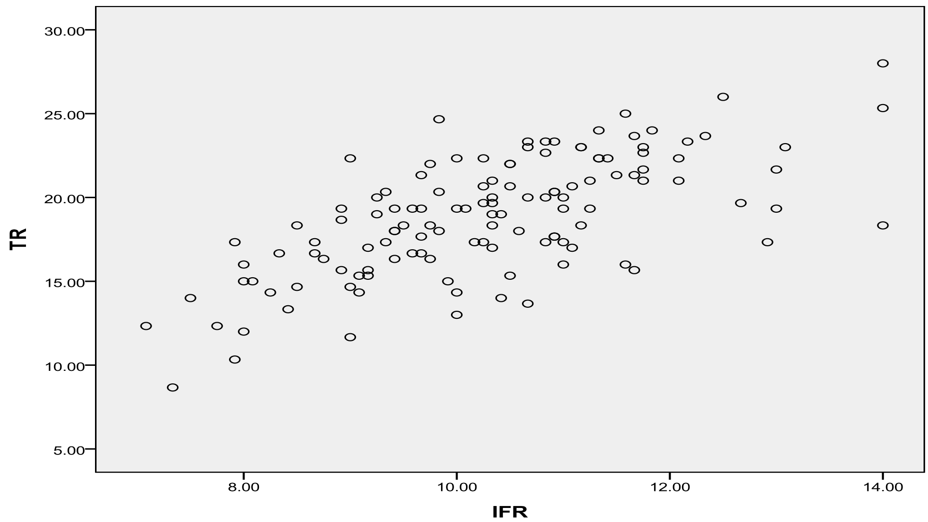
Technological capability



Power



Trust



Appendix 7: Rotated component matrix

Items	Rescaled Component 1	2	3	4	5	6	7	8	9	10
IFR7	.697									
IFR6	.695									
IFR5	.618									
IFR3	.606									
IFR4	.595									
IFR8	.579									
TC13		.739								
TC3		.627								
TC14		.621								
TC1		.618								
TC2		.559								
TC4		.545								
TR4			.851							
TR3			.844							
TR1			.729							
TR2			.700							
TR6				.797						
TR7				.785						
TR8				.679						
TR5				.678						
TR9					.809					
TR12					.763					
TR11					.636					
TR10					.626					
TC7						.770				
TC5						.731				
TC6						.726				
TC12*										
TC9							.843			
TC8							.790			
TC11							.628			
TC10							.602			
PW2								.832		
PW3								.564		
PW1								.522		
PW4*										
IFR2									.720	
IFR1									.718	
IFR9*										
IFR10*										
PW6*										
PW5*										
PW7										.616
PW8										.610

*Denotes item loadings below 0.50