UNIVERSITY OF SOUTHERN QUEENSLAND

THE ROLE OF TECHNOLOGY ATTRIBUTES, TRUST AND DEPENDENCY ON E-PROCUREMENT ADOPTIONS: AN EMPIRICAL ANALYSIS OF MALAYSIAN MANUFACTURERS

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ABSTRACT

Firms may gain benefit from each other's skills and resources when they engaged in a long term supply chain relationship, hence, improving their competitive advantage. Adoption of information technology initiatives such as e-procurement systems may further enhance the effectiveness of the relationship. Trust and dependency factors have been identified as important elements that influence business relationships. The objective of this study is to investigate the role of technology attributes, inter-organizational trust and inter-organizational dependency manufacturer's have towards their suppliers and customers when making an e-procurement adoption decision. This study also aims to determine if there is a critical gap between trust and dependency towards suppliers and customers and to identify which trust and dependency constructs have the most critical gap. Data was collected through case study interviews and mail survey questionnaires. It was analysed using the Partial Least Square Regression (PLS) analysis where the results indicate that dependency did have a significant positive influence on e-procurement adoption decisions, while trust did not. Size of the company, which is a control variable, has a significantly negative effect on adoption decision. Hence, this study confirmed that the level of dependency and size of company did influence an e-procurement adoption decision. Three gap analysis methods, namely the T-test analysis, weighted mean gap and the un-weighted Important Performance Analysis (IPA), were adopted and the results indicate that there is a significant gap between trust and dependency towards the supplier and customer, where the level of both variables are higher towards the customer than the supplier. Construct related to communication of problem is identified as trust factor with the most critical gap, while how partners help improve a firm's reputation and the level of knowledge transfer have the most critical gap for dependency. This study extends the body of literature related to information technology adoption factors by investigating the effect of trust and dependency in supply chain relationships within a single study. While findings on dependency and size of company are consistent with previous studies, findings on trust provide a new paradigm to trust-related studies as it is identified as not an important factor that influence e-procurement adoption decisions, particularly in a developing country such as Malaysia.

CERTIFICATION OF DISSERTATION

I certify that the ideas, case study work, results, analysis, software and conclusions reported in this dissertation are entirely my own efforts, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for another award, except where otherwise acknowledged.

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Signature of Candidate **Date**

ENDORSEMENT

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Signature of Supervisor **Date**

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LIST OF ABBREVIATIONS

AVE	Average variance extracted
B2B	Business to business
B2C	Business to consumer
CIOS	Customer based inter-organizational systems
CPFR	Collaborative planning, forecasting and replenishment
IT	Information technology
EDI	Electronic data interchange
ERP	Enterprise resource planning
FMM	Federation of Malaysian Manufacturers
GSK	GlaxoSmithKline
IP	Internet provider
IPA	Importance performance analysis
ISP	Internet service provider
JIT	Just-in-time
MRO	Maintenance, Repair and Operating Materials
MRP	Material requirement planning
MYR	Malaysian Ringgit
PLS	Partial least square
RFID	Radio frequency identification technology
SCM	Supply chain management
SME	Small and medium enterprise
SPSS	Statistical Packages for Social Science
TQM	Total quality management
US	United States
VMI	Vendor managed inventory
VoIP	Voice over internet protocol
XML	Extensive markup language

CHAPTER 1: INTRODUCTION

1.0 Introduction

In today's competitive business environment, firms increasingly engage in strategic alliances and partnerships with their business partner to survive. Within the manufacturing supply chain, manufacturers and their supply chain partners are working together in a close alliance to gain benefit from each others skills and resources for mutual benefit. Developments in information and communication technology, especially the Internet, help make this partnership more effective through the integration of firms' information technology (IT) infrastructure. At the same time, IT also provides firms with new ways of managing a complex business supply chain within a very competitive environment, especially through the creation of e-business. E-business is also expected to generate new wealth and transform the way business is conducted in unprecedented ways (Amit & Zott 2001). One of the components of e-business that helps revolutionise supply chain activities is e-procurement.

E-procurement refers to the use of information technologies to facilitate business-to-business purchase transactions for materials and services (Fang, Zsidisin & Ross 2007). Sain, Owens and Hill (2004) described e-procurement as the electronic integration and management of all procurement activities, including purchase request, authorization, ordering, delivery and payment between a purchaser and a supplier. The switch to e-procurement is likely to provide better returns on investment for companies (Hawking et al. 2004). It is also expected to improve overall purchasing efficiency, streamline the purchasing process, and reduce purchasing processing times (Prier & McCue 2007). At the same time, relevant data can also be shared, queried and analysed through the value chain, achieving substantial benefits and bettering the performance of the whole system (Bottani & Rizzi 2005). It also allows both the manufacturer and their supplier to electronically check available inventory, negotiate price, issue an order, check the status of the order, issue an invoice and receive payment (Coyle, Bardi & Langley 2003).

The benefits and improvements delivered by e-procurement encourage supply chain partners to adopt and link their procurement activities together electronically. The case of Covisint, a joint e-procurement initiative sponsored by General Motors, Ford, Daimler Chrysler and Renault-Nissan, with a turnover of $250 billion and involving 60,000 suppliers, provides a useful example. Vendors such as Dana Corporation, which supplies parts for these automobile manufacturers, agreed to participate in order to continue servicing these companies (Neef 2001). Volkswagen also established its own private e-market system known as VWgroupsupply.com that integrates and provides suppliers with real time information on production plans so that suppliers can better utilise their production capacities and other resources (David, Phillip & Edith 2003). GlaxoSmithKline (GSK) implemented a global e-procurement tool to minimise purchase spending and to facilitate negotiations with suppliers. The system consists of an online ordering system, content aggregators, and internally developed decision-support tools. It allows GSK to implement reverse auctions, to send requests for information, to collect sealed bids, to analyse complex bids and to optimise sourcing decisions. It is estimated that GSK negotiates 90

percent of its annual spending online relative to an industry average estimated between zero to 15 percent (Kulp et al.2006).

The adoption of e-procurement systems by companies is expected to grow as Forrester, the reputable independent research company, expected that the market for e-procurement software—also called spend management or supplier relationship management solutions—will grow at a compound annual growth rate of 10% from 2003 to 2008. Larger enterprises are much more likely to have acquired e-procurement solutions, but adoption is starting to occur among small and medium-size businesses as well. Even the adoption by large firms is not complete, as more than 25% of the Global 2000 companies do not use e-procurement (Bartels, Leaver & Lo 2007).

1.1 Research problem

Procurement is an element of the supply chain that has previously been characterized as a slow manual business procedure and at the same time involves problems such as inaccurate data entry, errors in ordering, costing and invoicing. These problems are time consuming and can be very costly to trace (Castelli 2007; Hawking et al. 2004; Le Seuer & Dale 1998). Manufacturers then realized that these issues could be rectified by having a link with all their suppliers and customers through private networks such as electronic data interchange (EDI). The Internet then provided a much better platform for companies and supply chain partners can now link their IT infrastructures together, allowing complicated business processes such as procurement activities to be held electronically and efficiently. Tohamy et al. (2005) investigated the investments in procurement and sourcing solutions among more than 700 Asia Pacific businesses and government agencies. They discovered that only 23% of firms surveyed were either considering an investment in, or already piloting or sourcing procurement solutions. Another 19% have already deployed or are currently upgrading their sourcing and procurement solutions. Singapore leads the Asia Pacific countries, with 67% of the firms' surveyed being in the process of rolling out or implementing sourcing and procurement solutions. This indicates that the overall adoption of e-procurement among companies within the Asia Pacific region is relatively low. Even in one of the most recent studies, Saliba (2008) identified that only 38% of European businesses use the Internet to buy goods and services, while another 9% said that they have ruled out the option of using the Internet as a purchasing channel. Therefore, it is important to study the reasons or factors that encourage companies to adopt e-procurement systems and at the same time understand why companies do not use them.

Deciding whether to adopt an information technology initiative such as e-procurement is a significant decision to make as, most of the time, it is somewhat expensive and risky (Zhu et al. 2006; Eastin 2002). Many companies have painful experiences of being forced to change and simultaneously employ or upgrade IT in their operations. Often, companies found that they ended up in a situation where IT hindered their ability to change, rather than acting as a supporting or enabling factor (Mutsaers, Zee & Giertz 1998). It is, therefore, very important for managers to consider their business needs and motivations before making an adoption decision. Examination of the literature reveals that there are various reasons or factors that could influence information technology adoption decisions in companies, such as technological factors (Rogers 1995), social and organisational factors (Patterson,

Grimm & Corsi 2003; *Purchasing* 2007; Mallinckrodt et al. 2006) and behavioural factors (Ehigie & McAndrew 2005). Most of these studies concentrate on one group of factors only. This study will incorporate two adoption factors, which are the technological and organizational factors. Technological factors refer to the attributes of the technology itself, while the two organizational factors are the level of inter-organizational trust and the level of inter-organizational dependency manufacturers have over their supply chain partners.

The importance of trust towards a successful supply chain relationship or business to business (B2B) environment, especially between supplier, manufacturer and buyer, is widely acknowledged in the academic literatures. De Jong and Woolthius (2008), for example, study the antecedents and performance effects of trust in high-tech alliances; Myhr and Spekman (2005) study the collaborative supply-chain partnerships built upon trust and electronically mediated exchange; while Zineldin and Jonsson's (2000) study how trust influences supplier-dealer relationships in the Swedish wood industry. A high level of trust between all parties involved in this supply chain relationship is required, as the implementation of interconnected information systems to support inter-organizational collaboration will involve a high level of information sharing between them (Anupam & Jane 2008; Hoyt & Huq 2000). However, the importance of the trust factor when other organizational factors such as dependency and the firm size were taken into consideration has yet to be explored empirically. The previous cases of Covisint, Volkswagen and GSK, as discussed in the introduction section, indicate that the trust factor could be irrelevant when supplying firms are required to use an e-procurement system by their business partner.

The latter supported prior research which recognized that dependency within a business to business relationship is also an influential factor on that relationship (Zhuang & Zhou 2004; Svensson 2004). Within the supply chain point of view, firms that have leverage over their supply chain partners might have the capacity to influence those partners who depend on them for business to adopt an information system such as e-procurement (Hart & Saunders 1997). Increased complexity in managing supply chain activities requires an integrated information system, which results in increased dependency between supply chain partners. Imbalance in this level of dependency might cause feelings of insecurity among managers of less powerful companies as they feel that they are no longer in control of their firm's decisions. This was evident when Wal-Mart announced that they would require all their suppliers to implement radio frequency identification technology (RFID) on every box and pallet shipped to Wal-Mart by 2005 (Boyle 2003). Suppliers have no choice but to comply with this requirement if they want to continue doing business with Wal-Mart, as Wal-Mart will not conduct business with firms that do not have the technology in place.

However, the impact of dependency is not always negative. Dependency between business activity in the supply chain could also lead towards better cooperation and coordination between companies in order to achieve internal and, in some cases, mutual goals (Lambert, Cooper & Pagh 1998). This necessity of cooperation and coordination is likely to lead to the usage of a common IT infrastructure. In procurement activities, it is expected to lead to the adoption of a common

e-procurement system between all supply chain partners, and this study will seek to determine how important the dependency factor is compared to other factors.

Dependency could also create power imbalances in supply chain relationships where one of the partners might have more power than another. This situation can harm the relationship as it becomes unstable and in danger of becoming fief-like, where suppliers or buyers are tied-in to powerful, dominant partners (Blois 1997). Therefore, it is important for firms to identify whether power imbalances exist in their relationships. Gap analysis, which can measure and identify whether there is any critical gap in a business relationship, is a useful tool if the company wants to create a well-balanced and long-lasting relationship with their partner. Based on the analysis, managers can identify which areas have a critical gap and then try to reduce this gap by taking the necessary action. Power imbalances can be reduced by stipulating a long-term contract, entering a joint venture, or, at the extreme, merging with the dependent organization. This will result in the dominant party losing part or all of its discretion over the allocation of its critical resource to the dependent party (Blois 1997).

1.2 Research questions

Based on the above problem statement, the underlying research question for this study is follows:

Whether and to what extent did the attributes of technology, inter-organizational trust and inter-organizational dependency influence an e-procurement adoption decision in supply chain relationships?

Therefore, the research objectives derived from the above research questions are:

1.0.1 To examine the relationship between the attributes of technology and e-procurement adoption decisions.

1.0.2 To examine the relationship between the level of inter-organizational trust and e-procurement adoption decisions.

1.0.3 To examine the relationship between the level of inter-organizational dependency and e-procurement adoption decisions.

1.0.4 To examine the interaction impact of attributes of technology, inter-organizational trust and dependency with the e-procurement adoption decisions.

1.0.5 To determine whether there is a critical gap between the level of trust and the level of dependency towards supply chain partners.

1.3 Research significance

There are several reasons for this study. First, there are many studies on the factors that encourage adoption of various e-business technologies, specifically in supply chain, such as adoption of mobile e-commerce (Wu 2003), electronic data interchange (Hart & Saunders 1997), electronic marketplace (Son & Benbasat 2007; Shan, Archer & Wuping 2006), and radio frequency identification or RFID (Boyle 2003). However, limited attention is given by researchers to the factors that influence e-procurement adoption, which is another type of e-commerce technology. Therefore, this study is deemed necessary as e-procurement is one of the important elements in supply chain management nowadays. It is important to fill this gap in the literature because each e-business application has a different characteristic. Important

factors that have been identified as important determinants in other e-business system adoptions could be different from the factors that influence e-procurement adoption decisions, as each system serves a different function.

Second, the supply chain relationship is a dyadic relationship that involves many parties such as suppliers, manufacturers, buyers (retailer, wholesaler) and consumers. Previous studies on IT or e-commerce adoption mostly study the perception of only one party. This study looks at manufacturers' perceptions of trust and dependency towards both their suppliers and customers so that a comparison can be made in order to find out which partners have more influence on e-procurement adoption decisions. Understanding these relationships from multiple views will ensure effective adoption, and cultivate stronger supply chain relationships that will last for a long time.

Third, the findings of Forrester's study, as discussed by Tohamy et al. (2005), indicate that only 19% of companies in the Asia Pacific that participated in the study have either deployed, or are currently upgrading, their sourcing and procurement solutions. It shows that adoptions by companies in this region are rather low. Besides concentrating on the adopters of e-procurement to study the influence of technology attributes, trust and dependency, this study will also endeavour to identify the reason for non-adoption of e-procurement systems among non-adopters. The findings are expected to assist business managers or policy makers in creating policies targeting appropriate factors that hinder the adoption of e-procurement system in their organisations.

1.4 Research Methodology

The research methodology for this study consists of four different stages, as outlined below.

The first stage of this study involved an extensive literature review to identify gaps in the literature and to understand the theories that will guide the conduct of this study on e-procurement adoption among supply chain members. The second stage involved case study interviews, conducted with key informants from 10 manufacturing companies. The interview process involved open-ended questions that required the interviewee to explain the background of the company, the procurement process and any kind of system that they use, followed by their perception of how technology attributes, the level of trust and the level of dependency factors influence e-procurement adoption decisions.

The third stage was the quantitative data collection process involving a survey questionnaire. Two versions of the survey questionnaire were prepared, which included an online and a postal mail questionnaire. The survey was developed based on findings from the previous research and also the findings from the exploratory case study. The fourth stage was the data entry and analysis process of the 104 questionnaires returned by the respondents. Data was coded into SPSS (Statistical Packages for Social Science) version 16 before it was transferred to SmartPLS software version 2.0 to test the research model and the hypothesis of the study. The same data was also analysed using SPSS for gap analysis where a paired sample T-Test method was employed to test if there was any significant difference between mean of supplier and buyer data. In order to identify the critical gaps for the trust and

dependency factors, two other gap analysis methods were conducted; the weighted mean gap analysis and unweighted importance performance analysis (IPA) matrix analysis. The final stage was the writing up process, mainly discussing the findings generated from data analysis stage, and to draw conclusions from the outcomes of the study.

1.5 Key Definitions

Technology adoption: The mental process through which an individual passes from first hearing about an innovation to final adoption (Rogers 1995). In an organizational setting, technology adoption decisions are made by some decision makers who have resources and the decision rights to change behaviours, or control resources associated with development practices (Mustonen-Ollila & Lyytinen 2003).

Dependency: The degree to which the target firm needs to maintain its relationship with the source in order to achieve its desired goals (Kale 1986) or, the extent to which the dealer depends upon the major supplier for service, product warranty, advertising, response to emergency orders and the timing of new product development (Jonsson & Zineldin 2003).

Internet: A huge network of computer network spanning the globe *(World Almanac & Book of Facts* 2008)

Procurement/Purchasing/Supply management: The process of acquiring goods and services for business (Quinn 2005).

E-procurement: E-procurement means applying the procurement process electronically via connected infrastructure such as Intranet and Internet based platforms (Coyle, Bardi & Langley 2003).

Supply chain: The collection of functional activities through which raw materials are converted into finished products for sale to a customer (Ballou 2003).

Trust: Trust is the willingness to rely on another party and to take action in circumstances where such action makes one vulnerable to the other party (Doney, Cannon & Mullen 1998).

1.6 Delimitations of scope

There is some delimitation of the scope of this study to ensure that it concentrates on the research questions and objectives only. First, the supply chain—also known as the logistics network—encompasses a network of many different firms that act as suppliers, manufacturers, warehouses, distribution centres and retail outlets (David, Phillip & Edith 2003). The interest of this study is on the supply chain relationships that exist between manufacturers, their suppliers and customers only. The term customers refers to buying companies such as distributor, wholesaler or retailer, and not the consumer/end user. There is some debate that exists where the term supply chain is referred to as limited to the supplier relationship and does not involve the customer or distribution process. However, the traditional term supply chain is used in this study, as it is readily understood and emphasises the interconnected nature of the various functional activities involved in supplying of materials and goods or

services beginning from the supplier up to the customer (McLaren, Head & Yuan 2002). It reflects the needs to coordinate both the management of product supply (materials management) and subsequent product deliveries (distribution) activities (Ballou 2003). At the same time, this study will also concentrate on how the level of trust and dependency influence adoption decisions in the implementation of e-procurement systems only—and not other e-business or e-commerce application in general, or any other specific type of application.

Second, study of technology adoption can be divided into two areas, namely, individual or organizational adoption (Premkumar & Potter 1995). This study focuses on organizational adoption decisions, therefore, factors influencing individual adoption decisions will not be considered. All relevant theories in this study consist of multidimensional constructs. Third, Rogers (1995) identified five variables that determine the rate of adoption: attributes of technology; type of technology; communication channels; the nature of the social system; and change agent's promotion efforts. However, this study will examine only one of the variables, which is technology attributes. Technology attributes itself consists of five dimensions: relative advantage, compatibility, complexity, trialability and observability. Organizational power, which is mostly referred to as the source of power in the literature, includes dependency power (Emerson 1962), reward power, coercive power, legitimate power, referent power, expert power and information power (French & Raven 1959). This research is interested in determining how dependency influences adoption.

Finally, trust and dependency are multi-dimensional constructs and a number of dimensions have been identified by researchers for both variables. However, there is no prior research that has studied each and every dimension at the same time. A common strategy is to choose dimensions that are appropriate for the research questions (Mallinckrodt et al. 2006). Based on the above argument, this study will incorporate some dimensions that relate to the research questions only, and they will be determined via case studies.

1.7 Structure of the dissertation

This first chapter has discussed the background of this study which includes the research problem, research questions, significance of this study, research methodology, and definition of key terms used throughout this dissertation. The second chapter discusses the relevant literature on supply chain relationships and e-procurement, followed by the theoretical underpinnings that constitute this research. Previous study within this area of research is also discussed before the relevant gap in literature is identified. Based on the literature review, a theoretical framework is developed and discussed, together with the hypothesis of study in chapter three.

Chapter four reviews the research methodology approach used during the course of this study for data collection and analysis. It includes the procedures taken to develop the instrumentation for both the qualitative and quantitative data collection methods. The sample selection and questionnaire development processes are then discussed, followed by a discussion of the data analysis technique used in this study.

Chapter five presents the findings from the qualitative data collection, which is the first phase of this study. All information gathered through the case study interviews with the ten manufacturers are discussed in detail. A summary of the findings from case study interviews are then provided. Chapter six is an additional chapter added to discuss the changes in the research questions, objectives and theoretical framework of the study based on the findings from the case study interview. A new list of hypotheses to be tested is also presented.

Chapter seven discusses the empirical findings from the quantitative data analysis gathered through the survey questionnaires, while the final chapter (chapter eight) concludes with a discussion of the findings, conclusions and implications of the study. Limitations and suggestions for future research are then discussed.

1.8 Conclusion

While the study on technology attributes, trust, and dependency influence on information technology adoptions have been explored by previous studies, none have ever endeavoured to investigate the joint impact of all these three factors on adoption, or to identify which factor is more important than another. Furthermore, there are relatively few studies that particularly concentrate on e-procurement adoption. This study seeks to fill that gap in the literature and enhance the body of knowledge on factors that influence adoption decisions, specifically by looking at the e-procurement system adoption, a system that revolutionises the purchasing process specifically, and supply chain activities as a whole.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter will review some of the relevant literature on supply chains, e-procurement and factors that influence adoption decisions. It starts with a brief outline on the meaning of supply chain and why firms engage in supply chain relationships with their partners. It is followed by a discussion of how information technology impacts supply chain activities, before a specific glimpse at e-commerce and e-procurement—which are the main concerns of this study. The next section is then dedicated to discussion of all the related theories and previous studies that relate to the context of this research. The gap in the literature that this study tries to fill is then discussed.

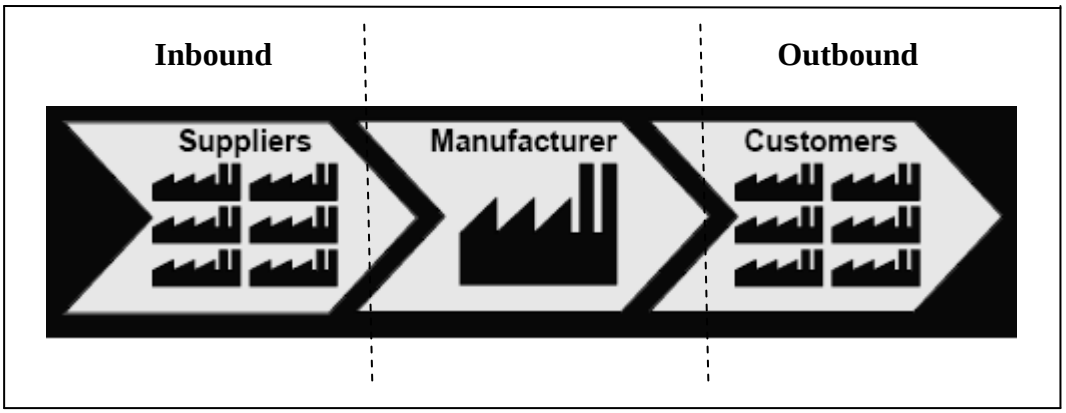
2.1 Supply chain management

A supply chain is a network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the production, delivery, and sale of a product to the consumer. The supply chain is typically made up of multiple companies who coordinate activities to set themselves apart from the competition. It involves the coordination of an organization's internal planning, manufacturing and procurement effort with the company's external partner (McLaren, Head & Yuan 2002). Supply chain management (SCM), therefore, is defined as a methodology to improve business efficiency in finding raw materials and components for a business product or service and delivering it to the customer (Victoria Government 2004). Proper management of supply chain activities is important as it may serve as a source of competitive advantage (Ireland & Webb 2007). A supply chain is not just a chain of businesses with one-to-one business-to-business relationships, but a network of multiple businesses and relationships. SCM offers the opportunity to capture the synergy of intra- and inter-company integration and management. In that sense, SCM deals with total business process excellence and represents a new way of managing the business and relationships with other members of the supply chain (Lambert, Cooper & Pagh 1998). Currently, collaborative supply chain management is becoming the focus of firms, as it not only improves competitive advantage, but may also help reduce information imbalance that might lead to the bullwhip effect—which happens when a small variability in orders at each stage of the supply chain will cause an excessive swing in different demand or inventory-stocking points throughout the supply chain (Paik & Bagchi 2007). Collaborative supply chain may also helps increase market responsiveness and improve customer service (Ballou 2003; Coyle, Bardi & Langley 2003). The next section will discuss these reasons for entering into a supply chain relationship in detail.

2.2 Rationale for supply chain relationship

Businesses previously were often vertically integrated, where they performed sourcing, warehousing, sales and logistics functions by themselves. However, vertical integration had almost disappeared by the late 1990s as organizations started to outsource some functions and to include their external partners in their supply chain (McLaren, Head & Yuan 2002). A company supply chain can be differentiated into two separate functions: inbound logistics and outbound logistics (Figure 2.1). Inbound logistics encompasses activities such as receiving, storing and supplying raw materials, between suppliers and manufacturers. Outbound logistics meanwhile

is associated with the storage and distribution of physical goods produced by manufacturing companies to their customers (Bharati & Chaudhury 2006).



(Source: Adapted from www.smartlink.net.au)

Figure 2.1: Supply chain relationships

Managing complex inbound and outbound supply chain activities with large numbers of suppliers and customers is an enormous task, especially when the supply chain expands across the globe. Firms are realizing that opportunities for growth lie in the global arena, specifically in developing or emerging markets such as Asia or Latin America (Ueltschy, Ueltschy & Fachinelli 2007). Cross border supply chain relationships are gaining popularity as firms learn that this can lead to reduced cost and create competitive advantage (Pearcy, Parker & Larry 2008; Ireland & Webb 2007). Rudzki et al. (2005) identified the cost associated with procurement activities to be anywhere between 30 percent to as high as 70 percent in some industries such as automotive and chemicals. Therefore, many successful organizations have taken the initiative to cooperate with their partners on both sides of the supply chain to minimize procurement costs (Porter 1987). Cost reduction can be achieved as the implementation of e-procurement system has a direct effect of the elimination of middlemen and the elimination of transaction-related costs (Wyatt & Graw 2002). Transaction related costs can also be minimised as e-procurement allows the company to conduct a paperless transaction by using a cheaper means of communication such as e-mail, rather than through telephone or facsimile machine

Thus, the supply chain relationship is not only necessary; but it is viewed as a critical success factor in achieving a sustainable competitive advantage (Bajwa et al. 2008). Supply chain relationships are expected to provide better return on investments and assets, and increased reliability and responsiveness to market needs (McLaren, Head & Yuan 2002). Effective and well-synchronised supply chain activities between partners can improve customer service through the reduction in replenishment lead time (Chandra & Grabis 2008; Ward & Honggeng 2006); process, inventory, and product cost reductions, as well as increased cycle times, service levels, and market intelligence (McLaren, Head & Yuan 2002); and elimination of excess inventories, improvement in product design and development, better marketing coordination, optimized delivery speed and frequency, and better after sales support (Lee & Whang 2001). This can help steer a company ahead of their competitors, hence, improving their competitive advantage.

Another reason why firms engage in supply chain relationships is to capitalize on each others' skills and resources through resource sharing to develop better products and services (Samaddar & Kadiyala 2006). These resources include technical/information technology, financial and even human resources that the other company has. Besides resources, all partners throughout the value chain can also share and react to concurrent information such as changes in product specification, inventory level, production forecasts, order information, customer demand and forecast (Mohtadi 2008, Mukhopadhyay, Yao & Yue 2008). Sharing of concurrent information is important as it can reduce the bullwhip effect (Paik & Bagchi 2007). By having the demand information available to all parties involved, the bullwhip effect can be reduced as each partner in the supply chain knows about customer demand and they can make an exact forecast on the level of inventory required to effectively maintain production levels (Ouyang 2007).

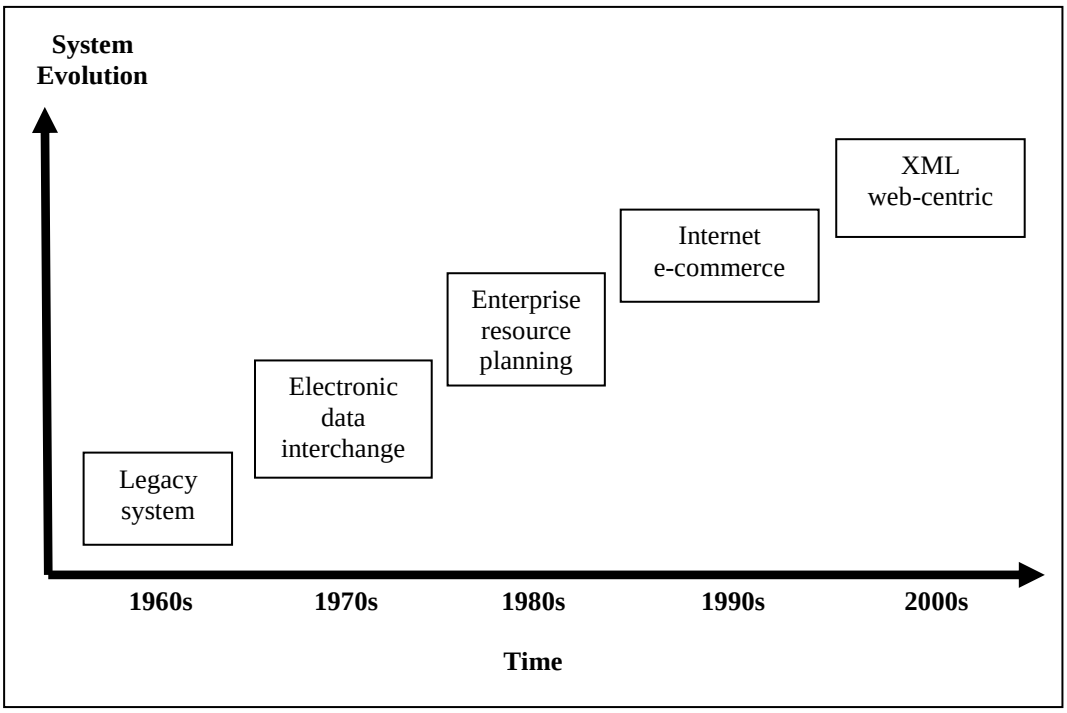
Final reasons for the formation of supplier-manufacturer-customer relationships are to exploit the new opportunities offered by developments in information and communication technology. The constantly improving power and processing capability of microelectronics, telecommunications, computers and network orientated software has provided the infrastructure for the new global information economy to operate. The compression of space, time and knowledge allows for unprecedented reach, speed and complexity in the management of the network-orientated supply chain (Moodley 2002) and companies that fail to take this advantage will be left behind by their competitors.

2.3 The impact of information technology on the supply chain

Rapid development in information and communication technology has had a great impact on supply chain management. Organizations focus their attention on information and communication technology to reduce any inefficiency within their supply chain and to integrate their system and process with their supply chain partners (McLaren, Head & Yuan 2002). The development of the Internet further supports supply chain relationships as it offers a seamless coordination of supply chain activities.

Supply chain information technology has evolved over time from a single computer environment into a more complex system that integrates each and every party involved in a firm's supply chain (Figure 2.2). It all started with a legacy system, which consisted of mainframe computers that processed transactions for isolated functions such as order entry, inventory control or accounting (Michaud 1996). It did not facilitate any coordination and collaboration between buyers and sellers, and business transaction at this stage were more arms' length in nature. Technology then continued to develop and create what was known as electronic data interchange (EDI) that allows trading between supply chain partners through a dedicated network that links both companies together (Sanchez & Perez 2003). However, EDIs only exchange transaction data with pre-arranged partners and is costly for small business. Next came the era of the enterprise resource planning (ERP) system, which was capable of integrating functional areas within enterprises at the operational level. ERP consists of a software package that uses database technology to control and integrate all the information related to a company's business, including customers, suppliers, products, employees and financial data. A single enterprise-wide database is used in which all business transactions such as inventory management, customer

order management, production planning and management, distribution, accounting, and human resource management are entered, recoded, processed, monitored and reported (Falk 2005). However, critics argued that ERP has weak analytical capabilities and it is considered costly to implement.



(Source: Developed for this study)

Figure 2.2: Supply chain information technology evolution

The 1990s mark the dawn of the Internet era and it started to have a significant impact on supply chain management too. The term business-to-business (B2B) and business-to-consumer (B2C) is gaining popularity as the Internet provides a platform for supply chain integration with suppliers and customers at a reasonable cost (Laudon & Laudon 2006). Companies now not only share information on simple operational and financial data, but also on vital strategic information such as forecasting, strategic goals and new product design, to maximize the potential from supply chain partnership (Kwon & Suh 2005). Internet e-commerce also facilitates cross border supply chain relationships and could involve up to thousands of business partners all over the world, for example, material suppliers, component or part manufacturers, sub-contractors, warehouses, distributors and retailers. Various applications to help firm improve business activities were created to utilise the power of the Internet such as e-procurement, e-warehousing, e-logistics, e-marketplace and e-communication.

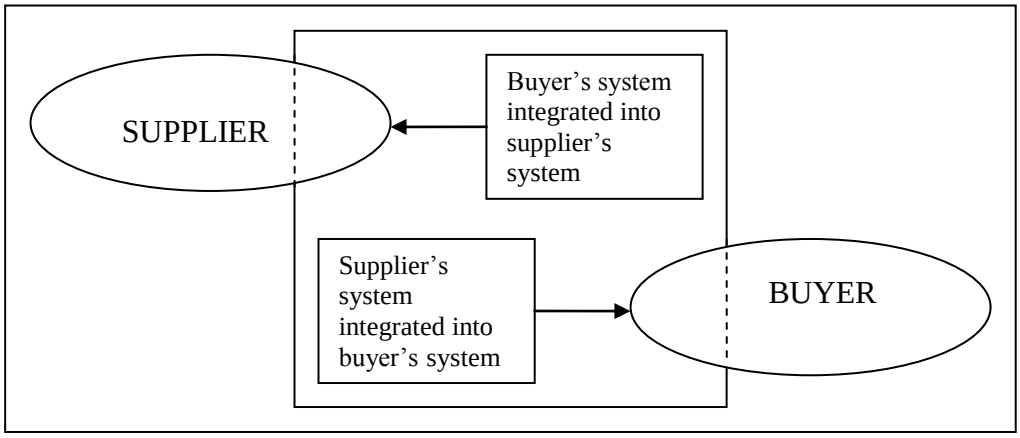
Looking to the future, a combination of Internet and Extensive Markup Language (XML) technology is expected to further automate business processes and throughput tremendously. The basic XML technologies enable straightforward exchange of data as XML documents between trading partners in a supply chain by providing context to information to facilitate its dissemination via the internet (Gara, Karim & Pinsker 2005; Nurmilaakso & Kotinurmi 2004). XML's biggest contribution is the ability to transmit, receive, and share information without data

re-entry, enabling greater automation and less redundancy. Data coded, or tagged, with XML can be uploaded or downloaded into multiple applications by multiple users without manual intervention or translation (Gara, Karim & Pinsker 2005).

The impact of information technology in business generally, and supply chain specifically, has been at the centre of attention in many studies before. It is not surprising to see that there have been theoretical and empirical studies conducted focusing on the impact of information technology adoption in diverse disciplines such as supply chain management (Frasquet, Cervera & Gil 2008; Ryssel, Ritter & Gemanden 2004), stockbroking industry (Gharavi, Love & Cheng 2004), manufacturing industry (Harrigan et al. 2008; Jharkharia & Shankar 2006) and medical industry (Tung, Chang & Chou 2008). Recent developments in IT allow companies to modify the way their supply chains operate and the way they communicate with their partners—such as through the internet, intranet, electronic mail, wireless communication and electronic data interchange. All these IT applications are expected to not only strengthen operational efficiency, but also enable linkage between firms with their customers, suppliers and other stakeholders (Mutsaers, Zee & Giertz 1998). Lack of integrated information systems that link all these parties will lead to uncertainty in inventory management, which may subsequently lead to bullwhip effects that can paralyse the supply chain process (David, Phillip & Edith 2003). Initiatives such as Just-in-Time (JIT), strategic alliances, Vendor Managed Inventory (VMI) and collaborative planning, forecasting and replenishment (CPFR) may help reduce bullwhip effects, but they must be supported by an efficient information management system that can help reduce the variability of information shared between supply chain partners.

Therefore, e-business applications have been developed to achieve the above purposes and of these is e-procurement. Researchers have acknowledged that e-business systems adoption such as e-procurement can be considered as technological innovation, which creates an opportunity for firms to establish interactive relationships with partners such as suppliers, logistics providers, wholesalers, distributors, service providers and end customers (Jackson & Harris 2003; Gebauer, Beam & Segev 1998). When this system is connected together, the organizational boundaries become extremely fuzzy and less relevant (see Figure 2.3). Firms have direct access to their partners' information system which allows for fast initiation of production, specifying product specification and, in extreme cases, have the authority to make changes on other systems parameters. Each party will have access to data such as the level of inventory, new orders, production forecast, payment status, invoice, and transportation schedule, and even allow a company to respond quickly to any special request, based on the information provided through the system.

E-procurement is one of the applications under an e-business system (Yoon, Markatsoris & Richards 2004). There is a difference between the definition of e-business and e commerce in general, but in practice these terms are used interchangeably (David, Phillip & Edith 2003). Damanpour, Faramarz and Damanpour (2001) describe e-business as any 'net' business activity that transforms internal and external relationships to create value and exploit market opportunities



(Source: Developed for this study)

Figure 2.3: Information system interface between supply chain partners

driven by new rules of the connected economy. David, Phillip and Edith (2003) define e-business as a collection of business models and processes motivated by Internet technology and focussing on improvement of extended enterprise performance. E-commerce meanwhile is the Internet based platform that provides users the ability to perform major commerce transactions such as online shopping, online banking, online investing and electronic payment for an Internet service electronically (Eastin 2002). E-commerce is only part of an e-business that involves an intra-organizational relationship, either between business to business (B2B) or between businesses to consumer (B2C) (David, Phillip & Edith 2003). E-business applications such as e-procurement usually involve business to business relationships only. The main difference between e-commerce systems as a whole and e-procurement is that e-commerce is a very broad concept, while e-procurement is just a small part of it. There any many more functionalities available besides procurement of raw materials or goods in a complete e-commerce system which may include marketing, human resource, customer education and after-sale-service.

The constant reduction in cost of using e-business applications such as e-procurement contributes significantly to its growth. The system is not only becoming more affordable, but it is also constantly improving in terms of functionality. For example, a procurement officer is now able to evaluate and select a supplier worldwide, shop around and make comparisons for the lowest price at a very low cost. They may also hold an e-reverse auction where suppliers will bid with the lowest price they are willing to offer with less hassle than if it is done manually (Charki & Josserand 2008). Besides the cost factor, e-business or e-commerce systems adoption is also recognized as a key concept for technological innovation and investment in a company. Many researchers argue that implementing e-business is no longer an alternative but, to a certain extent, it is essential to firms' survival in today's competitive business environment, as evidenced in all information technology related studies (Damanpour, Faramarz & Damanpour 2001; Mutsaers, Zee & Giertz 1998).

2.4 E-procurement

2.4.1 Why e-procurement?

Procurement has been increasingly recognised as a critical element in effective supply chain management since procurement processes are costly and sometimes complicated activities for businesses. Procurement covers not only purchasing (the actual buying of materials or components), but also associated activities such as transportation, warehousing and inbound receiving (*The Antidote* 1999). During the 1970s and 1980s, procurement was characterized as a slow manual business procedure and, at the same time, involved problems such as errors in ordering, delivering, costing and invoicing—which were time-consuming and costly to trace (Rudzki et al. 2005). After internal company initiatives such as JIT, TQM, Kanban and many others reached the maximum level of cost reduction, businesses then shifted their attention to their supply chain networks to determine how to further reduce the cost. They then began to realise that cost, and even time savings, can be achieved by having a link with their major suppliers through private networks such as an electronic data interchange (EDI).

Next came the Internet era and it created more opportunities for companies to reduce their costs further. The Internet enabled global firms to centralize their globally scattered procurement and logistics systems that were previously conducted in every country in which they operated to a single or only a few optimal locations. The e-procurement system was introduced by large corporations from various industries during the last few years to connect and integrate their order management activities with their partners within one inter-connected system. General Electric, for example, reports that the firm has saved over $10 billion annually through its e-procurement activities (Hawking et al. 2004), while FedEx also saved millions of dollars by automating its procurement operations (Dalton, Violino & Mateyaschuk 1999). Currently, setting up an e-procurement system is even cheaper with the Internet, and even small or medium size companies can take advantage of this. In the technology adoption study by Bharati and Chaudhury (2006), 24.4% of small to medium enterprises (SME) involved in their study employ e-procurement, with 46.9% of medium firms, 19% of small firms and 12.5% of micro firms employing it. It shows that e-procurement is not exclusive to giant manufacturers, as it is widely used by smaller firms too.

2.4.2 Type of e-procurement system

There are many e-procurement software packages with various functions and capabilities now available for companies to use. Software vendors such as Ariba, Commerce One and Clarus are among the wel- known companies that developed web-enabled procurement software. These systems allow electronic transactions over various platforms such as electronic data interchange (EDI), Internet, via e-mail and, most recently, through Extensive Markup Language (XML) platform, thereby making it easy for both buyers and vendors (Sarkis, Meade & Talluri 2004). E-procurement is not a single application, but consists of many different tools. De Boer, Harink and Heijboer (2002) identify six forms of e-procurement applications (Table 2.1). Each system is different from one another in terms of their function, capability and also usage. Some systems might be suitable for a certain supply chain members only, while other systems are universal. Firms may choose whether to implement all of them, or just some applications that are relevant to their own

business objectives and needs, and also the objectives of the supply chain relationship.

Table 2.1: Type of e-procurement application

E-procurement application	Descriptions
1. E-sourcing	Process of finding potential new suppliers using the Internet (B2B marketplace). Takes place during information gathering step of procurement process (De Boer, Harink & Heijboer 2002)
2. E-tendering	Process of sending request for information, price etc. to suppliers and receiving response using internet technology. Also possible to have an initial screening process for selecting suppliers that qualify for the negotiation step. Takes place during supplier contact step of procurement process (De Boer, Harink & Heijboer 2002)
3. E-informing	Part of e-procurement that does not involve transactions or call offs, but instead handles information about the supplier regarding quality certification, financial status or unique capabilities. Supplier data can come from third party information providers and from firm's own investigation. (De Boer, Harink & Heijboer 2002).
4. E-reverse auction	Enables purchasing company to buy goods and services that have the lowest price or combination of the lowest price via Internet. Auction traded in real time and takes place during negotiation step of the procurement process (De Boer, Harink & Heijboer 2002). Among the characteristics of e-reverse auction includes many sellers, descending prices rather than increasing in traditional auctions, identity of bidders unknown to all, bid prices are immediately known to al participants and very suitable for procurement (Wyld 2002).
5. E-MRO and Web-based ERP	Focus on creating and approving purchasing requisitions, placing orders and receiving goods or service ordered using Internet based system. E-MRO deals with indirect items (maintenance, repair and operating materials) while web-based ERP deals with product related items. Takes place during fulfilment step of procurement process (De Boer, Harink & Heijboer 2002).
6. E-collaboration	Correct and updated data regarding product versions, blueprints and sales forecasts are always available from the buying's company website or extranet, thus reducing errors before they occur and making it possible for suppliers to be in sync with the buyer. Involve collaboration tools such as virtual meeting rooms, bulletin boards and even shared knowledge management systems (De Boer, Harink & Heijboer 2002).

2.4.3 Benefits of e-procurement

The benefits of using e-procurement are a focus of researchers in most supply chain technology adoption studies. Table 2.2 indicates reduction in cost and improvement in business process efficiency as the most important factors for e-procurement adoption as identified by all these studies. Reduction in cost and improvement in efficiency will eventually lead to an increase in profit.

Table 2.2: Benefits of e-procurement adoption

Author	Croom & Johnston (2003)	De Boer, Harink & Heijboer (2002)	Lai et al. (2005)	Angelo (2008)	Harrigan et al. (2008)	Gupta (2008)
Access to information			√			
Speed up order cycle time		√		√		
Reduce paperwork				√		
Collaborate with suppliers				√		
Reduce manual process/automation	√					
Reduce transaction costs	√	√		√	√	√
Reduce errors		√				
Operational/ business process efficiency			√	√	√	
Enhance supplier/customer relationships						√

There are many ways firms can reduce cost and increase their profit through e-procurement. First, e-procurement allows an automatic initiation of orders following a link with the inventory system, the authentication of suppliers and the issue or payment of invoices and financial transactions. The whole process is expected to be much faster and easier than when done manually (Bland 2003) as it can reduce, or even eliminate, the need for paperwork when making an order (Angelo 2008). Furthermore, Croom and Johnston (2003) found out that web-based systems for requisitioning result in few transmission errors compared to paper based methods, and also enables electronic invoicing and payment. By these processes being paperless, cost savings are achieved.

Another way in which e-procurement helps reduce a firm's cost is by reducing the purchasing process lead time. A detailed study on processing lead time by Ericson & Edsinger (2003) found that the time taken to conduct the procurement activities reduced from an average five days to two hours using e-procurement. In a real case situation, Atlanta based company Cox Enterprise reported that faster lead time due to an e-procurement implementation allows for a 20% inventory cost reduction in the

company (Varmazis 2008). Besides cost reduction and business process efficiency, some other benefits identified include easy access to information, enhanced business relationships and better collaboration between partners.

2.4.4 E-procurement implementation strategies

Implementing an e-procurement system throughout the supply chain is not an easy task. In most cases, the adoption is conducted through various stages to ensure smooth transition and to reduce risk if problems occurred upon adoption. Usually, the system is adopted by the firm that first initiated the idea of using e-procurement and this could be the supplier, manufacturer or buyer. Once the system is installed and running, the initiating firm should streamline, test, troubleshoot and improve the processes before expanding it to the other supply chain partners. Once the system is ready for integration, supplier, manufacturer and buyer may first integrate and run an e-procurement system for non-critical items such as in their maintenance, repair and operations (MRO) purchasing activities (Chang, Markatsoris & Richards 2004). The main objective at this early stage is to reduce the amount of paperwork needed for purchasing and to reduce order complexity by standardizing the exchange process between supplier, manufacturer and buyer. Once the system is running and performing the desired task without error, supply chain partners may then move onto more critical items that relate very much with the buying, manufacturing and selling of their product.

After the system is running smoothly and each party involved becomes familiar with it, supply chain members should then exploit the full power of the e-procurement system by using the more advanced functions such as e-reverse auction, integrating it with their MRP/ERP system, and even using their own payment gateway that allows supply chain partners to make electronic payments with each other. Finally, the firm that initiates the use of the e-procurement system may, in the future, want to expand the system with another group of supply chain partners. It is not possible to have a uniform relationship with all suppliers, manufacturers and buyers group as the purchasing requirements might be different between one another. As the supply chain relationship grows, the system might be upgraded to allow aggregation of purchasing needs into groups that use a similar purchasing process (Epic Technology 2008).

2.4.5 Reasons for non-adoption of e-procurement

Although the benefit of using e-procurement has been studied in previous research and seems appealing to the supply chain partners, not all companies are using this kind of system—for various reasons. Previous studies on technology adoption mostly include discussion on the factors or barriers that hinder companies from using e-commerce initiatives such as e-procurement. Table 2.3 summarises some of the studies that sought to establish why companies did not adopt e-commerce technology in their business activities. One important observation from the reasons provided is that there is no universal or common reason for non-adoption from each study. Possibly, different companies have different reason as the adoption or non-adoption could be affected by the nature of the business, the competitive environment and even the culture surrounding the company.

Table 2.3: Reasons for non-adoption of e-procurement

Author(s) and year	Focus of study	Non-adoption reasons
Kamhawi (2008)	ERP adoption in Bahrain	• Large capital investments • Intensive training • Having other important priorities
Archer, Wang & Kang (2008)	Online supply chain solution in SMEs	• It is not seen as easy to procure major needs and sell major products online. • Do not know what kind of e-business solution is right for them. • Employees prefer the old ways of doing business.
Manufacturing Business Technology (2006)	Adoption of wireless computing	• Concern over security of data
Bharati & Chaudhury (2006)	Current status of supply chain technology adoption in the US	• Unfamiliar with technology • Low level of awareness about the technology
Tobin & Bidoli (2006)	Barriers to the adoption of VoIP and other IP services in South Africa	• High cost of service • Quality of services
Lai et al. (2005)	IT adoption in Hong Kong logistics industry	• Lack of expertise • Inadequate knowledge among employees

2.5 Related theories

2.5.1 Diffusion of innovation and perceived attributes of technology theory

Innovation is an essential element in the supply chain to remain competitive. Innovation refers to the adoption of new products, service processes, technologies, policy, structure or administrative systems (Damanpour, Fariborz & Schneider 2006). Diffusion is defined as the process by which an innovation is adopted and gains acceptance by members of a certain community. While a number of factors interact to influence the diffusion of an innovation, the four major factors are features of the innovation itself; how information about the innovation is communicated; time; and the nature of the social system into which the innovation is being introduced (Rogers 1995). Diffusion research, in its simplest form, investigates how these major factors, and a multitude of other factors, interact to facilitate or impede the adoption of a specific product or practice among members of a particular adopter group. Rogers identified five dimensions that could influence the adoption decisions of a new technology: perceived attributes of innovations; type of innovation decisions; communication channels; the nature of the social system; and the extent of change agents' promotion efforts.

One of the major factors that influence the diffusion of new technology is the attributes of the innovation itself and Rogers (1995) extended the diffusion theory by specifically introducing the theory of perceived attributes. The theory states that potential adopters judge an innovation based on their perceptions in regard to five attributes of the innovation: relative advantage; trialability; observability; complexity; and compatibility. It is believed that a technology will experience an increased rate of diffusion if potential adopters perceive that the innovation: can be tried on a limited basis before adoption; offers observable results; has an advantage relative to other innovations (or the status quo); is not overly complex; and is compatible with existing practices and values.

Technology attributes have been used as the theoretical basis for several studies on technology adoption. Van Dolen, Dabholkar & De Ruyter (2007) studied how technology attributes influence satisfaction with online commercial group chat. Wen-Chin (2006), meanwhile, investigate the causal relationship between technology attributes and process performance among manufacturing firms, while Martins, Steil & Todesco (2004) looked at how technology attributes influence the adoption of the Internet as a teaching tool at foreign language schools. Therefore, the appropriateness of using this theory is evident. Perceptions of compatibility, complexity, and relative advantage have been found to play a significant role in several IT-related adoption studies. Rogers (1995) states that the perceived attributes of a technology, which consists of relative advantage, compatibility, complexity, trialability and observability, explained up to 87 percent of the variance in rate of adoption. Therefore, this study will concentrate on technology attributes and not the other variables that were identified by other researchers. Some of the additions to the list of technology attributes that influence adoption by Rogers, as identified by other studies, includes perceived usefulness and perceived ease of use (Davis 1989), together with image and voluntariness of use (Moore & Benbasat 1991). However, Rogers' five attributes of innovation are believed to be most suitable, as a variety of technology adoption and diffusion studies have shown that they consistently influence adoption. This is evident in previous works related to various types of technology adoption by Van Dolen, Dabholkar & De Ruyter (2007); Wen-Chin (2006); Gebauer, Beam & Segev (1998); Ritu & Jayesh (1997).

The first technology attributes dimension as identified by Rogers (1995) is relative advantage. Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes expressed as economic profitability, social prestige, or through other benefits. The nature of innovation determines what specific type of relative advantage is important to adopters. It includes economic profitability, low initial cost, decrease in discomfort, social prestige, a saving of time and effort, and immediacy of rewards (Rogers 1995). The relative advantage of electronic channels is conceptualised as a multidimensional construct involving a cumulative assessment of the perceived relative merits of channels on three dimensions: convenience; trust; and efficacy of information acquisition (Choudhury & Karahanna 2008). An e-procurement relative advantage can be characterised as being more effective, more efficient and more economical than the manual purchasing systems it replaces. Studies almost universally report a positive relationship between relative advantage and adoption of different technological innovations in marketing channels (Choudhury & Karahanna 2008), among small business (Jungwoo 2004), in the

workplace (Al-Gahtani 2003), and in financial institutions (Truman, Sandoe & Rifkin 2000).

The second dimension of technology attributes is compatibility. Compatibility refers to the degree to which an innovation is perceived as consistent with existing socio-cultural values, past experiences and the needs of potential adopters (Rogers 1995). An idea that is more compatible is less uncertain to the potential adopter and fits more closely with individuals' life situation. Kamal (2006) identifies two aspects of compatibility: technological and organizational compatibility. Technological compatibility refers to the perceived compatibility of the systems required for effective communication and information sharing with an organization's existing technologies. Organizational compatibility can be thought of as the organizational fit of the system required for effective information sharing among different departments. Karahanna, Agarwal and Angst (2006) identify a more comprehensive conceptual definition that disaggregates the content of compatibility into four distinct and separable constructs: compatibility with preferred work style; compatibility with existing work practices; compatibility with prior experience; and, compatibility with values. However, in this study, compatibility is referred to as both technological and organizational compatibility as mentioned by Kamal (2006). The four constructs introduced by Karahanna, Agarwal and Angst (2006) can be grouped as organizational, instead of viewing them as separate constructs. Rogers suggests that the compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption. This is further proved by Wu and Wang (2003) in their study on adoption of mobile commerce in Taiwan, which is subsequently consistent with LaRose and Hoag's (1996) findings where prior adoption of similar innovations, related to compatibility, helps influence adoption. Compatibility was also a significant contributor of material requirements planning (MRP) systems adoption according to Cooper and Zmud (1990).

The next technology attribute that influences adoption is complexity. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers 1995). Some technological innovations are clear in their meaning to potential adopters, whereas others are not. It means that although an innovation appears to be useful, the organization may find it too complex to use and decide not to adopt it. In the context of this study, complexity refers to the difficulties occurring in relation to the use of e-procurement tools and systems and in coordinating the e-procurement system's integration between supply chain partners. Rogers identified that the complexity of an innovation as perceived by members of a social system is negatively related to its rate of adoption. Further research also supports Roger's view on the negative influence of complexity on technology and innovation adoption (Cooper & Zmud 1990; Al-Gahtani 2003; Batz, Janssen & Peters 2003). The fourth technology attribute is trialability. It refers to the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried are generally adopted more rapidly than innovations that are not visible (Rogers 1995). This trialability is a means to dispel uncertainty about the new idea. In the context of this study, trialability simply refers to the ability of both parties in the supply chain relationship to be easily able to experiment with the e-procurement technology. Rogers (1995) also suggested that the trialability of an innovation as perceived by members of a social system is positively related to its rate of adoption.

Observability is the degree to which the results of an innovation are visible to others, easily observed and communicated to others. The results of some ideas are easily observed and communicated to others, whereas some innovations are difficult to observe or describe to others (Rogers 1995). The issue of observability in this study refers to the visibility of e-procurement technology to supply chain partners so that they may consider adopting it. The observability of an innovation as perceived by members of a social system is positively related to its rate of adoption.

Rogers (1995) stressed that greater relative advantage, compatibility, trialability and observability, combined with less complexity, will more likely promote the rapid adoption of a technology. Subsequent studies that followed also identify the same causal relationship of these five factors with adoption. Moore and Benbasat (1991) developed an instrument to measure the perceptions of adopting IT innovation that has been utilised in many subsequent diffusion studies. Their conclusions confirmed the importance of all five attributes suggested by Rogers (Al-Gahtani 2003) and also observed the same findings in their study of computer technology adoption in Saudi Arabia. Grover's (1994) study on customer-based inter-organizational systems (CIOS) found that both compatibility and complexity were strong predictors of adoption decisions, while relative advantage was not. In the area of supply chain management, few studies have been conducted, however, the number of studies on information system adoption in the context of supply chain management is increasing. Woodside and Biemans (2005) studied the adoption or rejection process of new technology in manufacturing, while Mackay and Rosier (1996) measured the organizational benefits of EDI diffusion in the Australian automotive industry. In addition to research that is based on technology attributes by Rogers, there are many other studies directed towards understanding the other factors that influence adoption of a different type of technology. Additionally, there are also studies that focus on the level of technology adoption in a country, or adoption based on company size. This includes the study by Kendall et al. (2001) which investigated the adoption of e-commerce by small and medium-size companies, Wu and Wang's (2003) study of consumers adopting mobile commerce, and Al-Gahtani's (2003) study on computer technology adoption, to name a few. Table 2.4 summarises some of the latest studies, based on the various foci and testing of different factors that influence adoption.

Table 2.4: Previous study on technological adoption decisions

Author(s) and year	Focus of study	Adoption factors
Au & Yeung (2007)	Chinese manufacturers' technology adoption behaviour	Behavioural and organizational issues
Bharati & Chaudhury (2006)	Current status of supply chain technology adoption in the US	Top management and influence of customers
Lin & Lee (2005)	Organizational learning and knowledge management impacts on e-business adoption	Both factors are closely related to adoption decisions
Rusell & Hoag (2004)	Social and organizational influences on adoption	User perception, firm's culture, type of communication channel and leadership
Mustonen-olilla & Lyytinen (2003)	Information system process innovations adoption	Recognition, technology availability, past experience, own trials, ease of use and learning by doing.
Wu & Wang (2003)	Adoption of mobile commerce in Taiwan	Perceived usefulness, ease of use subjective norm influence the usage.
Eastin (2002)	Adoption of e-commerce activities	Convenience, financial benefits, risk, previous use, self efficacy, Internet use.
Harrison, Mykytyn & Riemenschneider (1997)	Adoption of information technology in small business	Perceived consequences to the firm, social expectations and perceived controls affect adoption decisions among small business.

2.5.2 Trust theory

Trust in business relationships has long been regarded as a key factor in a successful and long lasting supply chain relationship. It is becoming a more crucial element in today's supply chain relationships because it involves a high level of interdependency and information sharing between firms (Mayer, Roger & Davis 1995). Although trust has been an interest for researchers for a long time, the concept is very broad and complex. Even defining what trust really means is difficult as researchers keep using a different point of view on trust based on the discipline, perspective and the level of analysis of their study. Moorman, Deshpande and Zaltman (1993) define trust as the willingness to rely on an exchange partner in whom one has confidence, while Currall and Inkpen (2002) view trust as a decision to rely on a partner with the expectation that the partner will act according to a common agreement. Morgan and Hunt (1994), when introducing their well known commitment-trust theory of relationship marketing, believe that trust exists when one party has confidence in an exchange partner's reliability and integrity. The above definition of trust is adopted for this study as it encompasses the context of business-to-business relationship between partners, and aligns with one of the objective of this research, that is, to study trust between supply chain partners.

The economic importance of trust in business relationships is that it reduces the detail and monitoring of a contract, as well as reducing transaction costs (Gulati 1995). Firms can thus focus on an investment for the future and enhance organizational and relationship learning and knowledge transfer. The outcome of trust, therefore, is the firms' belief that a partner's company will perform actions that will result in positive outcomes for the firm, as well as not taking unexpected actions that result in negative outcomes (Anderson & Weitz 1989). Inter-organizational trust is the subjective probability with which organizational members collectively assess that a particular transaction will occur according to their confident expectations. It is derived from the interpersonal component of an e-commerce relationship (Ratnasingam 2005). In e-procurement adoption, presence of relationship trust will be crucial since supply chain partners will make available through the system real time information such as sales, manufacturing, designs, production plans, customer demand or potential evidence of the company's performance (Mukhopadhyay, Yao & Yue 2008; Mohtadi 2008; Ouyang 2007; Paik & Bagchi 2007). The higher the relationship trust a firm has in its partner, the more inclined it will be to exhibit positive behaviour, keep promises, and show care and concern. It is very unlikely that the company will use e-procurement if they believe that their partners will use the information for their own benefit. A high level of trust will also encourage the firm to explore new mutually beneficial arrangements related to technology adoption that improve inter-firm coordination (Hart & Saunders 1997).

Prior studies on trust in business and management mostly concentrate on the role of trust in organizational behaviour and inter-organizational relationships (Tyler & Stanley 2007; Mouzas, Henneberg & Nauda 2007; Andersen & Kumar 2006). Trust has been related to a firm's competitive advantage (Warrington, Abgrab & Caldwell 2000; Ba & Pavlou 2002), an important factor in organization leadership and managerial effectiveness (Ming-Jian & Ming-Chia 2007; Mayer, & Davis 1999; McAllister 1995), it allows an effective decision making (Brunetto & Farr-Wharton 2007; Olson, Parayitam & Bao 2007; Zand 1972), and could also increase organizational and relationship effectiveness (Paterson, Maguire & Al-Hakim 2008; Massey & Dawes 2007). Close inter-firm relations that build upon mutual trust will encourage compliance with business norms and technical standards, and curb opportunism by dominant producers or buyers. This helps prevent opportunistic behaviour by partners in supply chain partnerships (Wood & Brewster 2005; Bahmanziari, Pearson & Crosby 2003). Buyer/supplier relationships that exhibit high levels of trust will resist the temptation to discontinue the agreement despite the opportunity to earn short term benefits or advantages (Hoyt & Huq 2000). Effective supply chain planning based on shared information and trust between and among partners is said to be an essential element for successful supply chain relationships (Kwon & Suh 2005). Svensson (2000) also established that trust is an important element in supplier/manufacturer relationships in the Swedish automotive industry. Lack of trust would make it troublesome to implement lean, responsive and agile supply chains.

It is only recently that the role of trust in organizational technology implementation is gaining more attention among researchers. For example, Tung, Chang and Chou (2008) argue that trust has a substantial positive influence on behavioural intention to use electronic logistics information systems in HIS in the medical industry. Lee, Sohn & Lee's (2008) study shows how trust influences decisions to use mobile

Customer Relationship Management (CRM) software. Mukherjee and Nath (2003) look at the importance of trust in online banking, while Ratnasingam's (2001) study focused on the relationship between inter-organizational trust and EDI adoption, and then followed with studies on the influence of trust on e-commerce relationships (Ratnasingam 2005). Ba and Pavlou's (2002) study of the effect of trust building technology in electronic markets; while Bahmanziari, Pearson and Crosby (2003) studied the important of trust in software vendors on technology adoption and found that trust is indeed an important component of technology adoption decisions. This shows that extensive research has been conducted to identify the importance of trust in supply chain relationships and technology adoption, but none have sought to establish whether trust is important in e-procurement adoption decisions.

Another context in trust related research that has gained interest among researchers is in term of the dimensions that constitute the level of trust. It is generally accepted that trust is a multidimensional concept that has been discovered to contain various dimensions that make up the construct (Corazzini 1977). There has been a wide range of research conducted in various discipline to determine the dimensions of trust. Table 2.5 lists some of these latest dimensions of trust, as identified by previous researchers, specifically related to business to business relationships and technology adoptions. Some of the trust dimensions as shown in the previous table seem to be identical or closely related to one another and, therefore, many scholars try to categorize these dimensions. One of the commonly used dimensions is based on the work of Swan et al (1985) and Swan and Trawick (1987). They group all these dimensions into five major dimensions of trust, as follows:

i. Dependability/reliability trust—includes dimensions such as confidence, consistency, faith, loyalty, predictability, respect and security.
ii. Honesty trust—includes dimensions such as fairness, motivation to lie and openness of management.
iii. Competence trust—includes dimensions such as ability, character, expertness and integrity.
iv. Buyer/seller orientation trust—includes dimensions such as altruism, business sense and judgement, congruence, intentions and motives.
v. Friendliness trust—includes dimensions such as acceptance, benevolence and liking.

However, one dimension of trust which is considered important in a business relationship that is not included in any of the above mentioned categories is contractual trust. The importance of contractual agreement in business relationships is evident in several previous studies (Sako & Helper 1998; Ireland & Webb 2007; Ryan, Giblin & Walshie 2004) and is considered relevant within the context of this study. Therefore, it is added as one of the dimensions of trust that is used to determine the level of trust manufacturers have towards their partners.

Table 2.5: Dimensions of trust

Author	Liu et al. (2008)	Ireland & Webb (2007)	Ratnasingam (2005)	Ryan, Giblin & Walshie (2004)	Lui & Ngo (2004)	Sako & Helper (1998)	Mayer, Roger & Davis (1995)	Ganesan (1994)	Swan, Trawick & Silva (1985)
Benevolence	√		√	√			√		
Honesty	√								√
Competence	√	√	√			√			√
Contractual		√		√	√	√			
Goodwill		√		√		√			
Reliability			√					√	
Predictability			√						
Dependable									√
Customer oriented									√
Likeable									√
Expertise								√	
Intentionality								√	
Ability							√		
Integrity							√		

2.5.3 Power and resource dependency theory

Many companies form a supply chain relationship and alliances with their supply chain partners with the aim of increasing the supply chain efficiency. A partnership is expected to lead to better service and to provide access to new markets. However, placing too much reliance on specific supply chain partners proves to be very risky (Lankford 2004). Studies even suggest that today's business supply chains are converging towards a situation where one party assumes disproportionate power over another (Crook & Combs 2007). This could be manufacturer, supplier or buyer driven power. Most of the time, it is not the primary producer of components or raw materials at the start of the commodity chain, but the large transnational corporation that plays a central role in coordinating production networks with a large market or holders of prestigious brand names that achieve this predominance. The dominance of a particular partner will result in increased dependence on it and will eventually increase the dominant partners' ability to impose specific sets of practices or even to take punitive action on more junior partners (Gereffi 2001; Wood & Brewster 2005).

Studies also have proven that dominant partners can obtain control over their partners' decisions by creating a situation where these particular partners will become highly dependent upon them. It can be done by getting the partner to believe that the goods and services they obtain from the suppliers are essential in achieving their goals, or by persuading the partners to perceive that switching to alternative sources of supply would be difficult (Brown, Lusch & Muehling 1983). Increased dependency on members of the supply chain can have disastrous consequences if these supply chain members are unable to handle the functions assigned to them. Other than that, perceived dependency in business relationships between suppliers and their customers may be influenced by various factors such as the degree of outsourcing, the inventory levels, the number of suppliers/customers and the amount of preventive activities (Svensson 2004). Besides influencing the relationships between supply chain partners, studies also indicate that dependency of one party to another can influence technology adoption decisions (Norm, Shan & Claire 2008; Harrison, Mykytyn & Riemenschneider 1997; Treadgold 1990).

Dependency itself roots from the theory of power as Emerson (1962) states that the basis of power is dependency . Power has been defined in various ways, but all definitions essentially contain the idea of the control, influence or direction of one party's behaviour by another (Cartwright 1959). French and Raven (1959) state that source of power over a target is composed of the power bases the source holds over the target. In total, six types of power bases have been identified: reward power; coercive/dependency power; legitimate power; referent power; expert power; and, information power. The terms dependency and coercive power are used inter-changeably in studies, but both refer to the same situation where one party in the relationship has the ability to influence another, and can even impose punishment if their requests are not complied with (Leonidou, Talias & Leonidou 2008; Teo, Wei & Benbasat 2003; Hart & Saunders 1997).

In the context of this study, dependency that exists between supply chain partners and its influence on e-procurement adoption, the information technology or knowledge possessed by partners, could become an important factor that determines adoption. As

mentioned earlier, e-procurement is about the sharing of information via connected information systems; therefore, the necessity for information sharing will increase dependency levels between one business partner and another. Moreover, the use of e-procurement by supply chain partners is more likely if one partner that contributes much to their sales, or supplies an important material or component, conducts all their purchasing or selling activities through the system.

Based on the above discussions, the third theoretical basis that constitutes this research is derived from Emerson's (1962) power theory and Pfeffer and Salancik's (1978) resource dependency theory. Emerson theorised that the power of one firm in a two-firm relationship is based on the other firm's dependency towards it. He states that in a channel dyad, channel member A's power over B is derived from B's dependency on A. He also argues that power differentials derive from the relative dependencies of actors on one another for the resources of value they obtain through social exchange (Emerson 1962). Pfeffer and Salancik (1978) provide a new paradigm on dependency issues by introducing the resource dependency theory which describes dependency as a situation when firms that own or control valuable, scarce resources hold power over firms seeking those resources to the extent that the dependency is not mutual. Firms are viewed as an interdependent entity seeking to manage the uncertainty that is affecting them. In order to control the resulting uncertainty, firms lacking control of resources can use several means such as merger or acquisition, board of directors interlock, diversifications or other forms of inter-organizational relationships to improve power imbalances (Pfeffer & Salancik 1978).

Since then, subsequent study on dependency significantly proves that there are dependencies between a company's business activities, especially when it comes to the supply chain (Izquierdo & Cillan 2002; Lambert, Cooper & Pagh 1998; Brown, Lusch & Muehling 1983). However, most previous studies on power or dependency in business relationships have been conducted in the context of relationships between supply chain partners at the outbound side, which is basically between marketing channel members. This is evident in previous work by Zhuang & Zhou (2004); Buchanan (1992); Brown, Lusch & Muehling (1983); and Etgar (1978)—to name a few. It was not until recently that power and dependency gained more attention among researchers concentrating on the inbound side of the supply chain, mainly consisting of suppliers, manufacturers and customers. Izquierdo and Cillan (2004), for example, studied the interaction of dependence and trust in long-term industrial relationships between manufacturers and their suppliers. At the meantime, Svensson (2004) added to a developing body of literature on dependency and inbound supply chain by looking at the influence of dependence between suppliers and vehicle manufacturers in Sweden.

The literature indicates that almost all channel behaviour studies have supported the following causal relationship, which is that the more dependent a channel member is on another member, the higher it perceives the other member's power (Bachmann 1999; Brown, Lusch & Muehling 1983; Frazier 1983b). In contrast, a study by Zhuang and Zhou (2004) conducted in China shows that the relationship between dependence and power may not be a one-way causation as identified in previous studies. Culture is deemed to influence the results, hence, dependence seems to have more positive

meaning and is often actively pursued in Chinese marketing channels compared to the West. This is an interesting paradigm since this study will be conducted in Malaysia which, just like China, is considered as a developing country. Comparison between the outcome of studies similar to that in the West with those in China and Malaysia may provide a further contribution to the literature.

Just like trust, dependency is a multi-dimensional construct that consists of various dimensions that can be used to evoke desired actions from supply chain partners. As the dependence construct is *per se* ambiguous, an operationalization of the construct is necessary in order to measure and evaluate the level of dependence in supply chain relationships (Svensson 2002b). One of the most cited set of dimensions, and used widely in dependency or power related studies, is from the work of Hammarkvist, Hakansson and Mattson (1982) and the work of Mattsson (2000) (both cited in Svensson 2001). These two studies identify five and two additional dimensions respectively that make up the dimension of dependency. The five dimensions of dependency as described by Hammarkvist, Hakansson and Mattson (1982) are:

i. *Technical dependence*: The instance when two companies use compatible equipment and adapt their mutual business activities to each other in a technical sense.
ii. *Time dependence*: The instance when two companies have a time-based need or synchronization of their mutual business activities.
iii. *Knowledge dependence*: The interaction process between two companies where they can learn from each other's strengths and weaknesses. Create knowledge about each other's ability to solve problems.
iv. *Social dependence*: Interaction between two companies which is often base on personal relationships. Social atmosphere and personal chemistry between executives affect business activities between them.
v. *Economic/judicial dependence*: Formal dependence that exist such as written agreements. These strengthen the dependence between the business activities of two companies.

Mattson (2000) then adds two more dimensions to five identified above, which are:

vi. *Market dependence*: Company's image and status that may positively influence another company's image, status and improve goodwill of the other company in the marketplace.
vii. *Information technology dependence*: Two companies may invest in a common IT standard, where the hardware and software to communicate between the two companies must be compatible.

For this study, technical and information technology dependence are considered to be one dimension as both consider technology or a new process to be part of an innovation (Damanpour, Fariborz & Schneider 2006). Empirical studies looking specifically at how levels of inter-organizational dependency influence IT application adoption decisions are rather rare, while the relationship with e-procurement is almost non-existent. Most of the studies concentrate on identifying the type of dependency, for example, Svensson (2004). He argues that the dimensions of dependency may be categorized into two main groups, namely time dependence and relationship dependence. Relationship dependence

consists of all six dimensions introduced by Hammarkvist and Mattson (1982), except time dependence. Time dependence is becoming more relevant in recent supply chain network structures, especially in industries that emphasize leanness and just-in-time principles (Lambert, Cooper & Pagh 1998). Relationship dependence meanwhile refers to business activities being dependent upon the interaction process between companies in supply chains. The literatures acknowledges the existence of time and relationship dependencies in dyadic relationships, marketing channels and business networks (Svensson 2002a; Morgan & Hunt 1994; Hakansson & Persson 2004).

Other related studies on dependency using different kinds of dimensions to measure the level of dependency have also been conducted by researchers. One of these was conducted by Provan and Gassenheimer (1994). Rather than using the seven dependency dimensions as discussed before, they instead used different factors which they presume have an effect on the level of dependency between buyers and suppliers. They include purchase dependence, the instance when buyers commit a high proportion of their business to any one supplier, thus the level of dependency on that supplier will be high. The second is market leader dependence where dealers representing dominant suppliers have few equivalent alternatives and tend to be highly dependent. The third is dependence on major accounts. When a dealer serves mostly large customers, its dependence on these relatively few accounts is concentrated. Their needs must be catered for since the loss of any one would be more difficult to replace than if many smaller customers were served. The fourth and last dimension, according to Provan and Gassenheimer (1994), is the dealer size dependency. Larger organizations tend to be more important to suppliers and customers than small ones and can thus reduce their relative dependency on these groups. When the size of buyer is so large, the impact on supplier by the buyer's withdrawal from the relationship will be significant.

Another issue worth mentioning here is the fact that most of the previous studies on dependency in business relationships are uni-directional in nature. This means that most studies are conducted from the perspective of one supply chain partner towards either suppliers or customers, but not their perception of both of them. Svensson (2002b) argues that dependency is the outcome of a dynamic process that depends upon both parties' perceptions in a dyadic business relationship. An approach of bi-directionality is more appropriate since both actors in such a relationship might have different perspectives on their dependency on different partners from both sides of the supply chain and is considered appropriate for this study. Table 2.6 summarizes some of this research as it clearly shows that no previous studies has ever endeavoured to identify the perception of one supply chain partner towards both their supplier and customer.

Table 2.6: Unidirectional nature of previous dependence study

Researchers	Scope of study	Perspective
Bohme et al.(2008)	Dependency in buyer-seller relationships	Buyers and suppliers
Zhuang & Zhou (2004)	Power and dependence in marketing channels	Suppliers and department stores
Gassenheimer & Ramsey (1994)	Dependence and dealer satisfaction	Resellers and suppliers
Provan & Gassenheimer (1994)	Dependence and exercise power and supplier commitment	Dealers and suppliers
Knox & White (1991)	Power or dependency in relationships	Retailers and fresh produce suppliers
Brown, Lusch & Muehling (1983)	Conflict and power-dependence relations	Retailers and suppliers

2.6 Gaps in the literature

There are some gaps in the literature that this study tries to fill. First, previous studies on e-commerce in general or e-procurement specifically study the perception on the adoption of such a system between manufacturers and suppliers only; while in recent years, the manufacturer might also use an e-procurement system with their customer. This system could either be introduced by the manufacturer itself, or even suggested or required to be adopted by the customer. A survey by *Purchasing* magazine in 2007 indicated that 76 percent of companies involved used online procurement systems to conduct business with their distributor, compared to only 61 percent two years before (*Purchasing* 2007). This increased rate of e-procurement adoption when selling company products makes it worthy of research. Therefore, this research will fill a gap in the literature by incorporating the perception of manufacturers on both their suppliers and customers, as well as endeavouring to ascertain if there are any gaps between the level of trust and the level of dependency manufacturers have towards their suppliers and customers.

Second, the majority of studies on the supply chain relationship between partners and in the context of technology adoption, trust and dependency have been extensively explored within the marketing side or the outbound of supply chain activities, such as between retailers/buyers and suppliers (Bohme et al. 2008; Zhuang & Zhou 2004), retailers and manufacturers (Vlachos, Bourlakis & Karalis 2008) or dealers/resellers and suppliers (Morgan & Hunt 1994). Surprisingly, a study that focuses on the inbound supply chain, which relates to the relationship between suppliers and manufacturers, is not gaining as much interest as studies on the outbound side. Even some of the latest literature that did study supplier and manufacturer relationships are more interested in studying the nature of the relationship between supplier and manufacturer itself (Ryu, Min & Zushi 2008; Goffin, Lemke & Szwejczewski 2006), the control mechanism in relationships (Ryu & Eyuboglu 2007), relationship coordination (Gupta, & Weerawat

2006)—not on e-procurement or any other information technology related system adoption. Therefore, this study will look at the influence of technology attributes, trust and dependency on e-procurement technology adoption between manufacturers and their suppliers that has been of interest to previous researchers.

The third gap relates to the attributes of technology theory itself. Rogers (1995) identified five variables that determine the rate of adoption, which are relative advantage, compatibility, complexity, trialability and observability. Many researchers have attempted to add to the body of knowledge on adoption by introducing other factors that determine adoption (Patterson, Grimm & Corsi 2003; Eastin 2002; Harrison, Mykytyn & Riemenschneider 1997) and assume that technology attributes themselves did not necessarily encourage adoption. This study will extend the knowledge on these other factors that affect adoption by examining two important factors in supply chain relationships: the level of inter-organizational trust; and the level of dependency between firms. Any significant relationship between trust and dependency in adoption decisions of e-procurement technology will contribute to the literature in a way that both dimensions could be added to the list of factors that influence e-procurement technology adoption. Furthermore, empirical studies also have yet to investigate the joint impact of three factors, namely, technology attributes; trust; and, dependency simultaneously—specifically in the context of supply chain relationships between manufacturers, their suppliers and their buyers. Some studies only look at the interaction of trust and dependence, without including technology attributes factor (Svensson 2004; Izquierdo & Cillan 2002; Buchanan 1992; Andaleeb 1995). The same research also studies relationships in general, rather than e-procurement or other kinds of information technology adoption.

Fourth, the literature that focuses on the adoption of various e-commerce applications and the technology is widely available. This includes the adoption of e-government (Belanger & Carter 2008), Enterprise Resource Planning (ERP) systems (Kamhawi 2008), e-communication to facilitate exchange between partners (Wu 2005), mobile commerce among consumers (Wu 2003) and the diffusion of e-commerce (Eastin 2002). However, there is no evidence of any specific study on how technology attributes, trust and dependency could affect the adoption decisions for e-procurement technology. It is important to study e-procurement adoption decisions to fill this gap in the literature, because each e-commerce application has different characteristics from the others. Important factors that determine e-procurement technology adoption could be different from factors that influence other e-commerce adoption decisions.

Fifth, previous studies indicate a positive link between trust and dependency in successful supply chain relationships. Both factors are said to positively influence the decision to form the relationship (Sahay 2003; Izquierdo & Cillan 2002; Zineldin & Jonsson 2000; Buchanan 1992) and, at the same time, trust is also identified as a factor that can increase the level of dependency between firms (Ireland & Webb 2007). There is need for a study that will go beyond the importance of trust and dependency in making a decision to enter into a supply chain relationship, which has been the interest of many previous researchers. Studying the impact of trust and dependency after the relationship is materialized will provide a new perspective, as the impact of both factors

in the context of e-procurement adoption may differ or play a different role to what existed before the relationship is formed. The importance of both factors could be similar or different between the decisions to enter into relationship and decisions to adopt e-procurement in supply chain relationships.

A final gap in literature that is worth mentioning is that most previous studies on technology adoption have focused on one particular industry only, such as the manufacturing industry (Harrigan et al. 2008; Jharkharia & Shankar 2006), the logistics industry (Lai, Ngai & Cheng 2005), the banking industry (Lee, Kwon & Schumann 2005; Kolodinsky & Hogarth 2001) the automotive industry (Mackay & Rosier 1996; Sako & Helper 1998), or the medical industry (Tung, Chang & Chou 2008). This study, however, will encompass all major industries in Malaysia, which is expected to make the results more generalizable and at the same time provide some opportunity for comparison between industries.

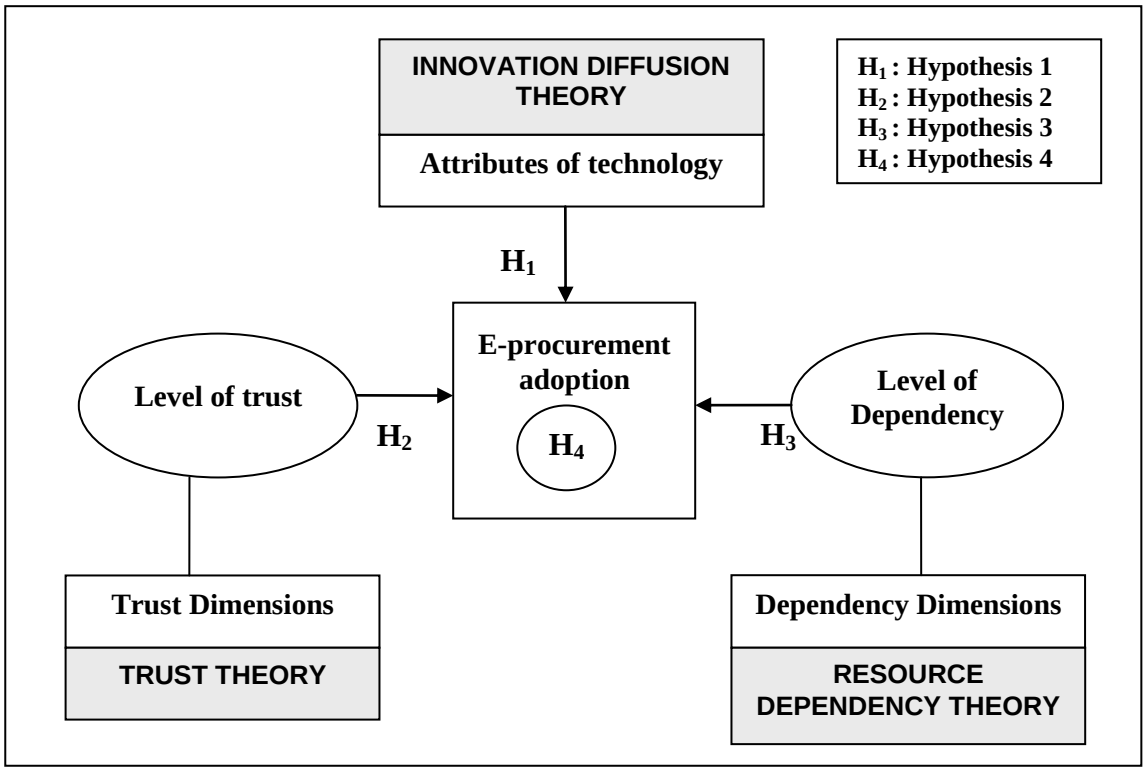
CHAPTER 3: THEORITICAL FRAMEWORK AND HYPOTHESES

3.0 Introduction

This chapter will discuss the relevance of all theoretical foundations that constitute the constructs in the theoretical framework. They include adoption, technology attributes, trust and dependency. The theoretical framework of this study is developed followed by discussions of the hypothesis of this study, together with some brief explanation on each element.

3.1 The theoretical framework of this study

The objective of this study is to identify the influence of three factors: technology attributes; trust; and dependency, on e-procurement adoption decisions among manufacturers. Therefore, the dependent variable for this study is the adoption itself. Technology attributes, level of trust, and level of dependency are the independent variables that constitute multiple dimensions that help measure the importance of technology attributes, the level of trust, and the level of dependency. The theoretical foundation of this research is based upon the theory of perceived attributes, theory of trust and theory of resource dependency. Figure 3.1 shows the research model that hypothesised that technology attributes, trust and dependency will influence e-procurement adoption decisions. Each dimension that makes up the construct for each independent variable, and the hypothesis, is discussed in detail below.



(Source: Developed for this study)

Figure 3.1: E-procurement adoption decisions theoretical framework

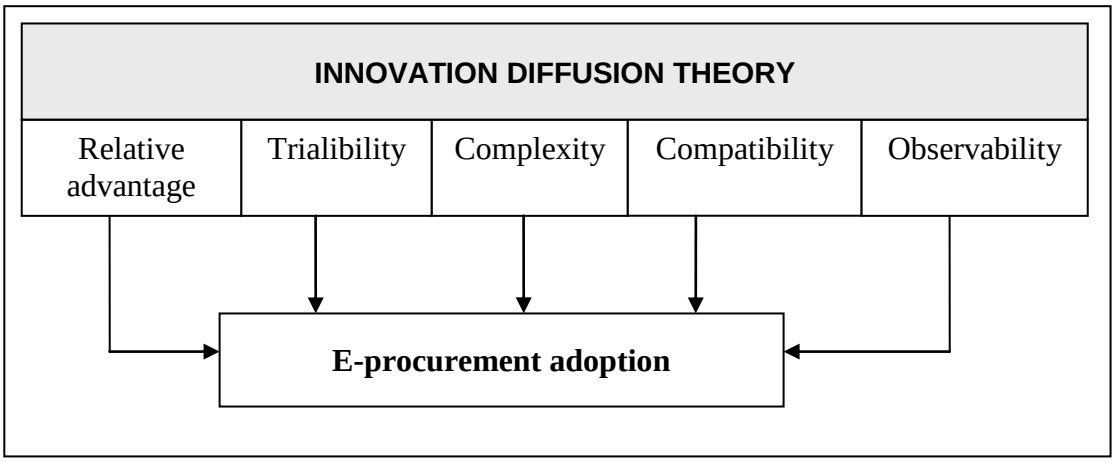
3.2 E-procurement system adoption decisions

Adoption decisions refer to the process of evaluating the proposed ideas from technical, financial and strategic perspectives, making the decision to accept an idea as the desired solution, and allocating resources for its acquisition, alteration and assimilation (Meyer & Goes 1988). Adoption decisions can be influenced by the internal and external environment. This study is interested to research the external environment that provides opportunities (information, resources and technology) to the organization (Damanpour, Fariborz & Schneider 2006). Therefore, adoption decisions are measured based on the degree of influence by firms' partners in e- procurement adoption decisions.

3.3 Attributes of technology and e-procurement adoption

This study adapts the theory of perceived attributes of technology by Rogers (1995) to investigate the importance of technology attributes on e-procurement adoption decisions. Five characteristics of technology that influence adoption decisions introduced by Rogers are used in this e-procurement adoption study: relative advantage; trialability; complexity; compatibility; and, observability (Figure 3.2). An innovation is more likely to be adopted if potential adopters have favourable perceptions with regards to its complexity, compatibility, relative advantage, observability and trialability (Surry & Gustafson 1994). Tornatzky and Klien (1982), however, suggest that out of these attributes, only three are found to be consistently significantly related to adoption: relative advantage; complexity; and compatibility. However, at this stage all five attributes will be considered and any reduction will be done based on preliminary studies via the case study interviews. Hence, the following hypothesis is formulated:

H_1: The attributes of e-procurement technology will positively influence e-procurement adoption decisions.



(Source: Developed for this study)

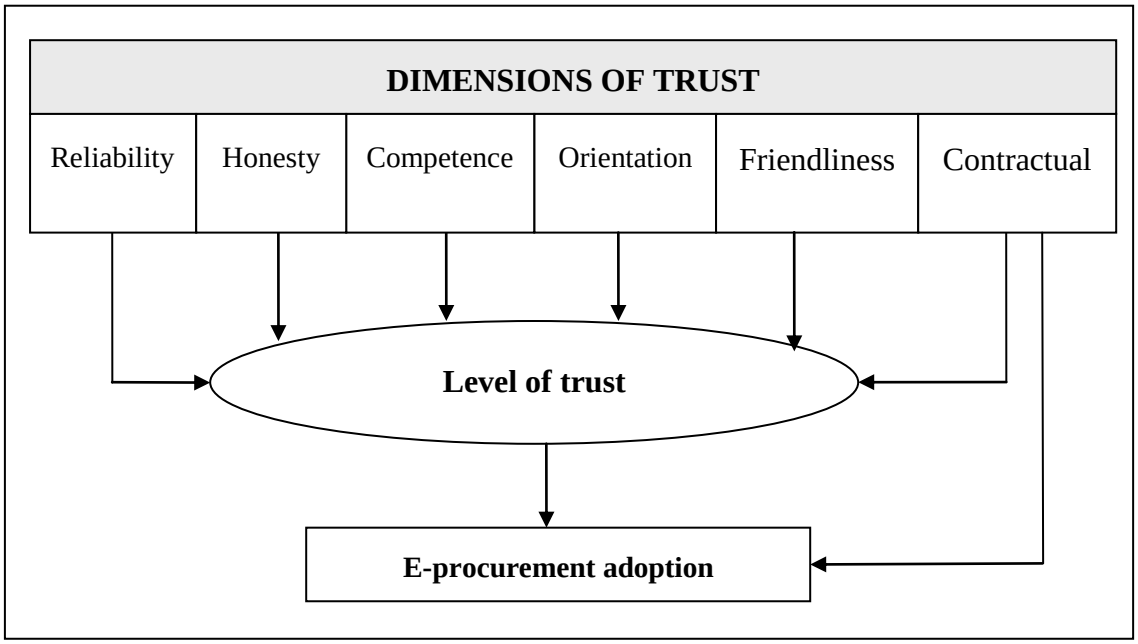
Figure 3.2: Technology attributes effect on e-procurement decisions

3.4 Level of trust and e-procurement adoption

Organizational trust has been examined by numerous researchers in business relationships (Kwon & Suh 2005; Dwyer, Schurr & Oh 1987) and is identified as one of the key factors for successful supply chain relationships (Morgan & Hunt 1994; Zineldin & Jonsson 2000; Svensson 2001). Some previous research examines the relationship

between trust and other constructs, such as the relationship between trust and joint collaboration (Ryan, Giblin & Walshie 2004), trust and co-operation (Kozar 1989), and also trust and commitment (Zineldin & Jonsson 2000). One of the studies that looks at the relationship between trust and technology adoption is that of Ratnasingam (2001), where she identified a positive relationship between trust and EDI adoption. Therefore, at this stage of the study, it is assumed that there is also a positive relationship between trust and e-procurement technology adoption in supply chain relationship.

As discussed in the literature review chapter (chapter 2), studies have identified many dimensions of trust and this can help to measure the level of trust between supply chain partners. However, only appropriate dimensions that relate to the research questions will be used in this research. For this study, five dimensions of trust introduced by Swan et al. (1985) and Swan and Trawick (1987), together the with contractual trust dimension by Ryan (2004), will be incorporated to measure the level of trust and to determine how it influences adoption decisions (Figure 3.3).



(Source: Developed for this study)

Figure 3.3: Level of trust and e-procurement technology adoption

As most studies identify that trust has a positive relationship with information technology adoption (Belanger & Carter 2008; Tung, Chang & Chou 2008; Bahmanziari, Pearson & Crosby 2003; Ratnasingam 2001), the second hypothesis proposed for this study is:

H_2: The level of trust will positively influence e-procurement adoption decisions.

Literature on trust and adoption also highlights the fact that trust that is developed based on contractual agreements between supply chain partners can directly influence adoption decisions in a positive manner (Ryan, Giblin & Walshie 2004; Sako & Helper 1998). Therefore, contractual agreements signed between partners in supply chains are expected

to directly affect the e-procurement adoption decisions and, thus, the following hypothesis was formulated:

H_{2a}: Contractual trust will positively influence e-procurement adoption decisions.

3.5 Level of dependency and e-procurement adoption

Another interest of this study is to identify the influence of inter-organizational dependency level manufacturers have over their suppliers and customers in e-procurement adoption decisions. Dependency is one of the dimensions identified by scholars as having an impact on the level of power in a business relationship (Emerson 1962). The dependency between business activities in the supply chain leads to the necessity of cooperation and coordination between companies in order to achieve internal or mutual goals (Hakansson & Persson 2004).

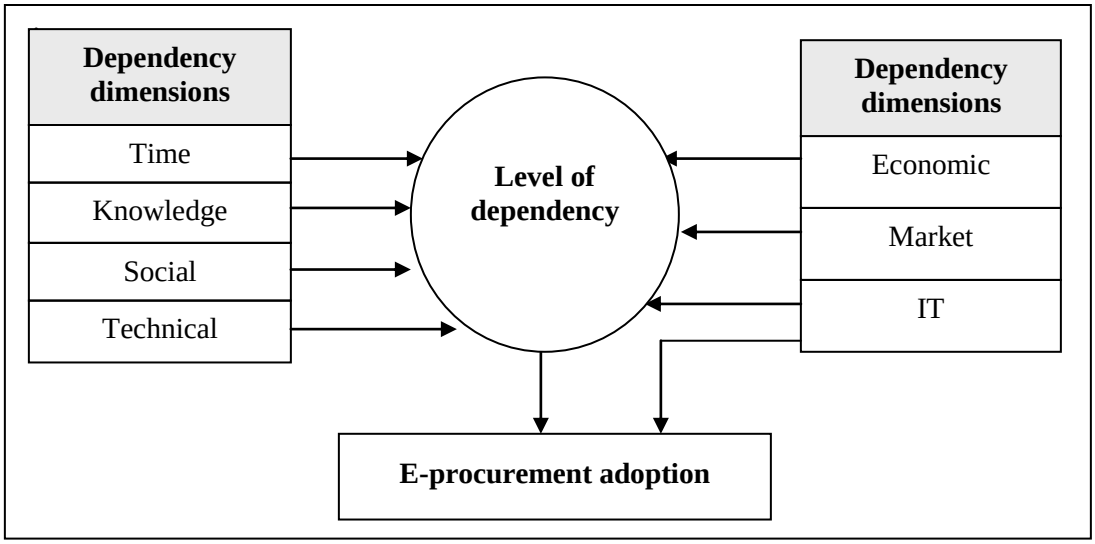
Implementation of a common information technology system will improve the level of cooperation and coordination between supply chain partners. Industrial marketing literature also makes it clear that the supplier of a technological innovation can exercise a direct influence on the diffusion process of a particular technological innovation (Frambach 1993). Therefore, it is assumed that dependency with each other between both suppliers and manufacturers has a direct positive influence on adoption decision in implementing e-procurement technology. Furthermore, Patterson, Grimm & Corsi (2003) in their study also identified that supply chain partner pressure has a significant impact upon the pace of technology adoption. In addition, the study clearly indicates that dependency is needed in maintaining the relationship in order to achieve desired goals (Frazier 1983a). As a result, dependency in this study is hypothesized as having a direct positive influence on e-procurement adoption decisions. Dependency dimensions as suggested by both Hammarkvist, Hakansson and Mattson (1982) and Mattsson (2000) will be used to measure and evaluate the level of dependency between supply chain partners. Figure 3.4 illustrates how these dimensions will help measure the level of dependency and its influence on e-procurement adoption.

The literature indicates that the level of dependency between supply chain partners will positively influence IT adoption decisions (Teo, Wei & Benbasat 2003; Patterson, Grimm & Corsi 2003; Frambach 1993), and this hypothesis is then developed:

H_3: The level of dependency will positively influence e-procurement adoption decisions

Previous study also noted that with firms which rely on their partners for the latest information technology to improve their efficiency, this will eventually lead to adoption (Kulp et al. 2006). Therefore, IT and technical dependency is expected to influence e-procurement adoption and this hypothesis is to be tested:

H_{3a}: The level of information technology dependency will positively influence the e-procurement adoption decisions.



(Source: Developed for this study)

Figure 3.4: Level of dependency and e-procurement technology adoption

3.6 Interaction of technology attributes, trust and dependency

One of the main objectives of this research is to study the interaction effect of three factors: technology attributes; trust; and dependency on e-procurement adoption decisions. When all three dimensions are considered together, the joint impact between attributes of technology, trust and dependency is hypothesised as having an influence on e-procurement adoption decisions too. Thus, the fourth hypothesis is developed:

H_4: Interaction of technology attributes, trust and dependency will positively influence e-procurement adoption decisions.

3.7 Gap between the level of trust and the level of dependency with partner

The objective of gap analysis is twofold: to identify which trust and dependency factor has critical differences between supplier and customer; and to identify whether there is a significant difference between the level of trust and dependency towards suppliers and customers. Therefore, two final hypotheses are formulated to determine whether there is a significant difference in the level of trust and the level of dependency towards suppliers and customers. Those hypotheses are:

H_5: There are no significant differences between the level of trust towards suppliers and level of trust towards customers.

H_6: There are no significant differences between the level of dependency towards suppliers and level of dependency towards customers.

3.8 Conclusions

This chapter has detailed the theoretical framework and hypotheses that will be tested in this study. The independent variables, namely, technology attributes, level of trust, and the level of dependency, together with the dependent variables, which is e-procurement adoption decision, have been described—along with the dimensions that make up each construct. The hypotheses to be tested are then discussed and at the same time, the direction of the relationships among the variables explained.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.0 Introduction

This chapter discusses the methodology used during the data collection and analysis stage of this study. There are two phases involved: qualitative (face-to-face interview and case study techniques); and quantitative (online and mail survey questionnaire) data collection process. The content of this chapter includes a detailed explanation of the research design for each phase, sample and population of study, followed by the methodologies used to develop the survey questionnaire and data collection process. The chapter concludes with a description of the data analysis technique and statistical application used during the empirical analysis stage.

4.1 Research design

This study on e-procurement adoption within the supply chain involves two phases of data collection, which include a combination of both qualitative and quantitative approaches. Qualitative evidence often uses words to describe situations, individuals or circumstances surrounding a phenomenon, while quantitative evidence generally uses numbers in the form of counts or measurements to give precision to a set of observations (Remenyi & Williams 1996). A combination of both methods is expected to improve the validity of the research findings as it can be enhanced when the research design involves some measure of triangulation such as by using multiple methods, data sources and researchers (Mathison 1988). Furthermore, using the different research approaches could provide a more complete picture of the study than that obtained by using either method alone. Triangulation refers to the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings. Since much social research is founded on the use of a single research method and, as such, may suffer from limitations associated with that method or from the specific application of it, triangulation offers the prospect of enhanced confidence (Bryman 2002).

Patton (1987) suggests that there are four methods of triangulation that can be used: triangulation by data sources (data triangulation); among different evaluators (investigator triangulation); perspectives on the same data set (theory triangulation); and, methods (methodological triangulation). This study uses methodological triangulation with the aim of improving the clarity of results, strengthening the validity of the findings, and enhancing the credibility of the conclusions. However, this type of triangulation is a little more costly since it uses more than one data collection method. A combination of case studies and a survey questionnaire method is used to obtain all the necessary data for further analysis. The reason why face-to-face interviews were held first is because the case study method is more exploratory in nature and will help in gathering more in-depth information on individuals, groups, organisations or communities that are involved in the subject of the study. Furthermore, case study interviews are useful in exploratory research as they can help the researcher design hypotheses and can assist during the development of the questionnaire used in the empirical study (Cavana, Delahaye & Sekaran 2001).

The second phase of data collection involves a survey questionnaire to help identify the relationship between variables and support the hypothesis testing method. The best means to obtain the necessary data for hypothesis testing incorporated in this study is via a structured questionnaire as it has the advantage of reaching more geographically dispersed samples, is low in cost, and is more convenient for the respondent (Zikmund 1991). It also provides a good way to investigate the attitudes, thoughts, and behaviours of a large group of people. This also allows more generalization of the findings of the study (Cavana, Delahaye & Sekaran 2001). An appropriate research design for both the qualitative and quantitative phases is used in determining to what extent technology attributes, trust and dependency influence the adoption decisions of e-procurement technology in supply chain relationships, as discussed in the following section.

4.2 Qualitative research design

4.2.1 Introduction

Since scant information is available specifically on e-procurement technology adoption decisions in the prior literature, qualitative case studies were deemed appropriate to start this study (Hussey & Hussey 1997). Case studies will be useful because they provide further understanding of certain phenomena and generate further theory for hypothesis testing later (Cavana, Delahaye & Sekaran 2001). According to Yin (1993) a case study design must have five components: the research questions; its propositions; its units of analysis; a determination of how the data are linked to the propositions; and criteria to interpret the findings. Since this case study design was focused on exploration and description, emphasis was placed on the purpose and aims of the study, and not on formulating propositions.

This first stage of the study was employed as exploratory research to identify the current trends in e-procurement adoption specifically in Malaysia, and also to gain insights into the important factors that influence e-procurement adoption within the supply chain. It also provides preliminary evidence regarding the validity and applicability of the research framework and makes it easier to develop a questionnaire that accurately tests the hypotheses. Case study evaluation can include the use of document analysis, open and closed-ended interviews, quantitative analysis of archival data and direct field observations. An interview approach was used in this study as it is more focused than the other method. However, some weakness of this case study interview approach includes bias due to poor questions, and incomplete recollection and reflexivity—where an interviewee expresses what the interviewer wants to hear (Yin 1993). In terms of the number of companies interviewed, there is specific rule or formula available to calculate the number of samples. It is a matter of discretionary and judgemental choice, as the number of samples should reflect the degree of certainty of the case study results. Yin (1993) stressed that two or three replications are enough if an excessive degree of uncertainty is not demanded. If a higher degree of certainty is required, six or more replications are required. Based on the above suggestion, 10 companies were selected for case study interviews to make sure that the certainty of results obtained from this research is at the highest level.

4.2.2 Case study objectives and research questions

The study objective is to investigate the importance of technology attributes, trust and dependency factors on e-procurement adoption decisions among supply chain partners. Therefore, the following research questions to guide the case study interview process were developed:

R1: Do companies in Malaysia use e-procurement within their inbound and outbound supply chain?

R2: If used, what kind of e-procurement system did they adopt?

R3: What are the factors that encourage the adoption of e-procurement, or the factors that hold back companies from adopting the system for non-adopters?

R4: What are the benefits of e-procurement adoption?

R5: Is there any relationship between technology attributes, trust and dependency with adoption decision? Which factor is more important?

4.2.3 Sample selection procedure

The unit of analysis for the case studies consist of manufacturing companies in Malaysia that can be categorised as adopters, partial adopters or non-adopters of e-procurement in their procurement activities. They also vary in their size, location, type of company (local; joint venture; multinational corporation) and they come from a wide range of business industries, including automotive, aircraft, electrical, electronics and the gas industry to allow for increased generalisability. A judgment sampling, sometimes also referred to as purposive sampling method, is used in determining the sample for this case study. This non-probability sampling technique was deemed to be appropriate because of the need to make sure that all three categories of adopters, partial adopters and non-adopters are included in the sample frame. Furthermore, judgment samples are more convenient and economical in terms of financial cost and time (Hair et al. 2003). However, since a sample of convenience was used in this case study, generalizations to populations should be made with extreme caution.

4.2.4 Administration of the interview

Potential organizations for the case studies were first identified from the Directory of Malaysian Industries for the year 2007, published by the Federation of Malaysian Manufacturers (FMM). Selected companies were then contacted via telephone in an effort to especially understand the formalities required regarding how to obtain permission to conduct case study interviews at the company. A letter which further explained the purpose of the case study interviews and seeking participation from the company in the research process was then sent to the appropriate person to seek permission from the top management of the company. If permission was not given, another company from the list was contacted. There were difficulties in obtaining management agreement to participate in this study from some companies contacted. Among the reasons given were poor timing, having no time (busy), did not use e-procurement, or simply because it was company policy not to disclose their business practices. Due to rejections from selected companies, more time was spent before the total number of ten companies needed for the case studies was achieved. The identity of these ten companies, together with the interviewee, is not revealed in this report as each company was promised that they would remain anonymous in the invitation to participate in the interview.

For companies that agreed to participate, the appropriate manager was contacted by telephone or email to arrange for an interview appointment. A list of questions was prepared as a guide during the interview process and some of the respondents requested the list of questions to be emailed to them prior to the interview session. Managers were chosen based on the methodology of key informants. The key informant interview was conducted with a member of the organization who is in a unique position and sufficiently knowledgeable to report on the topic of study. They are responsible for all operational and strategic issues and are very important decision-makers within their organisation (Phillips & Bagozzi 1986). In this case, it is those who are directly involved during the e-procurement adoption decision making process and some of whom even use the system on a daily basis. A semi-structured interview was conducted with the procurement/purchasing manager or the managing director of the company itself. Semi-structured interviews are more flexible, as they allow new questions to be brought up during the interview as a result of what the interviewee says. During the interview session, the purpose of the interview was briefly explained and the key themes for discussion were highlighted at the very beginning of the interview. Questions were deliberately broad so that the respondents had as much freedom in their answers as possible. In order to avoid any diversion from the subject matter, a written guideline, based on the previous literature, was used as a guide during interviews so that no irrelevant discussions would result. Some interview conversation with the respondents was recorded, but some was not because the respondents did not consent. Eight out of the ten companies interviewed did use an e-procurement system, while two did not. Table 4.1 summarises the characteristics of the respondents for case study.

Table 4.1: Characteristics of companies interviewed

Company	Industry	Adopt E-Procurement	Designation
CsA	Automotive	Yes	Procurement Manager
CsB	Aircraft components	No	Purchasing Manager
CsC	Automotive	Yes	Procurement Officer
CsD	Cables	Yes	Procurement Manager
CsE	Automotive	Yes	Managing Director
CsF	Cables	Yes	Assistant Manager, Procurement
CsG	Medical and industrial gases	No	General Manager
CsH	Automotive	Yes	Manager, Information Technology
CsI	Automotive	Yes	Procurement Executive
CsJ	Electrics and electronics	Yes	Purchasing Officer

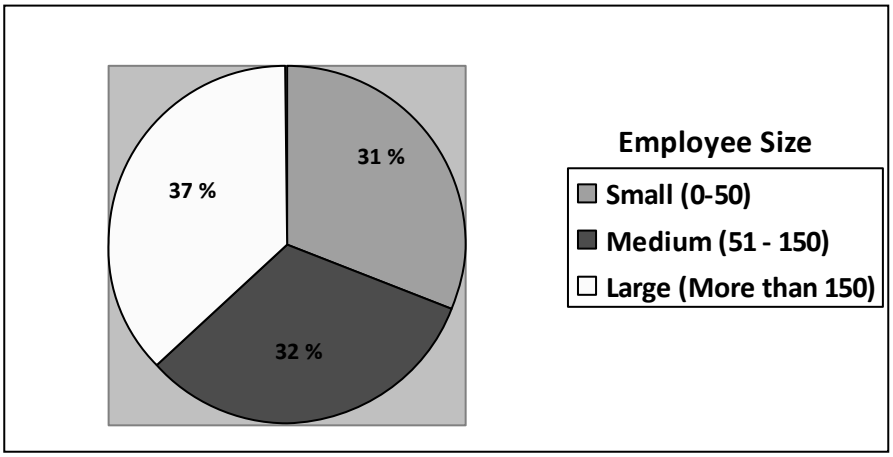
There are some differences between the questions for respondents that are adopters of e-procurement and those who are not. Companies that use e-procurement were asked to explain in detail what kind of e-procurement system they used, how it works, the factors influencing e-procurement adoption in their company, as well as benefits and problems that arise from using the system. It was then followed by discussions on the level and elements of trust with their supply chain partners and how dependent they are on their customers or suppliers. For companies that do not use e-procurement, discussion was centred on the reasons why the company did not use it, the possibility of use, benefits they think they can achieve from adoption, and discussion on their perceived trust and dependency with their supply chain partners. Each interview took around 30 to 40 minutes and all of them were face-to-face interview.

4.3 Quantitative research design

The second phase of data collection for this study involved the use of both online and mail survey questionnaires. The objective of using a survey questionnaire was to test and expand the knowledge gained through the case study interviews across a larger sample of companies and to allow empirical analysis on the research issues. The online questionnaire was intended to speed up the data collection process and, at the same time, reduce the cost. A mail questionnaire was sent to companies that did not respond to the online version.

4.3.1 Population and sample

The population of the study consists of all manufacturers in Malaysia. The sampling frame for this study is the list of companies that was obtained from the Directory of Malaysian Industries for the year 2007, published by the Federation of Malaysian Manufacturers (FMM). There are 2000 potential respondents available from FMM directory located all over the country and from various industries. Major industries includes electrical and electronics, automotive, chemicals and petroleum, food and beverage, and also machinery and fabricated metal. A stratified random sampling method based on the size of companies was used to select the potential respondents. The amount of paid up capital or employee size is commonly used by the Malaysian government to define small and medium enterprises (SMEs) and large enterprises of the 2000 companies. Fifty-seven percent of companies are large enterprises, while 43 percent are SMEs if defined based on the amount of paid up capital. For this study, the sampling units are operationally defined based on the number of employees, since the directory has a more detailed explanation of each company's employees rather than its capital. Figure 4.1 shows the percentage of each company size based on their number of employees. There are no significant differences in terms of the number of companies from each category of employee size (37% for large companies, 32% for medium and 31% for small). Therefore, a stratified random samples technique with the same number of samples drawn out from each stratum was conducted.



(Source: Developed for this study)

Figure 4.1: Size of company based on employee size

4.3.2 Pilot Study

The pilot study was conducted in two phases in order to have greater validity and reliability from the responses, especially within the trust and dependency section. During the first phase, the draft questionnaire with more than 60 items was mailed to a random sample of 150 companies that were randomly selected from the FMM directory. A phone call was made or an email first sent to potential respondents asking whether they were willing to participate in this pilot study or not. Only those who agreed to participate were selected and the questionnaires were mailed to either the procurement manager of the company or another decision maker involved during the e-procurement adoption decision process. Out of 150 questionnaires sent out, 32 of them were returned and analysed. Of the respondents, 22 were e-procurement adopters while the other 10 were non-adopters. Both factor and reliability analysis was conducted and a new draft of the questionnaire was prepared. The second phase of the pilot study process was conducted via face-to-face interviews with five procurement officers from five more companies. These were different companies to those involved in the case studies interviews. A description of each company interviewed during this stage is shown in Table 4.2.

Table 4.2: Companies interviewed during pilot study

Companies	Industry	Person Interviewed
Interview1	Pharmaceutical	Managing Director
Interview2	Electrics and electronics	Purchasing Manager
Interview3	Tyres manufacturing	Supply Chain Manager
Interview4	Telecommunication	Assistant Manager (Purchasing)
Interview5	Plastics product	Procurement Officer

The objective of this interview is rather different than that with the first ten companies. It is primarily to validate the case study findings and also to find the best set of questions for the quantitative data collection phase. A new draft questionnaire was created based on the first phase of pilot study findings and given to these five executives for evaluation. Based on their opinion, the best set of questions to measure trust and dependency were determined. There were also some minor changes to the wording and structure of the questionnaire based on these expert opinions.

4.3.3 Measurement instrument

There have been a number of instruments developed in previous studies related to technology adoption, trust or dependency, and several have been adopted with some modifications for this study. The use of an existing questionnaire saved time and reduced the work needed in developing a new questionnaire, and at the same time also carried some evidence of reliability and validity with it (Morgan & Hunt 1994).Table 4.3 lists the previous work on technology attributes, trust and dependency survey items incorporated in this study.

Table 4.3: Measurement instruments

Variables	Previous research
Technology attributes	Premkumar & Potter (1995) Harrison & Mykytyn et al. (1997)
Trust	Kwon & Suh 2005 Myhr & Spekman (2005) Doney, Cannon & Mullen (1998) Svensson (2001)
Dependency	Svensson (2002b) Brown & Lusch et al. (1983) Gassenheimer & Ramsey (1994) Kumar et al. (1998)

The first draft questionnaire, which combined all the previous measures used in related research, consisted of 68 total items that measure technology attributes, trust and dependency (Appendix 1). After two phases of the pilot study where the questionnaire was posted to 150 companies and then followed up by face-to-face interviews with five more companies, the number of items was reduced significantly to just 15 items. All items that measured technology attributes were totally removed as the findings of the exploratory case studies (Chapter 5) did not show any significant difference from the majority of previous technology adoption studies. Furthermore, input from the survey questionnaire sent to companies for the pilot study revealed that technology attributes were the most important factor that influences adoption—as chosen by the respondents. In the pilot study questionnaire, respondents were asked to rank which of the three factors: technology attributes; trust; and, dependency were the most important reason why they decided to adopt the system. A total of 32 questionnaires were received back during the pilot study and 22 companies were adopters of e-procurement system. As evident in Table 4.4, 18 out of 22 adopting companies, or 81.8%, chose technology

attributes factors as the most important reason why they use e-procurement compared to 4 for dependency, while not a single companies chose trust.

As a result of the exclusion of technology attributes factor, the focus of the study now is only on the influence of trust and dependency factors on adoption. For both trust and dependency items, a factor analysis was conducted and items with loading less than 0.7 were removed (Hair et al. 1998). The scale was then tested for its reliability by looking at the Cronbach alpha value. The alpha coefficient value can vary from 0.00 to 1.00. The value 0.00 indicates no reliability at all and 1.00 means perfect reliability. Based on this, several more items were deleted based on the suggestion given from the SPSS output in order to achieve a Cronbach Alpha value of more than 0.7, which is the acceptable value for each variable (Cavana, Delahaye et al. 2001). The above item reduction process is necessary as respondents may not answer a questionnaire if it is too long or too difficult to answer (Hair et al. 2003), or may superficially scan for answers they think apply to end the process quickly (Folz 1996).

Table 4.4: Important adoption factors from pilot study

	Frequency	**Percentage**
Technology attributes	18	81.8
Dependency	4	18.2
Trust	0	0
Total	**22**	**100**

The final version of the questionnaire had only 15 items that measure latent variables (trust and dependency), together with nine items dedicated for non-adopters of e-procurement which study the factors for non-adoption. It was divided into five sections. Section A was for the demographics of the company, section B looks at e-procurement adoption or non-adoption, section C consists of the items to measure trust, section D is items to measure dependency and, finally, section E is dedicated only to non-adopters of e-procurement. It lists out factors for non-adoption for them to rate. The measurement for Section C, D and E were developed using a seven point Likert-scale ranging from 1 for strongly disagree to 7 for strongly agree. A 7 point scale was chosen rather than 5 as review of the literature indicates that expanding the number of choice-points beyond 5 does not systematically damage scale reliability, yet it helps increase the scale sensitivity (Cummins & Gullone 2000). The following sections will discuss each variable and the items that were used to measure them.

4.3.3.1. Level of trust

Level of trust is a second order factor and it can be estimated using various procedures. The method of repeated indicators, known as the hierarchical component model suggested by Wold (1989), is used for this study. By using this method, the level of trust is directly measured by observed variables for all of the first order factors that are measured with reflective indicators. Altogether, eight total indicators were created to measure the level of trust, based on the important dimensions identified using the case

studies. Two items are specifically for understanding the important of contractual trust. A 7-point Likert scale was used where respondents were asked to read eight statements and to indicate to what extent they agreed or disagreed. Those statements are shown in Table 4.5.

Table 4.5: Items used to measure trust

	Statements	Code
1	Our partners do not breach agreements to their benefit	ConT1
2	Our partners are always sincere and do not alter facts to get what they desire	ConT2
3	Our partners always try to inform us if a problem occurs	Tru1
4	Our partners always provide the correct information we require	Tru2
5	Our partners always listen and seriously respond to our proposals	Tru3
6	Our partners are always cooperative	Tru4
7	Our partners always treat us kindly	Tru5
8	Our partners commit to maintain and develop our relationships	Tru6

4.3.3.2 Level of dependency

Just like trust, the method of repeated indicators, known as the hierarchical component model suggested by Wold (1989), is used to measure the level of dependency in this study. Again, a 7 point Likert scale with seven constructs was used to measure the level of dependency. Respondent were required to read seven statements and indicate to what extent they agreed or disagreed. A list of the items that measure dependency are shown in Table 4.6. Item 4 (Dep4) was negatively stated and, therefore, was reverse coded during data analysis. The above seven items correspond with all the important dependency dimensions identified from the case studies.

Table 4.6: Items used to measure dependency

	Statements	Code
1	Our firm is well aware of its partners' strengths and weaknesses	Dep1
2	Our firm activities are developed through the knowledge that is interchanged with its partners	Dep2
3	Partners' skill is crucial to our firm's operation and is very difficult to replace	Dep3
4	Our firm's partners do not improve our firm's goodwill	Dep4
5	Our firm's partners influence our reputation in the marketplace	Dep5
6	Our firm's IT investments are adapted to the partners' decisions on IT solutions	ITechD1
7	Our firm strives to maintain a common IT standard of hardware and software with its partners	ITechD2

4.3.3.3 E-procurement adoption decision

As both trust and dependency are external factors that influence adoption of information technology initiatives, a special scale was created to measure the importance of these two external factors in adoption decisions. This scale is customised based on the work by Damanpour, Fariborz and Schneider (2006) who studied the adoption of innovation by public organisations in United States. The external factors that influence adoption in their study are councils' financial support and a scale is developed to measure this level of support and its relationship with adoption. In this study, the respondents were asked to rate the level of outside influence when they are making adoption decisions, using a scale from 1 to 7. One indicates that it is totally the company's own internal decision, while seven means that it is totally an external requirement. Any number in the middle will reflect a degree of own and external influence on adoption decisions. A high level of external influence reflects the importance of trust and dependency factors, which constitutes the external environment of the company. The statement and scale to measure adoption decisions is shown in Table 4.7.

Table 4.7: Measurement for influence on adoption decision

Please indicate whether the decision to use e-procurement is part of an internal requirement or an external requirement (to match the requirement of partners). Circle 1 if it is totally company's own decision or 7 if it is totally an external requirement. If it is a mixed decision, please circle one of the numbers in the middle that reflect the degree of own and partner's influence on the adoption decision.								
Totally own decision (100%)	1	2	3	4	5	6	7	Totally partner's decision (100%)

4.3.3.4 Control variable

The size of the company was used as a control variable for this study. Inclusion of this variable will allow any variance in the dependent variable, e-procurement adoption decisions which may not be explained by the research model. Furthermore, Porter (1987) argues that size of a company indicates the scope of a firms' operation and the power to influence an industry's overall structure. Indicators of organisational size often include revenue and paid-up capital. As a result, both revenue and companies' paid up capital will be used as a measure to determine the size of company during data analysis.

4.3.3.5 Interaction effect

In studying the interaction effect of the level of trust and the level of dependency on adoption, a product indicator approach is used to estimate the underlying interaction construct, as suggested by Chin, Marcolin and Newsted (2003). Under this approach for modelling interaction effects, a single product term is used (Trust*Dependency) to examine the influence that the level of trust would have on the relationship between dependency and the dependent variable, which is the adoption decision. This approach is made under the assumption that each measure is error free. Independent variables trust,

dependency and trust*dependency is viewed as an indicator which reflects the true underlying continuous latent constructs of interest. The estimation of this true underlying construct, in turn, entails the use of multiple/parallel indicators.

4.3.3.6 Reasons for non-adoption

The secondary objective of this study is to investigate the reasons for non-adoption among respondents who did not use e-procurement in their operations. This item was incorporated from previous studies on information technology adoption (Lai, Ngai & Cheng 2005; Shariff, Kalafatis & Samouel 2005; Tobin & Bidoli 2006; Bharati & Chaudhury 2006). Table 4.8 lists all the items used to identify the reason for non-adoption of e-procurement.

Table 4.8: Items used to identify reasons for non-adoption

	Statements
1	Expensive to established and maintain
2	Concern over security of data
3	Lack of professional IT staff
4	Lack of trust on partners
5	Difficult to use
6	Lack of knowledge about e-procurement
7	Lack of commitment from top management
8	Not required by supplier or customer
9	Benefits of the system are not good enough

4.3.4 Data collection

Both the online and mailed questionnaire version was prepared for data collection. These two methods of data survey collection were chosen because they have the advantage of relative ease and speed with which the research can be conducted and they are relatively cheap compared to others (Hussey & Hussey 1997). An online survey form was created using different browsers to ensure it appeared correctly and was also checked for anyone using the free online survey generator provided by Response-o-Matic (Response-o-matic.com 2005). The survey form created by this survey generator was then tested for errors. It was then uploaded and hosted using the free hosting service provided by a company known as WebNG.com (Webng.com 2007). Every survey form completed by the respondent was automatically sent to the researcher's email address registered with Response-o-Matic. After two weeks, a mailed package that included a cover letter explaining the research objectives and instructions on how to complete the questionnaire, together with a postage-paid reply envelope, was sent to respondents in order to encourage the return of the questionnaire. Those who filled in the survey online were omitted from the mailing list. Just like the interview process, the questionnaire was sent to the key informant within the companies, which included the procurement

manager or other officer in-charge of supply chain and logistics operation. A telephone follow up was made two weeks after the questionnaire was posted to companies.

4.3.5 Data analysis technique—Structural equation modelling (SEM)

A structural equation modelling (SEM) technique is used in this study with the purpose of studying the influence of trust, dependency and their interaction on e-procurement adoption decisions. There are varieties of software available for SEM analysis such as LISREL, AMOS and PRELIS (Garson 2008). For this study, AMOS software version 7 was used. The reason why SEM is chosen instead of multiple regression analysis is due to the fact that SEM allows more flexibility by allowing interpretation in the face of multicollinearity, use of confirmatory factor analysis to reduce measurement error by having multiple indicators per latent variable, the desirability of testing models overall rather than coefficients individually, the ability to test models with multiple dependents, and also because of its graphical modelling interface (Garson 2008). As this study involves an estimation of a series of simultaneous equations with multiple indicator constructs, SEM is expected to improve the statistical estimation between dependent and independent variables (Bollen 1989). The fitting of the SEM is a recursive process that typically involves five steps (Fenlon 2008), namely:

Step 1: Specification of the model;
Step 2: Identification of the model;
Step 3: Estimation;
Step 4: Testing the fit of the model; and
Step 5: Re-specification of the model.

The drawback of SEM is that a small sample size is not recommended. The accuracy and stability of SEM results decline with a decreasing sample size, as well as with increasing number of variables (Nachtigall et al. 2003). However, there is much discussion on the perfect size of sample needed for the best results. Stevens (2002) assumed that 15 cases per measured variable in SEM are reasonable as SEM is closely related to multiple regressions, which have a rule of thumb of 15 cases per predictor. If the data is normally distributed with no evidence of missing data or outlying cases, Bentler and Chou (1987) stressed that five cases per parameter estimate is good enough. Loehlin (1992) argues that in a model with two to four factors, the researcher should collect at least 100 cases, with 200 being better. When data is not normally distributed or are otherwise flawed in some way, larger samples are required. The consequences of using smaller samples include more convergence failures (the software cannot reach a satisfactory solution), improper solutions (including negative error variance estimates for measured variables), lowered accuracy of parameter estimates and, in particular, standard errors as SEM program standard errors are computed under the assumption of large sample sizes (Byrne 2001).

4.3.6 Data analysis technique—Gap analysis

Gap analysis is also used in this study to provide answers to the two hypotheses that are interested in identifying whether there is a significant difference between the level of trust and the level of dependency towards supplier and customers. A combination of three gap analysis methods is adopted to identify factors with the most critical gap for trust and dependency. First, by using the T-test analysis to determine the significance

value of each item, followed by the weighted mean gap analysis method that ranked each items and, at the same time, identified the top three factors with the highest weighted mean gap values. This is then followed by the unweighted Important Performance Analysis (IPA) method which identifies which factors fall under the 'Critical' area within the IPA matrix (Patterson, Grimm & Corsi 2003). Determination of criticality is based on which factor satisfy all these three criteria:

- Obtain a value of less than the 0.05 significance level for paired sample T-test;
- Within the top three factors based on the highest weighted mean gap values in the weighted mean gap analysis; and,
- Item located within the "Critical" quadrant of the IPA matrix.

After that, the aggregate or cumulative mean value of items for trust and dependency is also tested using paired sample t-test statistics to determine whether there is a significant difference between the two means or not, in order to test the related hypotheses.

4.4 Conclusion

This chapter has described the methodology adopted for this study. The rationale behind the adoption of both qualitative and quantitative methods, together with instruments development for both methodologies, has been explained. The triangulation of data collection methods, which incorporates case studies interview and survey questionnaire, is used in order to increase the reliability of the findings and hence conclusions drawn from this study. The population and sample of the study, together with the sampling procedure were described, followed by the details of the survey questionnaire development and the data collection process. It concluded with a description of the data analysis technique used to analyse the data, which is the structural equation modelling and gap analysis technique.

CHAPTER 5: CASE STUDY FINDINGS

5.0 Introduction

This chapter will discuss each case study interview conducted with the ten companies selected that were either full adopters of e-procurement, just a partial adopters, or non-adopters. The interview process was conducted within the period of October 2006 to May 2007. Detailed information gathered through the face-to-face interviews with the key informant of the company is provided. Findings and conclusions from this first stage of data collection and the analysis process are then discussed.

5.1 Case study A

5.1.1 Company's Background

Case study A (CsA) is Malaysia's largest motorcycle manufacturer which was established in tandem with Malaysia's efforts to achieve industrialised nation status by 2020. This company spearheads the technology transfer and development of motorcycle manufacturing, to eventually enable the country to proudly produce indigenous motorcycles. Kawasaki Heavy Industries (KHI) is the main technology partner of CsA. In terms of shareholders, equity is shared by four parties; DRB-Hicom Berhad (55%), Kawasaki Heavy Industries (19%), Khazanah Nasional Berhad (15%) and Sojitz Corporation (formerly Nissho Iwai Corporation, Japan) (11%). The first 100 units of motorcycles produced by CsA were paraded in 1996 and the sales of their first model, the 4-stroke, 110 cc moped, began in November 1996. After less than one year sales in the domestic market, CsA launched its product in the international market on October 17, 1997. CsA started to export their motorcycle in 1997 to Cambodia (major international market), Greece, Turkey, Argentina, Egypt, Singapore, Malta, Vietnam and Iran. Currently, it produces and distributes more than 15 models of motorcycle both for local and international market. CsA's Malaysian market share was about 27 percent in 2006 with total sales of 120,000 units. The introduction of a new model in 2007 is poised to increase its market share to 32%. Their major competitors in the local market include imported motorcycle models from Honda, Suzuki and Yamaha.

5.1.2 Full adoption of e-procurement at CsA

CsA are full adopters of e-procurement technology as described by their procurement manager. He explains that: "*Almost 99.9% purchase of component, material and supportive item needed for our production and administrative function is done electronically. Manual procurement used only in the case of emergency where the item required as soon as possible, but this kind of situation is very rarely happen*". CsA uses a web-based MRP system that is directly linked with their suppliers' computers. This software was first purchased from a software provider, but then they customised it in-house to suit both CsA and their suppliers' operations. CsA require all their suppliers to use the same procurement system and, therefore, they supply and install it into their suppliers' information system. Suppliers are then charged a small installation and monthly fee for using the system.

When asked about the cost to suppliers to install the system, the procurement manager insists that: "*I believe that affordability is not a major issue among our suppliers as the amount that we charged them is so small. We are indeed subsidizing our suppliers when*

they use the system. Installation and monthly fee is very small compared to the amount of business suppliers get when dealing with us". Regarding the reason why they chose the particular e-procurement system, he added that: "*It is because the web-based MRP system is affordable and easy for our employees and even suppliers to use. Furthermore, it is flexible and can be customized according to ours and also supplier's requirements*".

The same system also helps them link with their motorcycle distributor domestically and internationally. It allows CsA to monitor orders and inventory available at each of their distribution centres. As all ordering processes are held electronically through this system, distributors are also supplied with this system and charged only a small installation and monthly fee. Another e-procurement system used at the outbound side of CsA's supply chain is known as the E-Excise system. This system provides them with a link to the Malaysian Customs Department that enables a quick registration process for each motorcycle produced by CsA for tax and duty purposes.

5.1.3 High level of trust at CsA

Since CsA has a direct e-procurement system link with its suppliers, the issue of trust is somewhat important. However, CsA has taken all the necessary actions to make sure that only information that is relevant to their suppliers is available through the web-based MRP system. Only pre-approved suppliers may login into the system using the pin number provided to prevent unauthorised access. There are also terms and agreements that must be agreed upon and followed by their suppliers in regard to using the system. Among the information that CsA shares with its suppliers through the system is the production forecast and inventory level data. This allows their suppliers to plan their delivery ahead of production scheduled by CsA. At the same time, suppliers also share their level of inventory information with CsA, giving them precise information on the availability of materials or components so they know which supplier has available what they need. At the same time, suppliers may also view new orders, send an invoice and view payment status through the system.

A Just-In-Time (JIT) delivery system is applied by CsA so there is only a minimum level of inventory kept at their premises. The MRP system helps CsA manage their orders and time when the materials or components should be delivered. "*That's why it is strategically important for our suppliers to have the same system too, so they will have correct information on our requirement and when were they suppose to deliver the item. Reliability in terms of prompt delivery is crucial to our production. At the same time, we also expect them to be honest and share their level of inventory*", said the procurement manager. For very important materials or components, CsA does have some inventories kept and there is also a fixed supply contract with particular suppliers to protect themselves against shortages in supply that can halt their production.

In terms of their trust in suppliers, the procurement manager explains that: "*We have confidence in our suppliers because they have to go through a strict selection procedure before they can become our vendors. Our policy here is to take into consideration three important aspects which are called CQD: cost; quality; and, delivery. In terms of cost, of course we tend to look for suppliers that can supply the materials or component at the right cost. Lowest price does not guarantee selection since we will consider the quality*

of materials or components they supplied too. Prompt delivery, as I mention before is crucial since we use JIT system in our inventory management".

The procurement manager interviewed also insists that CsA has never experienced a major problem with their appointed suppliers. He believes that their selection process ensures that only capable suppliers that can fulfil their requirements are appointed. Furthermore, CsA and their suppliers always have good communication with each other and if the supplier cannot fulfil their requirement for whatever reason, they always inform CsA early so they can source from alternative suppliers. It is the same situation when CsA choose the distributors of their motorcycles. As a result of this strict selection procedure, CsA perceives itself as having a high level of trust on both their suppliers, and also their customers (distributors).

5.1.4 High supplier dependence on CsA

CsA has a wide supplier base for the majority of components or materials that they need for their production to protect themselves against any contingency. However, the procurement manager agrees that they did have some parts that were supplied by a single supplier: "*For this type of item, we usually have a close relationship with the supplier and the number of purchases is constant every month. Deliveries are well protected by a pre-determined purchase agreement between our company and the suppliers. So it is the supplier's responsibility to adhere to the contract requirement in terms of delivery of this crucial item*". At the same time, CsA also keeps more inventories for such items to prevent any problems in their production line. Since they have many suppliers for most items and are perfectly guarded by a pre-determined contract for specific items, CsA perceives itself as not having a high level of dependency on any of their suppliers for parts or components. At the same time, CsA also has a huge number of distribution centres in Malaysia and overseas and hence do not depend on any particular distributor to sell their motorcycles. Therefore, its level of dependency towards its customers is also considerably low.

In terms of their suppliers' dependency on CsA, there are some suppliers for which the majority of their business is with CsA and therefore they have a high level of dependency on them. As a result, these suppliers have to make sure that they always fulfil the requirements, including the use of the e-procurement system provided by CsA. When asked whether CsA forced all their suppliers to use the e-procurement system in order to keep on being their suppliers, the procurement manager said, "*Yes, it is true that all our suppliers must use the system since each and every part of our purchasing and selling activities is held electronically. However, I disagree with the statement that we force our supplier to do so. We never force the suppliers but only suggest that they use the system. Even our suppliers themselves do believe that the adoption of the e-procurement system will eventually benefit them and their business. We charged suppliers a very small fee to use this system, combined with the installation and technical support that we provide; it is a win-win situation for both parties*". It is believed that CsA's suppliers and distributors will get more than what they pay for using the system when doing business with CsA, so they believe that suppliers voluntarily use the system and there is no issue of suppliers being forced to use it.

5.1.5 Most important factor for e-procurement adoption

The final question asked of the procurement manager was related to which of the three factors discussed before, that is, technology attributes, trust, and dependency, was considered the most important factor that encouraged them to use the system. He answered, "*The fact that the system itself is cost effective and brings a lot of advantages to us and our suppliers, so I strongly believed that the technology attributes itself is indeed the main reason why we decided to adopt e-procurement, followed by the trust we have in our suppliers and customers*".

5.2 Case Study B

5.2.1 Company's background

Case study B (CsB) is a manufacturer of composite parts for secondary structures of commercial aircraft, which then supply the Hexcel facility in Kent, Washington for final assembly before being shipped to Boeing or other customers worldwide. CsB is a joint venture company which consists of Boeing, Hexcel Corporation, Sime Darby Berhad and Malaysia Helicopter Services (MHS). Composites are tough, lightweight materials made by combining two or more dissimilar products such as fibers and resins to create a product with exceptional structural properties not present in the original materials. Composites are used in virtually all the world's major aircrafts to meet requirements for reducing weight, increasing payloads, improving fatigue life and increasing corrosion resistance. Boeing is the world's largest consumer of composite materials while Hexcel is the world's largest manufacturer of advanced composite materials. The composites produced by CsB consist of fabricated parts for secondary structural assemblies on commercial aircraft, including assemblies of wing fairings, fixed or movable surfaces, inspection-access doors and similar parts for the worldwide market. CsB's local competitor is Composite Technology Research Malaysia (CTRM), who also supplies aircraft parts to major aircraft manufacturers.

5.2.2 Manual procurement at CsB

An interview with the Procurement Manager at CsB revealed that this company did not use any kind of e-procurement system in their purchasing or selling activities (0%). Their information system is not linked with either their suppliers or customers. All purchasing activities are held manually using the traditional telecommunication facilities such as facsimile, telephone and also regular mail. Some communication and ordering processes between CsB and their suppliers or buyers can be conducted through email and that is the only electronic means of purchasing materials for their production or supporting items for daily business operations. Therefore, CsB can be categorised as non-adopters of e-procurement. The procurement manager interviewed stressed that: "*Materials we use to produce composite components are unique and there are only a few suppliers available worldwide. Hence, managing this small list of suppliers is fairly easy for us, even though it is done manually*". So far, CsB are satisfied with all their suppliers since they always deliver within the required schedule and at the level of quality they need. Their only customer is Hexcel Corporation, which further use the components produced by CsB in their own aircraft components, manufactured for Boeing. CsB have a long-term supplying contract with them. Therefore, it can be said that CsB have a high level of trust in both their suppliers and customers.

Regarding CsB's dependency on their suppliers, the procurement manager argues: "*Our dependency on our suppliers is considerably high. The materials we used in producing composite product are unique, and therefore the number of our suppliers is relatively small. In order to protect against uncertain events, we enter into a long term agreement with our suppliers to ensure that we receive enough materials each month for our production*". At the mean time, CsB's dependency on their customer is also considerably high because they sell their products solely to Hexcel Corporation. They would experience difficulty if they suddenly lost their business with this company.

5.2.3 Why not using e-procurement?

According to the procurement manager, among the reasons why e-procurement is not seen as a necessity at CsB are:

i. There is a limited supplier source and even limited customers due to the type of product that they produce;
ii. Almost all CsB purchases do not need to be set up for e-procurement since they are not as complex as other manufacturing industries such as automotive or electronics. Every purchase can be managed manually without any problem;
iii. Materials used in producing composite parts are unique with a very small supply base. Furthermore, material prices are agreed upon via a contract with their suppliers; and,
iv. CsB are not required by their major supplier and customer to use e-procurement.

5.3 Case Study C

5.3.1 Company's Background

Case study C (CsC) was first established in 1975 to distribute, sell and service imported luxury cars, before then venturing into the automotive manufacturing business. CsC was originally the franchise holder for South Korea's Kia vehicles in Malaysia before their own automotive manufacturing division was incorporated in 2005. Currently, they have the license to manufacture a new range of Kia and Peugeot cars as their own brand, especially for the Malaysian market. Its range of locally-made cars are now roaming Malaysian roads, distributed through its network which consists of 68 sales outlets and is supported by 35 service centres for after sales service nationwide. In just a short period, CsC has moved forward and have already started exporting their products to other countries, through its current Appointed International Dealers agreement with Kia, such as Malta, Cyprus, Sri Lanka, Brunei, India, Bangladesh, South Africa, United Kingdom, Pakistan, Nepal, Singapore and other ASEAN countries. CsC's market share in 2006 was 14% and is expected to improve to 17% in 2007. The majority of the Malaysian car market is dominated by their local rivals, Proton and Perodua, in addition to foreign imports such as Honda, Toyota, Mazda, Chevrolet, Hyundai and Nissan.

5.3.2 E-procurement in selling activities at CsC

According to the procurement officer, all purchasing activities at CsC are conducted manually, while at the other end, all manufactured cars were sold using an integrated information system. Therefore, the volume of materials or component purchased electronically in terms of percentage is 0% while 100% of their selling activities are conducted electronically. "*Since we have no electronic system to share information with our suppliers, we conduct a monthly briefing with our suppliers to communicate our*

production schedule and inventory requirements, and to announce any future programs at the company too. For less important information, we communicated via email or fax", explained the procurement officer. He also added that: "*Of course this is quite inconvenient especially for suppliers that are located far from our manufacturing plant, since they have to send representatives to attend the briefing every month. Based on this situation, coupled with the huge number of materials and components needed in production, plus an increase in the number of models produced, which also means an increase in the number of suppliers, it is becoming much more difficult for us to manage with the current manual system*". The top management at CsC realises that there is an urgent need for an e-procurement system to overcome current problems and automate CsC's purchasing process by linking them directly with their suppliers. Therefore, CsC has already employed a consultant to study their process and to suggest the best system that can help them improve their supplier management and purchasing activities. They are hopeful that the system will be in place in 2009.

Current practice at CsC requires that all cars manufactured by their manufacturing division be sold directly to their subsidiary, which then distributes their cars through their appointed dealers. All selling activities between CsC manufacturing divisions and their distribution subsidiary are held electronically using their internal ERP system. Therefore, it can be said that CsC sells the entire stock they produce through an e-procurement system that links these two divisions. "*This system allows our distribution subsidiary to communicate the number of actual sales and the forecast number of cars needed for the next coming month. The number of cars produced at our manufacturing plant depends largely on the forecast developed by the distribution subsidiary. This system also allows efficient and effective ordering, invoicing and payment processes between both divisions which brings a huge advantage to us*", explains the procurement manager. The visible outcomes of using such system in the selling process encourage them to seriously consider using an e-procurement system in their purchasing activities too.

5.3.3 Level of trust between CsC and its partners

CsC has a vendor development program wherein they support and encourage local suppliers to supply materials and components to them. Overseas sourcing will be held only if there is no capable local supplier available for any materials or component they need. However, there are strict requirements that must be fulfilled before a supplier can be included into this program, as described by the procurement manager: "*Upon application, we will carefully study the potential supplier's background in terms of financial situation, type, price and quality of material or component they supply. The company must be financially strong so they can supply us for a long time. We also tend to look for a high quality material at the right price, since durability and safety is very crucial in automotive industry. Delivery efficiency and the supplier's previous track record is another secondary factor that we will look into. We will have also had a meeting and further discussions to better understand the company and their management before they are approved as one of our appointed vendors*".

According to the procurement officer, being involved in CsC's vendor development program will bring many benefits to the suppliers, not only in financial terms, but also in

other benefits such as staff training, technical advice and knowledge transfer. "*We at CsC feel that we have responsibility to develop these small local suppliers so that they will become more competent and not depending on our company only for business in the future. That is why we create this vendor development program and try our best to source our materials or component from local company*", he added. The procurement officer at CsC also insists that they did have a high level of trust in their current suppliers, but they always remain cautious by doing a multi-sourcing for each material or parts needed. Since they started their operation, CsC has never faced a major problem with their appointed suppliers that halted their production. Most of the time, suppliers have satisfied their requirements. Issues such as late delivery, incorrect quantity or components that are broken or not working sometimes did happen, but their suppliers always did well to resolve the problem. Although CsC is generally satisfied with their current suppliers, this does not stop them from time to time seeking alternative suppliers that could provide them with a better quality component at the right price. Furthermore, the technology is always changing over time so they value any suppliers that come out with new parts or components that can improve the quality of their cars.

Since CsC does not use an e-procurement system within their purchasing activities, there is no issue of electronic data theft, especially among its suppliers. They also believe that their suppliers will not expose any information given during suppliers' briefing, which might include some sensitive information. Suppliers are strictly bound by the contract they sign when they are selected to supply to CsC. Although CsC did sell their cars to the distribution subsidiary electronically using the ERP system that links them together, it is an internal system and the data leakage issue is not a major concern to them.

5.3.4 Dependency on licensor

In terms of dependency, CsC has taken the necessary measures to reduce their dependency on their suppliers by having various sources of supply. If one supplier fails to deliver, they always have another company as a backup. However, there are a few items that are unique and are supplied by a certain company according to the procurement officer: "*Our car engine especially is supplied by our technological partner, which is currently Kia and Peugeot. We do not have the capability to produce our own engine yet and this purchase is part of our licensing contract with Kia and Peugeot too, where we have to buy this engine from them. There are also some other components such as the electronics and airbag that we source from only one company overseas but for all of these items, we have a pre-empted agreement with the supplying firm to supply a fixed amount of the items within a certain period to make sure that it is always available*".

Based on the above statement, CsC is initially producing cars based on the license given by both Kia and Peugeot. They are very much dependent on these two companies for technology and expertise. In this case, the level of dependency between CsC and these two suppliers can be considered as high. However, for the suppliers of other materials or components, it is relatively low due to the fact that CsC has multiple sources of supply. In terms of their suppliers' dependency on CsC, the procurement officer's personal opinion is: "*There are some supplying firms under our vendor development program, where the majority or sometimes all of their business comes from us. These companies*

could be in trouble if they lost their supplying contract with us. However, we will never take advantage of this situation by forcing the supplier to do something or to use an e-procurement system. But if the suppliers failed to fulfil their obligation in terms of delivery and quality as required by the agreement, then we might reconsider our business relationship with this particular supplier".

5.3.5 Most important factor for adoption

Again, the final question asked before the interview concluded was about which of the three factors discussed before, namely, technology attributes, trust, and dependency is considered as the most important factor that encourages the company to use the system. The procurement officer also chose technology attributes as an important reason for adoption. The reason given was: "*We use this system in selling our cars and it proves to be very effective and efficient. Therefore, we are going to introduce it into our purchasing process because we believe this technology is the best solution to most of our manual processing issues and not because of any obligation from others*".

5.4 Case Study D

5.4.1 Company's Background

Case study D (CsD) is an established manufacturer of cables, wire harnesses and components for the automotive industry, in addition to some electrical modules for the consumer electronics industries. For instance, their major customer comes from the automotive industry. Almost 80% of their products are sold to the two largest car manufacturers in Malaysia, Proton and Perodua, in addition to other customers which include Modenas and Mitsubishi. CsD initially had a technical assistance agreement with a Japanese firm to manufacture wire harnesses in Malaysia in 1993. Currently, CsD and their Japanese partner have expanded the operation into Indonesia where they created a joint venture company, mainly to supply the Japanese car manufacturers in Indonesia. In Malaysia itself, CsD operates two manufacturing plant and one research and development facility with the objective of helping their client in styling, engineering, prototyping, product development and mass production. CsD currently employs more than 500 employees nationwide. Competition, however, is very stiff in this industry as there are many major players such as 3M, GE Cables and Supercomal in the same market. The procurement manager estimated that CsD's local market share for cable and wire harness, which is their main product, to be between 20 to 25%.

5.4.2 Transition from manual to e-procurement at CsD

For the moment, all purchasing activities at CsD are conducted manually. During the case study interview, however, CsD was in the process of upgrading their system from the current MRP system, which is a standalone system, into ERP, which will allow them to link directly with their suppliers. The ERP system, which can be linked with their suppliers through the World Wide Web, is expected to be fully running in June 2007. When asked about why they are moving towards e-procurement, the procurement manager at CsD said: "*This industry is characterised by its huge number of materials and components that go into our production process. We have thousands of suppliers either in Malaysia or from overseas. That's why there is a serious need for an effective e-procurement system that can help us manage and speed up the procurement processed at our company. Furthermore, we are also expecting an increase in demand for our*

product by the end of 2007 as both of our major customers are going to introduce a new car model. At the same time, we are expecting more business in the future as our top management is in the process of negotiating a new deal with another car company, which is a foreign car manufacturer".

In terms of benefit, the introduction of the new e-procurement system is expected to speed up the process and to increase the efficiency of purchasing activities once it is fully implemented. CsD also hopes that by using the system, it will allow them to implement a JIT system in their operation as a means to reduce inventory and cost. "*The current inventory system requires some storage space, and it exposes us to inventory risk such as theft, becoming obsolete or broken because we order them monthly on a 1+2 basis. It means that we now keep one month worth of inventory for actual production requirements and two months as a safety stock, and that is too much*", added the manager. When asked whether CsD will require all their suppliers to have link with their system once it is running, the procurement manager said: "*No I do not think so. We realize that some of our suppliers are SMEs and some is just a trading company, where they did not manufacture the material or component themselves. So what we will do is to encourage them to use the system because of the benefit it brings. If they do not want to use, then we will still buy from them manually*."

At the other side of their supply chain, CsD uses e-procurement in all their dealings with all three of their major customers. They were directly connected to Perodua, Proton and Modenas through the customers' e-procurement system, while for other customers, they were held manually. The customers' system that CsD is using is either a web based portal that is accessible via the Internet or web based ERP system that is developed and installed into CsD's system by their customers. CsD pay a small installation and a monthly fee for the web based ERP system. As an approved supplier, CsD received a username and password to enter the system, where they can check new orders, view current level of inventory kept by the customer, their production plan and payment status. The benefit of such system to CsD includes the fact that it is easy and simple to use, improves accuracy and efficiency of their order management, in addition to improving the communication process between both companies. When asked to estimate the percentage of business held electronically at both side, the procurement manager said: "*I think it is around 70% of our selling activities are conducted electronically using this customer's e-procurement system, while in terms of our own purchasing, currently we have none, but it is expected to be around 50% of electronic purchasing once our own web based ERP system is running*".

5.4.3 High level of trust on customers

When selecting their suppliers, the most important factor considered by CsD is the quality of materials or components they supply, followed by the price being offered. Other than that, they will also consider the supplier's previous track record and financial situation. CsD mostly do business with suppliers with a good business history, and from time to time, they carry out an audit of suppliers' performance and even facilities to ensure conformity to their requirements. At the current time, CsD also practise dual sourcing of all materials and components they need to protect their production run from any uncertainty. CsD believes that their suppliers will fulfil their obligations as agreed

within their contract and, if not, they might stop dealing with that particular company and purchase from other suppliers. When asked about their level of trust with suppliers, the procurement manager said: "*It is quite difficult to determine because we have thousands of suppliers and each have their own way of doing business. I must say that our level of trust is different for each different supplier. As a long established company, we did experience problems with some of them and the most common problem involved quantity, quality and delivery issues. However, the majority of our suppliers did do well. So I think it is fair to say that we have a considerably high level of trust with all our suppliers*".

The procurement manager interviewed also believe that they really trust their customers, and gain trust from them too, since all three major customers are continuously purchasing CsD's parts and components from time to time. When their customers want to introduce a new product or model, they usually consult CsD first on every issue which includes design and even pricing. Their customers also provide technical support and advice to CsD whenever necessary. Therefore, it comes as no surprise when the procurement manager agreed that among the reasons why CsD agree to use their customers' e-procurement system is very much related to their trust in their customers. Most of them are huge automotive manufacturers and very much steady in their financial situation. CsD believes that the relationship will bring many benefits to them, so it is worthwhile to use an e-procurement system as requested, even though there is a fee.

5.4.4 High dependency on customers

According to the procurement officer at CsD, materials and components required in their production are rather universal and they have many suppliers available: "*Our dependency on suppliers is considerably low. For each material and component, we usually appoint at least two suppliers to ensure that there is an alternative source or backup whenever the first supplier cannot supply the amount that we need. Anyway, there is a situation where some customers require us to use a specific material or component produced by a pre-determined supplier*". Then the procurement manager added that: "*This is our customer's requirement that we have to agree to. Their objective is to ensure that the material or component used to produce the component that will go into their car achieve a certain quality standard. So they already list down some companies to supply the materials and it is included in our contract. It could also happen because our customer themselves might have an agreement with the specific supplying firm to use their materials or parts for their car. However, the number of component or material that falls under this kind of category is fairly small and we rarely face supply issues with it*".

The reason why CsD is compelled to agree to use e-procurement and to purchase from pre-determined suppliers is very much related to the level of dependency they have with their major customers. As mentioned before, almost 90% of CsD's business is with three major automotive manufacturers in Malaysia, which are Proton, Perodua and Modenas. They depend very much on these three companies for business. At the same time, CsD also have a knowledge sharing and joint research and development activity with these companies. In order to keep on obtaining the benefits, CsD had to fulfil their customers' requirements of using the pre-determined suppliers for some materials or components

and also to use the customers' e-procurement systems. Using the system, however, is not a major issue to CsD since it either did not incur any extra cost because it is a web-based portal system, or it involved just a small fee or investment on new hardware or software. However, there is a situation where CsD has to make some adjustment to their practices and even to their products to suit their customers' needs as well. "*When our customers want to roll out a new model, the specification and dimension of components they need are usually different from the previous model. In this case, we might have to do some changes in our machine settings or sometimes might have to buy a new tool and machines to fulfil our major customer's request*", says the manager. That clearly shows how high the level of dependency CsD has on their major customers.

5.4.5 Most important factor for adoption

The procurement manager at CsD was in two minds when asked which factors had the most influence on their company's e-procurement adoption decision. Their ongoing adoption process is based on the fact that they are facing serious problems with a growing number of suppliers and this is becoming difficult to manage. E-procurement adoption hopefully will solve the issues and bring benefits to the company. Therefore, technology attributes are considered as important factors from the purchasing point of view. But from selling point of view, their dependence on their customer is the important reason why they use the system. Therefore, both factors are considered as important for CsD.

5.5 Case Study E

5.5.1 Company's background

Case study E (CsE) is a medium sized local company with paid up capital of 500,000 Malaysian Ringgit (MYR). They manufacture steel based parts or components used especially in the automotive and electronics industries. The company was incorporated in 1996 and now operates at a 12,800 sq. ft factory located in Sungai Petani, at the Northern part of Malaysia, with 60 employees. Their principal activities include metal stamping and spot welding, contract assembly of automotive parts, pipe and tube bending and steel fabrication. Currently, the major products that CsE produce include stands, brake levers, brackets and mufflers, which are major components of a motorcycle. It comes as no surprise that their current major customer is the local motorcycle producer Modenas, which brings about 90% of business to them. CsE other customers include Permintex electronics (supply of console box cover) and NAZA automotive manufacturing. Recently, CsE has also diversified their business by producing steel based household products such as hangers and racks for the local market. Their competitors include BHL Metal Industries and Titan Metal Works which produce the same components as CsE.

5.5.2 Customer's e-procurement system adoption at CsE

CsE themselves do not utilise any kind of e-procurement system in their purchasing activities. According to the managing director: "*The number and type of material that we use in our production is small and, therefore, so is our supplier base. The majority of our material purchase is steel, since our product is used mainly in the production of motorcycles. It is followed by machine tools, chemical, industrial gases and of course administrative items. Therefore, we do not feel that there is an urgent need to use such a*

system at the moment. However, we did not rule out the possibility of using e-procurement in the future as our business grows and becoming more diversified". Currently, CsE will make an order manually whenever they need any material or component either by contacting the suppliers directly via phone or facsimile. E-mail is used for communication and administrative purposes only, and not when making orders. The quantity of orders will depend on their production schedule for the next coming month, which is developed based on their customers' requests.

In contrast to purchasing activities, CsE sells its products to their major customer through a web based MRP system that is provided by their customer. It is an e-procurement system that allows CsE to receive orders or any other related information from their customer. This system is installed by their customer and CsE have to pay a small installation and monthly fee to use it. Through this system, CsE may view information such as the customer's production schedule, inventory level, new orders, delivery schedule, send out invoices and even check payment status from their customer. When asked whether they feel like they were forced to use the system by their customers, the managing director said: "*Yes, we must use the system to get orders from them. But I do not feel that we been forced to do so. It did not cost us too much as they charged a considerably low amount of fee. Furthermore, the business volume and earnings that we get from doing business with our major customer far outweighs the fee that we pay for installing and using the system. I also personally think that IT is a necessity in today's business environment and that is why we are happy to use the system as required by customer*". In terms of benefits of using the system, they found that it helps CsE a lot in terms of communication and the sharing of information with their customer. Furthermore, people at CsE who deal with the system also find that the system is simple, yet easy to understand and use.

5.5.3 High level of trust on major customer

CsE's purchasing activities concentrate on buying materials such as steel, machine tools, industrial gases, administrative items and also some electrical components that go into their products. Most of these materials are universal and they have many suppliers to supply them. In choosing their suppliers, CsE stressed the quality and price of materials they supplied, especially in the procurement of their most important material which is steel. Although there are many steel manufacturers and suppliers available to choose from, either in Malaysia or overseas, CsE must be very selective in buying this material to make sure that a high level of standard and quality is achieved since safety issues are a real concern in the automotive industry. The managing director stressed that: "*We have to use the steel that is directly manufactured from an iron ore excavated from earth and not from a scrap metal to produce the motorcycle parts. That is the requirement from our customer to ensure that their product achieves the highest level of quality and safety. However, finding a high quality newly produced steel is not too difficult since there are many reliable sources of supply locally. Most of our supply comes from Perwaja Steel, but there is also other steel manufacturer available to choose if we need more*". In terms of price, steel is a commodity and the price did not vary too much between suppliers. However, price fluctuates from time to time based on market conditions. To date, CsE has never faced a huge problem with their suppliers and, therefore, their level of trust with their suppliers is considerably high.

The managing director at CsE also insists that trust plays a major role in their business relationship with the manufacturer (customer): "*Our company has a long term supply agreement with our major customer. It is not just about buying and selling, but our relationship goes beyond that. We receive not only financial but also other benefits too from our customer such as technical assistance, staff training, consultation and other incentives that brings a huge benefit to the company. The customer's commitment in this relationship shows that they are serious in helping a small company like us and it did instil our trust on them. It is among the reasons why we did agree to install their web based MRP system too even with some fee*". At the meantime, CsE also has to make sure that they always fulfil their customer's requirements, especially in terms of quality and delivery to sustain their customer's trust in them and to make sure that they will not lose this important business contract.

5.5.4 High level of dependency on Modenas

CsE is a relatively small company and, as mentioned earlier, they really depend on Modenas as their major customer since it constitutes up to 90% of their business. As a result, they have to adhere to all requirements which include using the web-based ERP system as required by this customer to continue doing business with them. Even though CsE has to pay a monthly fee, they do not feel it is a burden since the amount is relatively small compared to the amount of business they have with their buyer. Besides business volume, CsE as a new and small company also relies on their customer's knowledge and technical abilities to help them grow and keep abreast of the latest manufacturing techniques and technology. They always receive advice, training and support from Modenas in improving their capabilities.

Within their own purchasing activities, CsE have a few companies on their supplier list for each material or component they require for production so that they never depend on one supplier only. Even for their major item purchase which is steel, they did not rely on a particular supplier and have the flexibility to change or seek new suppliers if available. There is absolutely no unique item with limited suppliers so it can be concluded that CsE has a low level of dependency on their suppliers, but a high level of dependency on their customers.

5.5.5 Most important factor for adoption

It is obvious for CsE that the reason why they use the system just in their selling activities is due to their business relationship with the major customer, Modenas. The managing director, however, views the trust factor as the important reason why they use the system provided by their customer, rather than dependency. There is enough trust between both companies to make them willing to fulfil their customers' requirement.

5.6 Case Study F

5.6.1 Company's Background

Case study F (CsF) is a MESDAQ listed company which started its operation in 1991 producing hook-up wire for the cable harnessing industry. CsF's paid up capital is RM 20 million and they have over 600 employees at their factories in Sungei Petani, Kedah. CsF is a joint venture company between a local (55%) and a foreign company from Taiwan (45%). Currently, this company continues to develop more new products which

are related to wire and cable. Major customers for their product are producers of electrical appliances, audio/video, computers, communication and security product manufacturers such as Sony, Sharp, Fujitsu, Yamaha, Matsushita and Phillips. CsF has also diversified its business by producing network cable for networking, broadband and communication purposes. In 2005, CsF moved one step further by diversifying into high technology product for the automotive and medical instrumentation sectors. CsF has more than 200 customers on their lists, which include multinational as well as local companies. Altogether, about 45% of their product is sold overseas, while 55% is sold in the local market. Their major competitors include 3M, GE Cables and Permintex Technologies

5.6.2 Off the shelf e-procurement system at CsF

According to the Assistant Manager at CsF, they currently use software known as GS ERP to manage all their supply chain activities from purchasing to distribution. "*GS ERP is an e-business solution developed by a company known as Globalsoft. This system addresses all areas of our manufacturing activities including purchasing, material requirement planning, production scheduling, costing, inventory management and sales management. One of the advantages of this system is that it can be linked with our supplier's or purchaser's ERP system. At the moment, about 20% of our purchasing activities are held electronically and most of them are with our overseas suppliers*", she explained. At the same time, some of CsF's suppliers have their own e-procurement system, either a web based portal or specific system that CsE must use when making an order. For the other 80%, purchasing was conducted manually and CsF has no intention of asking their suppliers to link with their system at this moment, unless their supplier voluntarily requests to use it.

In terms of selling activities, the assistant manager at CsF said: "*Almost 80% of our selling activities are conducted electronically where our customers can place their orders through the sales control function of the GS ERP system. Customers may obtain an online sale quotation through the system and later, the sales quotation may be converted into a sales order. It makes the process much easier for us and our customers since the system can be accessed through the Internet and they can simply click which product they require. For our sales person, the order processing lead time can be reduced significantly using this system because there is no need for manual order entry and it can reduce mistakes too. However, we still receive orders manually from some customers who prefer more personal communication with us*".

The manager added that there is also an online inventory management module that provides real time monitoring of stock available at CsF for efficient sales order fulfilment. The reason why CsF decided to purchase this GS ERP system is because of its cost and effectiveness. They feel that the system is real value for money because it helps CsF overcome problems that they faced with their previous manual system, such as inaccuracy of inventory recording and no direct link with suppliers/buyers.

5.6.3 Strict supplier selection procedure at CsF

In choosing their suppliers, CsF's main concern is the price they offered and the quality of materials or components they produced. Other factors include conforming to their

requirements, previous track record and whether they were involved in the Greenpartners program or not. Some of CsF's customers are very concerned about the environment and it is the same case for CsF itself. Therefore, they prefer to purchase from suppliers who are engaged in the Greenpartners program too, even though it is not their main priority. CsF manufactures a wide range of products, which means that they have many suppliers that supply them either materials or components. All these suppliers must go through a strict selection procedure, based on the factors mentioned above, before they are selected.

Once selected, CsF will always evaluate the performance of their suppliers as explained by the manager: "*From time to time, we will continuously monitor the performance of these approved suppliers and we will not hesitate to change to other suppliers if one company fails to deliver their promise or if they did not meet our requirements especially in terms of quality. There is a case where some suppliers were removed from our list because of non-conformance*". When asked about the perceived level of trust CsF have in their suppliers, the assistant manager estimates it around 80-90%, depending on the individual supplier. Confidentiality of the company's data is not a major issue for CsF as they only share relevant information with their suppliers through their GS ERP system. This information is not highly confidential and is very much related to their business activities only, such as the CsF production schedule, inventory requirements and the latest news or information. Furthermore, they always take all the necessary online security measures to prevent any intruders into their system.

5.6.4 Huge supplier base reduce dependency

The CsF customer base is wide enough that they do not depend on any particular company for business. They have a huge number of customers ranging from electrical and electronic, IT product, and also automotive manufacturers. Therefore, the level of dependency that CsF has towards their customers can be considered low. It is the same situation from their supply base point of view. CsF practises dual sourcing, so that if one supplier fails to deliver, they will always have another one as an alternative. Furthermore, there are no unique materials or components that are supplied by a single company only. According to the assistant manager: "*We do have a specific agreement with our suppliers, so they have to supply enough number of the materials and components whenever we need them. We also provide them with our production plan and inventory requirements usually one month in advance, so it is their responsibility to plan their production well based on the production schedule for the next coming period as we provide in our system. If they think they cannot deliver, they are supposed to notify us as soon as possible so we can order from other suppliers*".

Based on the assistant manager's explanation, it can be said that CsE's level of dependency on their suppliers can be categorised as low. Specifically on e-procurement adoption, the assistant manager insists that: "*When we first decided to use this GS ERP system, it is mainly our own decision. The suggestion of using this particular system came from our partners in Taiwan, but it was merely a suggestion as the final decision to use was made by our own top management itself. There is definitely no influence from either our suppliers or buyers whatsoever. But there are some of our suppliers that use*

such system so we have to use it when making orders from them. That is the 20% of purchases that are conducted electronically, as I mentioned before".

5.6.5 Most important factor for adoption

It is clear that the technology attributes factor plays a major role in CsE's decision to use e-procurement. This is based on the statement made by the assistant purchasing manager, namely: "*The core values of our company include offering quality products, and superior service at the right cost. Use of e-business initiative such as e-procurement is expected to help achieve the objectives and even improve supplier and customer relations. Therefore, I feel that technology attributes are the driving force behind the implementation and not other factors*".

5.7 Case Study G

5.7.1 Company's Background

Case study G (CsG) from its establishment in 1981 has grown into one of the largest medical and industrial gas manufacturers and distributors in Malaysia. Its major product is medical oxygen, mainly for hospital use, and acetylene, an industrial gas which is used mainly for welding of metal parts. In addition, CsG also produces other type of gases such as carbon dioxide, nitrogen, hydrogen, argon and helium. Oxygen and acetylene, however, account for almost 80% of their business. All these gases are sold to its customers in a high-pressure cylinder. Major customers for CsG's gases include hospitals, shipyards, automotive and the steel based manufacturing industries. Since 1984, CsG was appointed as an oxygen supplier to all government funded hospitals in Malaysia and in 1986 they secured a contract to supply industrial gas to all organisations under the Ministry of Defence. Therefore, government sales are extremely important to the company as they constitute up to 85% of its business.

Currently, CsG have one air separation plant and six depots throughout the country to supply their products. The gas industry in Malaysia consists of other players apart from CsG. They include Malaysian Oxygen (MOX), Sitt Tatt Industrial Gases, Nissan-IOI, Messer Gas and Hydrogas. When asked about their market share, the General Manager said: "*Each company has their own market possessions which makes the market structure between each company different. Our major customer is government agencies, while our competitors have a strong foothold in the private market. Overall, we have about 60% market share where 40% of it comes from our government dealings*".

5.7.2 No urgent need for e-procurement at CsG

Production of medical and industrial gases requires a huge volume of raw materials. As a result, CsG always purchase their materials in bulk since it is more cost effective. The purchasing department at CsG do buy some components, but they are mainly replacement parts for their air separation machines. It is a nature of this industry that there are not many suppliers for each raw material CsG needs for their production. Since the number of suppliers on their list is small, the management at CsG feels that there is no need for an integrated purchasing system that links them with their suppliers. As a result, all materials purchasing activities are held manually. CsG also have no plans to use any e-procurement system for their purchasing functions within the next coming

years because it is not a necessity in this industry and they also lack people with the knowledge to manage such a system.

The same situation occurs at their selling end where all their customers' purchases are done manually. At the moment, CsG has not received any request by their major customers to use any kind of e-procurement system. However, there was a plan drafted by the Health Ministry of Malaysia where all future purchases made by the government funded hospital, including medical gases, might be conducted via the Malaysian government e-sourcing portal that is accessible via the Internet. This e-sourcing portal is already active and has been used by some other government ministries. However, this plan is still under review by the Health Ministry and CsG does not see it as a problem if they implement it since all they need is the Internet to access the e-sourcing page and it will not involve any extra cost, except the monthly Internet fee.

5.7.3 High dependency on government business

CsG has a small supplier base and most of them have been doing business with CsG since their early days of operations. Almost all of them have a good reputation in terms of delivery and quality of materials they provide. The price offered is much the same among suppliers since the price of the commodities used in CsG's production depends very much on market forces. Therefore, CsG know and trust all their current suppliers. The combination of good suppliers and good inventory management by CsG means they very rarely face material shortage problems that affect their production. Although their supplier base is small, CsG do not depend on only one supplier for each material. They always have more than one supplier for each material they need for their production. Therefore, the level of dependency on each individual supplier is very low.

CsG business, however, depends very much on their contract with government ministries, which constitutes up to 85 percent of their business. Therefore, CsG has a relatively high level of dependency to its customer. They have to follow all government requirements and make proper adjustments if required to ensure that their contract is renewed from time to time. When asked whether CsG would use the government e-procurement system if they are required to do so, the general manager stressed that: "*We will definitely use it to ensure the continuation of our business with these government agencies*".

5.8 Case Study H

5.8.1 Company's background

Case study H (CsH) is Malaysia's first and largest local car manufacturer. CsH was publicly listed on the Kuala Lumpur Stock Exchange in 1992, and currently the shareholders are Khazanah Nasional Berhad 42.5%, Petroliam Nasional Berhad (Petronas) 9.85%, Employees Provident Fund Board 12.6%, as well as other local and foreign investors 45.05%. Since the beginning of its operation in 1983, CsH has commanded a substantial share of the Malaysian car market for passenger cars. Now, CsH cars roam across the streets of United Kingdom, Australia, Middle East and South East Asia. The local market share for CsH's car in 2005 was 40% or 166,968 units, while the total exports sales for the period was 12,765 units. Their business has also expanded to include engineering consultancy, manufacturing, distribution, financial

services and property investment. In 2005/2006 financial year, CsH recorded a turnover of almost RM 8 billion and employed almost 11,000 employees worldwide. Strong customer orientation and competitively-priced products are the foundation of CsH's business and are essential to its success. They also work closely and collaborate with other international car manufacturers such as Lotus, Mitsubishi and Renault that helps them improve their car design, quality, safety and performance.

5.8.2 Web-based e-procurement system at CsH

CsH have a fully integrated supply chain system which links all their activities from initial car design, materials and parts sourcing, and manufacturing, up to the distribution of their cars. For all their procurement activities, CsH utilised an integrated e-procurement system known as Precise. It is actually a web-based system that is linked with their suppliers. The manager interviewed insists that: "*We really do not want to burden our suppliers to buy a sophisticated e-procurement system that could be very costly especially for SMEs, which is the majority of our suppliers. That's why we just use the web-based portal which is much cheaper, even though its functionality is rather limited. But I do not rule out any possibility of using a much better system in the future*".

The current e-procurement system at CsH does not require any special equipment or software by the suppliers in order to use the system. So there is no substantial investment required in order to access Precise since it is an Internet based system. The only requirement is for the suppliers to use a DSL line rather than dial up because it is somewhat interactive, with graphics and engineering pictures, which require high bandwidth. Suppliers can have detailed information on parts or component design and dimensions, download or transmit e-form, check new orders, track inventory level, production planning and schedule, invoicing and payment status.

According to the manager: "*For some parts or components, or for a purchase of administrative items, we publish our requirements through the system and our suppliers will bid with the best price they can offer (reverse auction). Afterwards we will select and put out purchase orders electronically to the successful bidders. However, in terms of percentage, it is very low right now. Only around 15 to 20 percent of our sourcing activities are conducted this way and it is mostly for administrative or less critical items that do not have much influence on the quality of our final product*". Precise system benefits CsH by allowing them to manage their procurement process more efficiently. It also shortens the order lead time and, at the same time, improves efficiency and accuracy of its ordering process. At the same time, suppliers also get real time information on inventory levels and production schedules which can help them determined their own forecasts.

5.8.3 4M requirement to supply CsH

A comprehensive supplier selection procedure ensures that only trusted suppliers are chosen to supply the materials or component needed for production. The manager explained: "*As part of national interest, we always try our best to source materials or components that are produced locally to help local suppliers. However, the final decision in choosing suppliers is based on a selection practice known as 4M, which refers to man, machine, method and material. Man means the ability of the suppliers*

whether they have enough manpower with high skills and also have enough training. Machine refers to the facilities, equipments and tools that they have to produce their product. We also prefer to do business with those who have their own facilities for production rather than merely buying from someone else (trading company). Method refers to delivery capability, the timing and support capabilities of suppliers, while materials means how the materials or components meet the requirements in terms of quality, safety and also the percentage of local contents. Other factors considered include track record and price offered", explained the manager.

He then added that: "*Price is not the most important factor because quality and safety is so important in the car manufacturing industry and we are even prepared to pay more for better components in order to build a reliable and safer car. Potential suppliers' engagement in research and development activities could be a factor too when choosing our suppliers. Components that can improve car reliability, safety and performance are very sought after and we sometimes have an agreement with some suppliers to support them in their R&D activities*". CsH also has its vendor development program where they help suppliers by giving them advice, technical support, training and sometimes R&D funding. It helps suppliers to improve their capability and at the same time serve CsH better.

Regarding the Precise system, all approved suppliers for CsH are given a username and password which allows them to access this system through the Internet. However, they must agree to the terms and agreements when using the system, especially the requirement not to disclose any information to any other party. The manager explained that: "*The information shared through our Precise system is the one that is relevant to the each individual supplier itself only. For example, a car tyre supplier will only receive and view our requirements for tyres based on our production schedule during the next coming month and not any other parts or components information such as steering wheels or headlights etc*". He also added that: "*…there is also some classified information that we might share with our suppliers, such as a new car design for example, so that suppliers can produce the exact components based on the measurements given. It is important that this kind of information does not fall into competitors' hands. That is why we have to make sure that only the approved suppliers can access the system. But still, there is a constant threat to the information when using this system, so we have to take all the necessary measures to make it more secure*".

Since CsH has a huge supply and distribution base, it is difficult to estimate the level of trust CsH has in their partners. There is always some problem with either the suppliers or distributors. So the manager estimates that the level of trust CsH has in both partners is fairly moderate, which is around 70 to 80 percent.

5.8.4 CsH multi-sourcing strategy reduce dependency on suppliers

According to the manager, CsH multi-source their suppliers so they will not depend on only one particular supplier for their materials or components, thus, if the initial suppliers cannot fulfil the order, they will have another alternative. However, there are unique or very specialised components such as electronic components and microchips that are supplied by only one company. "*For this kind of component, we protect*

ourselves against any uncertainty by having a higher level of inventory, most of them up to two times more than what we need in our actual production requirements. Of course, we also have a supply contract with these suppliers to supply a constant number of components each month and this contract usually spans for many years of supply".

Regarding suppliers dependency on CsH, some local suppliers that are involved in CsH's vendor development program only supply to them and would be in trouble if they lost their business with CsH. CsH, however, do help this kind of company through their vendor development program to improve or diversify their product so that they can explore other market opportunities too. The relationship with CsH is so important to this kind of company because it brings a lot of benefit to them.

In utilising the Precise system, it is a joint decision between CsH and its suppliers. When it first wanted to introduce it, CsH had discussions with almost all its suppliers, conducted briefings and even training sessions for suppliers' staff to familiarise them with the system. There was no pressure to use the system since almost all suppliers have an Internet system and for those who did not, the installation and monthly cost of Internet is so small that they can easily afford it.

5.8.5 Most important factor for adoption

According to the manager interviewed, technology attributes were the important factor for e-procurement adoption at CsH. He said: "*I think the adoption happens because of the pressure that is not from our suppliers or customers, but from the world around us as technology keeps on coming and updating itself from time to time. Our competitors are using it and gaining huge advantage over us. Therefore, we feel that we need to keep abreast of this technological advancement to remain competitive. So the technological factor for me is the important reason*".

5.9 Case Study I

5.9.1 Company's Background

Case study I (CsI) is a prominent automotive component manufacturer and a contractor in the power and utility industry. Established in 1991, CsI's products and services have been acknowledged by its customers as being reliable and cost competitive, as well as of the highest quality comparable to those produced by more established manufacturers in advanced nations. CsI is proud of the fact that it has been able to make a regional presence amidst stiff competition from the more established world players trying to gain a foothold in this region. Not only in Malaysia, CsI is now one of the only two players in Thailand with a full-fledged manufacturing plant that produces automotive components. CsI is associated with prominent manufacturers such as Proton, Perodua, Toyota, Suzuki, Honda, and Isuzu/GM as one of their consistently top-ranked suppliers. CsI also has forayed into the Indonesian market as an alternative supplier for mouldings and sashes for the car manufacturers. During the last financial year, CsI recorded revenue of MYR 286 million, where their local and Thai operations contribute 63.35% and 33.55% respectively to this amount. The remaining 3.1% comes from its Indonesian operations. CsI's emphasis on market development and technological competency is complemented by its drive towards quality and human resource development. Its

manufacturing activities have received ISO 9002 certification, whilst a Total Quality Management (TQM) programmed has been initiated group-wide.

5.9.2 Internal purchase using e-procurement at CsI

CsI can be categorised as partial adopters of e-procurement from the purchasing point of view. CsI is different from the other companies involved in these case studies in the sense that it buy materials or components either from external suppliers or from its own subsidiaries that are part of its group of companies. The procurement executive interviewed clarifies that: "*For our production, we purchase microchips that will go into one of the car parts from our own technology division in Shah Alam, Selangor. So all of these internal purchasing activities are held electronically, using an integrated ERP system that links us [the manufacturing division] directly with the technology division, which is our internal supplier. Whenever we need the component, an order will be sent through the system and all other processes that follow, which includes invoicing, payment and delivery, are managed and monitored through the ERP system*". He also added that this ERP system helps CsI speed up its internal purchasing process and also reduce order processing errors. In contrast, CsI have no e-procurement system that has a direct link with its external suppliers. As a result, all ordering activities between the company and its external suppliers are conducted using manual forms and telecommunication facilities such as phone, email and facsimile. Among the reasons why they are not using an e-procurement systems when dealing with external suppliers according to the procurement executive are: "*There is no need for such system yet since we can still manage our external procurement activities manually. But of course as a procurement officer here, I would be very happy if we had this system, as it could help us do things in a better way. At the end of the day, it depends on the top management as they are the ones who decide whether we should invest in e-procurement system or not for the whole purchasing activities, not just internally*".

From the selling point of view, CsI—just like any other supplier to giant automotive manufacturers—fully utilise an e-procurement system because its partner requires them to use it. Almost all their major customers such as Proton, Perodua, Honda and Toyota have their own web-based portal system that can be accessed by CsI via the Internet. As an approved vendor, CsI has a special login and password to access each buyer's system. The system allows CsI to check for new orders, access production schedule at buyer's facilities, check delivery status, send invoices and review payment status. There is no fee charged for using this system since it is merely a web-based system. No special setup or components are needed by CsI—just a reliable Internet connection. The system brings a lot of benefits to CsI as it is very convenient to use and it also helps reduce the time taken to manage ordering activities significantly compared to manual processing.

5.9.3 4M supplier assessment at CsI

CsI produce many kinds of products so they have quite a large number of suppliers. When looking for new suppliers, CsI have a special assessment audit which looks at 4M (man, machine, method, material) factors, before a company can become its supplier. Other factors in addition to the above four are the potential supplier's financial situation and track record. Once selected, CsI will continuously assess its supplier's performance to ensure conformity to requirements. Strict assessment ensures only the best suppliers

in terms of quality and delivery can become their suppliers. "*We never faced a major supply problem that results in a halt in our operation, as a result of this proper selection procedure and continuous assessment. The agreement between us and the suppliers are also well detailed for both parties benefit. If suppliers have problem and could not supply or deliver what we required, they always notify us early so we can get them from another supplier*", he explained. Therefore, CsI views itself as having a high level of trust in their suppliers.

Since CsI does not use any e-procurement system with its external suppliers, a monthly meeting is held to disseminate information, such as their forecast production volume for the next coming month with suppliers. The information provided is compulsory information to ensure smooth delivery to CsI by its suppliers, which is not sensitive or highly confidential. For the information shared through their ERP system, CsI does not face any confidentiality issues since it is only shared internally and, again, only relevant information is shared with their internal suppliers.

At the outbound side, most of CsI's customers are large car manufacturers that have a strong presence in the international market. In addition to financial benefit, their relationship with these customers also brings other benefits such as market information sharing, knowledge or technology transfer, and joint research and development program to CsI. "*Having a good relationship with major customers brings a lot of benefit to our company. It is important to have a long lasting relationship and therefore, we always do our best to maintain the level of trust our customers have towards us. At the same time, we also have a high level of trust on our customers based on the above factors too*", stressed the procurement executive.

5.9.4 Low level of dependency on supplier and customer

Just like other manufacturing company involved in these case studies, CsI also practices dual sourcing for each material or component necessary for its production, as explained by the procurement executive: "*We will elect two or three suppliers for each material or component we need, so there will always be a backup whenever our major supplier cannot deliver as requested. None of the materials or components we use in our production is unique and supplied by only one company. Each and every item has other suppliers that produce it, so the level of dependency on our supplier is extremely low. Even for the components purchased internally with our subsidiaries, we still have a few suppliers in our list as a backup in case there is a shortage in supply*".

CsI also has other measures to make sure that its production run will go smoothly—firstly, by having an agreement with suppliers to supply a certain number of materials or components to them on a monthly basis. Secondly, by storing some safety stock based on their production forecast for the coming month. Thirdly, by giving exact production figures for the coming month to their suppliers, together with two months' forecast figure. Therefore, their suppliers can prepare for what is coming and forecast their own level of production to fulfil CsI's requirements. CsI is able to reduce the level of dependency towards their suppliers by having all these measures. CsI's level of dependency on its customers is also considerably low since it never relies on any single company for business. CsI has a large number of customers which include giant car

manufacturers in Malaysia and all over the world. Although CsI use their customers' e-procurement systems when dealing with them, it is because of the benefit (technology attributes) that it brings to both companies, not because they really depend on this company for business. However, CsI does depend on some of its customers for knowledge and technology transfer. It is part of the joint R&D collaboration activities that they have with their customers.

5.9.5 Most important factor for adoption

As explained in the above paragraph, the purchasing executive stresses that technology attributes are considered as the major factor when deciding to use an e-procurement system within its internal purchasing activities. Dependency was also deemed as important for CsI in selling activities as they were required by their major customers to use it.

5.10 Case Study J

5.10.1 Company's background

Case study J (CsJ) is a leading producer of consumer electronics products such as home theatre systems, home audio, home network products, speaker systems and other related items. Its other operations include supplying speakers sold under other manufacturers' brands (contract manufacturing). The company sells its products worldwide through a traditional dealer network, and at the same time they utilise the Internet revolution by selling through Internet retailers. CsJ is a Japan based company established in 1946 and its presence in Malaysia started in 1989 when they established their subsidiaries and production facilities in Bangi, Selangor. Currently, CsJ products are sold worldwide with seven manufacturing facilities located inside Japan and ten overseas, which includes their two manufacturing plants in Malaysia. CsJ emphasis on superior visual management and sound reproduction technology has become the foundation on which CsJ has become a leader in the home theatre business and positioned them on the cutting edge of home network technology. Their products have also obtained a Dolby Digital and THX certification, a quality assurance program for surround sound for cinema and home theatre systems. CsJ's competitors include well-known international manufacturers such as Sony, Panasonic, Samsung, LG and also local manufacturers such as Pensonic, NEC and Soundtrend.

5.10.2 International e-sourcing strategy at CsJ

CsJ can be classified as full e-procurement adopters because almost all of its purchasing and selling activities are conducted electronically. Starting from the sourcing of suppliers, to the initial material or component purchase, they are all conducted through CsJ's web-based ERP software that was supplied by its parent company in Japan. The procurement officer at CsJ explained that: "*This self developed system enables us to employ the Internet in seeking new suppliers who are capable of providing us with the components or materials we required. Potential suppliers from all over the world can apply to become one of our suppliers through the Internet if their product is listed in our Procurement Requisition Item list, published in our website. New application however will be thoroughly examined in terms of quality, price and delivery of the materials and the components before they can go into an agreement*". He also added that the company can also efficiently exchange information with their present suppliers through this network. Existing and potential suppliers can simply browse via the Internet for

information such as materials or components required by CsJ, specific terms, conditions and quality levels that must be achieved.

The same system also links with all CsJ buyers in its distribution section. No special setup or installation is required at the buyer's premises since it is accessible via the Internet. Distributors may place orders for CsJ's products through the Internet, as well as accessing all other information they require about products such as new releases, technical information and support, warranty claims and account information. According to the purchasing officer: "*The e-procurement system allows us to better manage our purchasing and selling process since there are thousands of suppliers that supply a huge number of parts and components we need in our production, and also customers who purchase our product. They came from all across the world and it can never be done effectively if it is done manually*". The e-procurement system also helps reduce its processing time and reach its global suppliers and customers efficiently.

5.10.3 JIT and the importance of trust at CsJ

CsJ policy is to produce a high quality product at the right cost. This is the reason why it continuously seeks new suppliers that can offer them the best price and quality materials or components. In addition to price and quality, efficiency in delivery is also important to CsJ since it applies JIT in its inventory management system. The purchasing officer stated that: "*As a producer of technology base product which has a short product life cycle, coupled with the fact that the current technology is rapidly replaced by a new one, we seriously need to improve our product as our competitors will also continuously introduced a new product from time to time. Therefore, we are always looking for suppliers who are very competent and reliable in terms of their research and development activities. Suppliers that continuously producing new or an improved component will make our product better and give us an edge over competitors*". CsJ feels that it has a high level of trust in all its suppliers because most of them are carefully selected and capable of fulfilling their requirements as specified in the agreement. There are sometimes issues with some of its suppliers, but they consider that as a normal occurrence and this has never had a major impact on CsJ's operations. Besides, they can always replace ineffective suppliers with a new one if necessary with their worldwide sourcing policy.

The purchasing officer believes that better two-way communications between CsJ and its suppliers is the key to a successful supply chain relationship: "*... we always provide the latest information to our suppliers and they expect their suppliers to do the same too. Through our procurement system, we provide all the information that is necessary to trading with our suppliers and at the same time, the suppliers may also provide useful information to us especially when requested. Real time information exchange is crucial as new product development or existing product improvement is an ongoing process in our company. Suppliers must know what happens at our company so they can be prepared for it*". To protect their system and data, both parties agree to treat all the business content shared through the system as confidential and to keep it secret from outsiders, and all this is carefully stated in their contract. CsJ also make sure that only its approved suppliers can gain access into their procurement network by providing special passwords for them to login.

5.10.4 Reducing dependency through international e-sourcing

In managing their supplier base, CsJ use a policy of free competition, where suppliers either locally or from overseas may approach them as long as they supply quality materials or components that CsJ needs in its production. This helps CsJ broaden its supplier base and protect it against any shortcomings. However, there a few components for their products that are highly unique, or require a world class level of quality that are supplied by only one or two companies. For this kind of item, CsJ really depends on specific suppliers and, therefore, a closer relationship with a well detailed contract and agreement is required to make sure they have a constant number of supplies each month. CsJ also keeps an extra two weeks of stock of this kind of component to protect their production if something unforseen happens to their supply. Its dependence on their suppliers for these unique or high quality components is quite high, but so far they have never faced a major problem as they always keep an extra inventory. In terms of suppliers' dependency towards them, the interviewee said that there are some suppliers, especially local companies, that depend on CsJ for business since CsJ is their major customer. Most of the time, these companies have to adapt their activities, products and even delivery schedule to suit CsJ's requirements. CsJ also provides technical assistance to some suppliers to improve their product quality and also to help their companies grow. CsJ tend to develop this kind of relationship especially with local companies that have huge potential.

Although CsJ requires all its suppliers and distributors to use its e-procurement system when dealing with CsJ, this is not a big issue because the system is accessible via the Internet. No setup or installation with extra cost is needed by the suppliers or their distributors. The decision to use an e-procurement system in its operation was made by its parent company in Japan. The system is used by all CsJ's manufacturing facilities worldwide.

5.10.5 Most important factor for adoption

When asked about the important factors that made CsJ use an e-procurement system, the purchasing officer said that: "*I am not really sure which factor is more important since the system was already there when we started our operation as was is developed by our headquarters. I don't think dependency is the important reason, but based on the benefit that the system brings, I personally choose technology attributes as the major factor*".

5.11 Discussions

5.11.1 E-procurement adoption

Case studies on ten companies indicate that e-procurement systems are widely used by Malaysian companies, but in different ways. Table 5.1 below summarise the procurement characteristics of each company and the reasons for using or not using e-procurement. Based on the interviews, these ten companies can be classified into three different categories: full adopters; partial adopters; and, non-adopters. Full adopters are companies that fully make use of e-procurement systems at both side of their supply chain, namely purchasing and distribution functions such as CsA, CsG, CsH, CsJ. It encompasses systems that are either created by the company themselves or supplied by their suppliers or buyers. Partial adopters include those companies that either use e-procurement in purchasing activities only or during distribution activities only, or at

both purchasing and distribution function, but not at 100 percent capacity. The majority of companies involved in this case study fall in this category, especially when they buy or supply to a huge manufacturer that requires all business activities to be undertaken electronically. Examples of these partial adopters include CsC, CsD, CsE, CsF and CsI.

Out of the ten companies involved in these case studies, only two companies did not utilise any sort of e-procurement system at all in their supply chain, which are CsB and CsG. Both non-adopters gave the same reason why they did not use, and do not feel that there is a need to use such a system in their operation. They believe that they can manage their purchasing and selling processes efficiently, even though it is done manually, since their supplier or customer base is small. Their use is required by suppliers or customers and lack of expertise is also among the reasons why these two companies did not use an e-procurement system.

The table also clearly indicates that the popular choice of an e-procurement system type is the web-based ERP or MRP system, followed by a web-based portal. Only two companies use a customised system, which are CsF and CsH. It could be off the shelf software or custom designed software, developed by the company's own IT team. The reasons why companies use e-procurement and the benefits that they receive indicates which of the five technology attributes dimensions are important in e-procurement adoption. Based on the ten companies involved in these case study, only three out of five dimensions of technology attributes were mentioned by the person interviewed, which was relative advantage, compatibility and complexity. These case study findings agree with previous studies by Tornatzky and Klein (1982), followed by Chen et al. (2002), which identified that three attributes of technological innovation—relative advantage, compatibility and complexity—had the most consistent significant relationships to technological adoption.

Table 5.1: E-procurement adoption and technology attributes dimensions

Firm	Type	E-procurement	System type	Reason for using/not using the system	Technology attributes
CsA	Manufacturer of motorcycles	Yes Purchasing (100%) Distribution (100%)	Web-based MRP	• Affordable • Easy to use (not complex) • Flexible – customised based on requirements	• Relative advantage • Complexity • Compatibility
CsB	Manufacturer of an aircraft parts	No Purchasing (0%) Distribution (0%)	None	• Small supply base • Not required by customers/suppliers • Unique product and materials	
CsC	Manufacturer of cars	Partial. Purchasing (0%) Selling (100%)	Customer's web-based portal	Efficient and effective ordering, invoicing and payment processes.	• Relative advantage
CsD	Manufacturer of cables for automotive and electronic industries	Partial. Purchasing (0%) Selling (70%)	Customer's web-based portal	• Required by customer. • Accurate and efficient order management • Easy to use • Improves communication	• Relative advantage • Complexity
CsE	Manufacturer of automotive parts	Partial Purchasing (0%) Selling (90%)	Web-based MRP	• Required by customers • Accurate and efficient order management • Easy to use • Low monthly fee	• Relative advantage • Complexity
CsF	Manufacturer of cables for automotive, electronics and networking	Partial Purchasing (20%) Selling (80%)	Global soft ERP system and customer's web-based portal	• Can be linked with suppliers/customers • Real time inventory information • Low cost – value for money • Solve manual purchasing problems	• Compatibility • Relative advantage

Firm	Type	E-Procurement	System Type	Reason for using/not using the system	Technology attributes
CsG	Manufacturer of medical and industrial gases	No Purchasing (0%) Distribution (0%)	None	• Small supply base • Lack of IT expertise • Not required by customer/supplier	
CsH	Manufacturer of cars	Yes Purchasing (100%) Distribution (100%)	Precise	• Integrated - links all departments and suppliers/customers • No extra cost to supplier/customer – web based • Allows reverse auctions • Accurate and efficient order management • Information exchange in real time	• Compatibility • Relative advantage
CsI	Manufacturer of automotive parts	Partial Purchasing (40%) Selling (90%)	• ERP system (internal purchasing) • Customer's web-based portal	• No extra cost. Web- based portal. • Accurate and efficient order management • Convenience to use • Less time taken than if done manually	• Relative advantage • Complexity
CsJ	Manufacturer of audio/video products and components	Yes Purchasing (100%) Distribution (100%)	• Web-based ERP	• Global sourcing through e-sourcing. • Exchange information efficiently with partners • Effective management of large supply base	• Relative advantage

5.11.2 Trust

A summary of the case studies on companies' trust towards their suppliers and customers is available in Table 5.2. Based on the table, the majority of companies perceived that they have a high level of trust in their suppliers and customers. The important reason why these companies perceive themselves as having a high level of trust in their suppliers is because each of the companies has systematic supplier selection criteria to guide them during the supplier sourcing, screening and selection process. Only those who fulfil their requirements will be approved as their vendors, in addition to having to enter into an agreement that details the conduct of their business relationship. Over time, most companies conduct a continuous audit to make sure that suppliers maintain or improve their standards if they want to continue doing business with the companies.

Manufacturers interviewed also state that they have a high level of trust to the customers which are mostly large manufacturing companies. Manufacturers such as CsD, CsE, CsF and CsI believe the strength of their customers can help steer their companies forward, especially through the vendor developments program introduced by their customers. At the same time, it proves these large buyers' commitment towards sustaining their supply chain relationships—and in helping the smaller partners so that each parties involved will gain mutual benefits.

The important factors to be considered when choosing suppliers become indicators for important trust dimensions. Table 5.3 summarises these dimensions that can lead to higher or lower levels of trust between companies, as stated by the respondents. The most important trust dimension identified from these case studies is contractual trust. A written contract that details the monthly orders, payment terms, support, technology or knowledge transfer between supply chain partners will definitely improve trust between the parties. The second most important dimension that dictates the level of trust is competence. Seven companies described competence, which includes conformity to requirements, level of R&D activities and technical support provided as among the factors that could improve the level of trust. Suppliers' or customers' dependability/reliability and honesty come next, with both factors perceived as important to five companies respectively. Friendliness/benevolence was considered important by four companies, and orientation is the least important factor in this study, with only two companies mentioning it as important.

In terms of the level of trust towards their supply chain partners, the majority of manufacturers interviewed perceived themselves as having a high level of trust towards both their partners. Only a few companies gave a moderate estimation of the level of trust ranging from 70 to 90%. These are the companies that report they did sometimes experience problems or difficulties with either their suppliers or customers.

Table 5.2: Important dimensions and perceived level of trust

Firm	Type	Supplier selection	Trust dimensions	Perceived level of trust
CsA	Manufacturer of motorcycles	• Cost • Quality • Delivery	• Contractual – agreement that defines the relationship • Honesty – sharing of information • Dependability/reliability – high level of confidence in partners	Suppliers – High Customers - High
CsB	Manufacturer of aircraft parts	• Delivery • Quality • Price	• Contractual – agreement that defines the relationship • Dependability/reliability – delivery as promise	Suppliers – High Customers - High
CsC	Manufacturer of cars	• Financial situation • Type, price and quality of materials or components • Delivery efficiency • Previous track record	• Contractual – agreements that define the relationship • Honesty – sharing of information and maintaining confidentiality • Competence - always satisfying their requirements and receiving technical advice and training. • Dependability/reliability – high level of confidence in partners • Friendliness/benevolence – commitment to the relationship through a vendor development program	Suppliers – High Customers - High
CsD	Manufacturer of cables for automotive and electronic industries	• Quality of materials/components • Price offered • Previous track record • Financial situation	• Contractual – agreement that defines the relationship • Orientation – consult and always listen to proposals • Competence – receives advice especially in technical areas	Suppliers – High Customers - High
CsE	Manufacturer of automotive parts	• High quality • Price of materials	• Competence – technical support from customer • Contractual – agreement that defines the relationship	Suppliers – High Customers – High

Firm	Type	Supplier selection	Trust dimensions	Perceived level of trust
CsF	Manufacturer of cables for automotives, electronics and networking	• Price offered • Quality of materials or components • Conformity to requirements • Track record • Greenpartners program	• Contractual – agreement that defines the relationship • Competence – monitors the performance of suppliers	Suppliers – 80 to 90% (moderate) Customers – Not mentioned
CsG	Manufacturer of medical and industrial gases	• Delivery • Quality • Price of materials	• Contractual – agreement that defines the relationship • Dependability/reliability – delivery as promised • Friendliness/benevolence – commitment to the relationship	Suppliers – High Customers – Not mentioned
CsH	Manufacturer of cars	• 4M - man, machine, method and material • R&D	• Contractual – agreement that defines the relationship • Competence – high skills and continuous R&D • Honesty – Not disclosing important information shared through the system to someone else • Friendliness/benevolence – commitment to the relationship through a vendor development program	Suppliers – 70 to 80% (Moderate) Customers – 70 to 80% (Moderate)
CsI	Manufacturer of automotive parts	• 4M - Man, machine, method and material • Financial situation • Track record	• Dependability/reliability – delivery as promised • Competence – continuous audit to ensure conformity with requirements • Honesty – suppliers always notify if they have a problem with delivery. • Friendliness/benevolence – monthly briefing/meeting with all suppliers to discuss all related issues	Suppliers – High Customers - High

Firm	Type	Supplier selection	Trust dimensions	Perceived level of trust
CsJ	Manufacturer of audio/video product and components	• Price • Quality • Delivery efficiency • R& D	• Contractual – agreement that define the relationship • Competence – high skills and continuous R&D • Orientation – two way communication is important in their relationship • Honesty – confidentiality of new products or designs is important	Suppliers – High Customers – Not mentioned

Table 5.3: Important trust dimensions of each company

Firm	Dependability/ Reliability	Honesty	Competence	Orientation	Friendliness/ Benevolence	Contractual
CsA	X	X				X
CsB	X					X
CsC	X	X	X		X	X
CsD			X	X		X
CsE			X			X
CsF			X			X
CsG	X				X	X
CsH		X	X		X	X
CsI	X	X	X		X	X
CsJ		X	X	X		X
Total	5	5	7	2	4	10

5.11.3 Dependency

Table 5.4 summarises the case study findings on how dependent all ten companies are on their partners. Firstly, the study found that all companies, regardless of their size or products, state that they have a low level of dependence on their suppliers, except CsB. Among the reasons given are: due to the large number of suppliers that supply the same material or component available; and, also, because of company's adoption of a dual sourcing policy. Each company has also taken all the necessary measures to protect their production against any materials or components shortage, such as by having a well-detailed agreement or simply by having enough safety stock. CsB has a high level of dependency on their limited number of suppliers due to the uniqueness of their product and the materials they used. One company's dependency on their customers is very much dependent on the size of the company itself. Smaller manufacturers doing business with large manufacturing companies tend to have a higher level of dependency on their customers, especially when the majority of their business is with this manufacturer. CsB, for example, sells its composite products to Hexcel and no one else, so they really depend on this company for business. Meanwhile, CsD and CsE sell their products to three major automotive producers in Malaysia, and the majority of their income is generated from sales to these companies.

At the same time, CsG depends very much on their Malaysian government contract that for so long has helped them carry on in the gas manufacturing industry. The high levels of dependency on their customers make all these companies vulnerable and they have to adhere to any new requirements, regulations or instructions from their customers in order to continue doing business with them. Although each person interviewed at the larger manufacturing companies deny the fact that their suppliers are forced to use the e-procurement system, it is very clear that the situation does exist, but in an indirect way. By having all orders, information and communication through the system,

suppliers must use the system, even if it is against their will. This is evident when three of the large manufacturers involved in the case study, CsA, CsH, and CsJ, use only e-procurement in both their inbound and outbound activities and dealings. No purchase or sales are conducted with companies that do not use the same system.

In addition to the dependency on customers for business, other dependency dimensions that increase companies' dependency towards another are also evident in the case studies. A summary is shown in Table 5.5 and the most important dimension that is mentioned by all ten persons interviewed is economic/judicial dependency. All supply chain relationships are protected by a formal agreement that binds the two companies together. This can increase the level of dependency between one another because a breach of contract might cost a company significantly. Furthermore, it is difficult for a company to change their suppliers or customers and breeched the contract since it can incur some demands of compensation. The second most important dimension of dependency is time dependency, since nine out of interviewees mentioned it. This came as no surprise, as a previous study by (Lambert, Cooper & Pagh 1998) also revealed the same findings. Accurate and on time delivery is an important factor in today's manufacturing environment where most companies emphasise lean manufacturing and also utilise a JIT system.

Technical and market dependency was the next most common dimension with seven companies saying that they depend on either their suppliers or customers for technical assistance and business. This is followed by knowledge dependency (3), and IT dependency (2). Interestingly, social dependency, which includes close relationships, chemistry between companies, and social activities, is not mentioned as a factor that increases dependency. Therefore, this dimension will be removed from further testing in the survey questionnaire.

Table 5.4: Level and dimensions of dependency

Firm	Type	Decision to use e-procurement	Require suppliers/ customers to use	High dependency on customer/supplier	Type of dependence
CsA	Manufacturer of motorcycles	Own decision	Suppliers –Yes Customer - Yes	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Economic/judicial – relationship is regulated by contract • Market – distributors influence sale
CsB	Manufacturer of aircraft parts	Not applicable	No	Suppliers – Yes Customers - Yes	• Technical – technical agreement with buyers • Time – timely delivery by suppliers • Economic/judicial – relationship is regulated by contract • Market – limited number of customers
CsC	Manufacturer of cars	Customer	Suppliers –No Customer - No	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Technical – technical agreement with some suppliers • Economic/judicial – relationship is regulated by contract • Economic/judicial – unique material with few suppliers. • Market – distributors influence sale
CsD	Manufacturer of cables for automotive and electronic industries	Own decision Customer	Suppliers –No Customer - No	Suppliers – No Customers - Yes	• Technical – technical assistance from buyers • Time – timely delivery by suppliers • Economic/judicial – relationship is regulated by contract • Market – limited number of customers • Knowledge – advice, training and support from customer • IT – adapted to customer's system

Firm	Type	Decision to use e-procurement	Require suppliers/ customers to use	High dependency on customer/supplier	Type of dependence
CsE	Manufacturer of automotive parts	Customer	Suppliers –No Customer - No	Suppliers – No Customers - Yes	• Technical – technical assistance from buyers • Economic/judicial – relationship is regulated by contract. • Market – limited number of customers • Knowledge – advice, training and support from customer • IT – adapted to customer's system
CsF	Manufacturer of cables for automotives, electronics and networking	Own decision	Suppliers –No Customer - No	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Economic/judicial – relationship is regulated by contracts.
CsG	Manufacturer of medical and industrial gases	Not applicable	No	Suppliers – No Customers - Yes	• Time – timely delivery by suppliers • Economic/judicial – relationship is regulated by contract • Market – very much depends on government contract
CsH	Manufacturer of cars	Own decision but with support from suppliers	Suppliers –Yes Customer - Yes	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Technical – technical agreement with some suppliers/customers • Economic/judicial – relationship is regulated by contract • Market – distributors influence sale
CsI	Manufacturer of automotive parts	• Own decision • Customer	Suppliers –No Customer - No	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Technical – technical agreement with some suppliers/customers • Economic/judicial – relationship is regulated by contract • Knowledge – knowledge and technology transfer through joint R&D activities

Firm	Type	Decision to use e-procurement	Require suppliers/ customers to use	High dependency on customer/supplier	Type of dependence
CsJ	Manufacturer of audio/video products and components	• Own decision	Suppliers –Yes Customer - Yes	Suppliers – No Customers - No	• Time – timely delivery by suppliers • Technical – technical agreement with some suppliers/customers • Economic/judicial – relationship is regulated by contract.

Table 5.5: Important dependency dimensions

Firm	Technical	Time	Knowledge	Social	Economic/ judicial	Market	IT
CsA		X			X		
CsB	X	X			X	X	
CsC	X	X			X	X	
CsD	X	X	X		X	X	X
CsE	X		X		X	X	X
CsF		X			X		
CsG		X			X	X	
CsH	X	X			X	X	
CsI	X	X	X		X		
CsJ	X	X			X		
Total	**7**	**9**	**3**	**0**	**10**	**7**	**2**

5.12 Conclusions

The case study interviews conducted with ten companies that either adopted or did not adopt e-procurement help to answer the specific research questions for qualitative stage of this research, as outlined in Chapter 4:

R1: Do companies in Malaysia use e-procurement within their inbound and outbound supply chains?

The majority of the companies interviewed (eight out of ten) did use e-procurement either in their inbound or outbound supply chain activities, or even on both sides. The level of adoption, however, varies among companies. Some are full adopters, while some can be categorised as partial adopters as they use e-procurement either when making a purchase from a supplier or when selling their product to customers only. There is also a situation where some companies partially use e-procurement as only a percentage of purchasing or selling is done electronically, while the rest is still conducted manually. They are also classified as partial adopters of e-procurement.

R2: If used, what kind of e-procurement system did they adopt?

Various types of e-procurement systems are being used by the companies interviewed. Some companies even use more than one type of system in their procurement activities. Web-based MRP/ERP, Web portal, off-the-shelf and customized software are among the e-procurement systems adopted among eight adopters. Web-based MRP/ERP and Web Portal, however, is the most popular application used by the adopters in this study.

R3: What are the factors that encourage the adoption of e-procurement, or factors that hold back companies from adopting the system for non-adopters?

The attributes of the technology itself are identified as the most important reason why manufacturers adopt e-procurement. The reasons most cited by the people interviewed include: the ease of use of the system itself; affordable; improves the efficiency of the purchasing process; convenient and easy to use; and reduces order processing and cycle

time. Only two companies said that the reason they use e-procurement is because their partners required them to use it. This implies that technology attributes is the major factor that encourages adopters of e-procurement to use the systems.

R4: What are the benefits of e-procurement adoption?

Among the benefits enjoyed by the adopters of e-procurement, as mentioned during the interviews, were the increase in efficiency and effectiveness in ordering processes, faster electronic invoicing and payment processing and the fact that all of these can be done in less time than when it was done manually. Other benefits include allowing firms to globally source their supply, and at the same time able to share and exchange concurrent information with their partners.

R5: Is there any relationship between technology attributes, trust and dependency with adoption decision? Which factor is more important?

The case studies show that the above three factors do influence e-procurement technology adoption decisions, however, the significance of the contribution and if there is any relationship between these three factors requires further empirical analysis. However, the case studies revealed that most people interviewed believe that the technology attributes of the system itself is the most important reason why their company decided to adopt e-procurement. Table 5.6 summarises respondents' opinion of the important adoption factors.

Table 5.6: Most important factors that encourage adoption

Firm	Technological attributes	Trust	Dependency
CsA	x		
CsB			
CsC	x		
CsD	x		x
CsE		x	
CsF	x		
CsG			
CsH	x		
CsI	x		x
CsJ	x		
Total	**7**	**1**	**2**

As the majority of the adopters of e-procurement systems in this study revealed that the most important reason for the adoption is the attributes of that technology itself, there is no point testing it again empirically. Furthermore, the majority of studies on adoption also identified the same findings (Van Dolen, Dabholkar & De Ruyter 2007; Wen-Chin 2006; Gebauer, Beam & Segev 1998; Ritu & Jayesh 1997; Surry & Gustafson 1994). As a consequence, technology attributes is dropped as one of the variables of this study and the centre of attention is now on how the level of trust and the level of dependency

influence adoption. The next chapter will briefly outline the new research questions, objectives, theoretical framework and hypotheses of this study, excluding technology attributes as a variable.

CHAPTER 6: REVISED THEORETICAL FRAMEWORK

6.0 Introduction

This chapter discusses the revised research questions, objectives, hypotheses and framework for this study. These revisions are necessary as the findings from both the case study interviews and the pilot study (discussed in chapter 7) reveal a trend in the findings that are identical to previous studies on technology adoption. As they are considered common findings that will not provide a new contribution to the literature, there is no point to testing these again empirically. At the same time, a new construct, which is the size of companies that appears to be important in the context of this research based on the case studies, was also added to the list.

6.1 Revised research questions and objectives of study

The findings from the case study interviews and from the pilot study questionnaire reveal that the majority of companies view technology attributes as the most important factor for adoption. Therefore, there is enough evidence to remove technology attributes completely from the research questions as there is general agreement with most previous studies on technology adoption. The size of company will be added as a control variable as the case study findings show that smaller firms tends to adopt e-procurement as requested by their larger partners. With the exclusion of the technology attributes factor, the new research question for this study is:

Whether, and to what extent, inter-organisational trust and dependency interactively influence e-procurement adoption decisions in supply chain relationships?

Based on the above research question, the new objectives of this study are as follows:

6.1.1 To examine the relationship between inter-organisational trust and e-procurement technology adoption decisions;

6.1.2 To examine the relationship between inter-organisational dependency and e-procurement technology adoption decisions;

6.1.3 To examine the relationship between the size of company and e-procurement technology adoption decisions;

6.1.4 To examine the interaction impact of inter-organisational trust and dependency in e-procurement adoption decisions;

6.1.5 To determine whether there is a critical gap between the level of trust and the level of dependency towards suppliers and customers; and

6.1.6 To identify which trust and dependency items have the most critical gap between suppliers and customers.

6.2 Revised hypotheses of the study

Based on the above research objectives, some hypotheses are totally removed or revised, and some new hypotheses were also created. Previous studies identify that trust has a positive relationship with technology adoption (Ratnasingam 2001; Bahmanziari, Pearson & Crosby 2003). Therefore, the following hypothesis was developed:

H_1: *The level of trust will positively influence e-procurement technology adoption decisions.*

Trust developed based on a contractual agreement between supply chain partners can directly influence adoption decision in a positive manner. This was proven by the case study findings, and also the results from previous studies (Ryan, Giblin & Walshie 2004; Sako & Helper 1998; Gattiker 1989), which identify that the legal environment will affect the interrelationship between technology adoption and organisational adaptation profoundly. Therefore, the following hypothesis was formulated:

H_{1a}: *Contractual trust will positively influence e-procurement technology adoption decisions.*

Like trust, findings from the literature (Frambach 1993; Patterson, Grimm & Corsi 2003), and the outcome of the case studies indicate that the level of dependency between supply chain partners will have a positive influence on e-procurement adoption decisions. Teo, Wei & Benbasat (2003) also posit a strong positive association between organisational intent to adopt EDI and the perceived dominance of their customers or suppliers that have already adopted EDI. Therefore, the next hypothesis of this study is:

H_2: *The level of dependency will positively influence e-procurement technology adoption decisions*

The case study findings and the literature also highlight that firms which rely on their partners' information technology or technical ability to improve their efficiency will eventually embrace adoption (Kulp et al. 2006; Hong 2005). Therefore, the hypothesis to be tested is:

H_{2a}: *The level of information technology and technical dependency will positively influence e-procurement technology adoption decisions.*

The case study findings show evidence that small and medium sized manufacturers might have to adopt e-procurement if it is a requirement for continuing business with their major supplier or customer. Previous studies also identify the same trend where the smaller the size of the firm, the greater the possibilities of using external advice in adopting an Internet technologies (Kulp et al. 2006) It is also supported by the latest study conducted by Atkinson (2007). Therefore, a new hypothesis was included:

H_3: *The size of company will negatively influence e-procurement technology adoption decisions.*

As one firm places a higher amount of trust towards it partners, the level of dependency will increase. Dependency could lead to control over a partner's decision making process and this could even lead to a higher probability that the stronger partner will act opportunistically (Ireland & Webb 2007). Therefore, it is expected that higher trust will subsequently lead to higher level of dependency. Based on this relationship, the next hypothesis of this study is:

H_4: *Trust will positively increase the level of dependency between one company and another.*

The next hypothesis is designed to test the interaction effect of both factors on e-procurement adoption decisions. This proposition is developed based on the suggestion by Bachmann (1999), that most social relationships are based on a mixture of trust and power. A dependency is one of the components of power, thus it is hypothesised that:

H_5: The interaction between the level of trust and the level of dependency positively influences adoption.

The two final hypotheses are intended to determine whether there is a significant difference in the level of trust and the level of dependency towards suppliers and customers. Those hypotheses are:

H_6: There are no significant differences between the level of trust towards suppliers and the level of trust towards customers.
H_7: There are no significant differences between the level of dependency towards suppliers and the level of dependency towards customers.

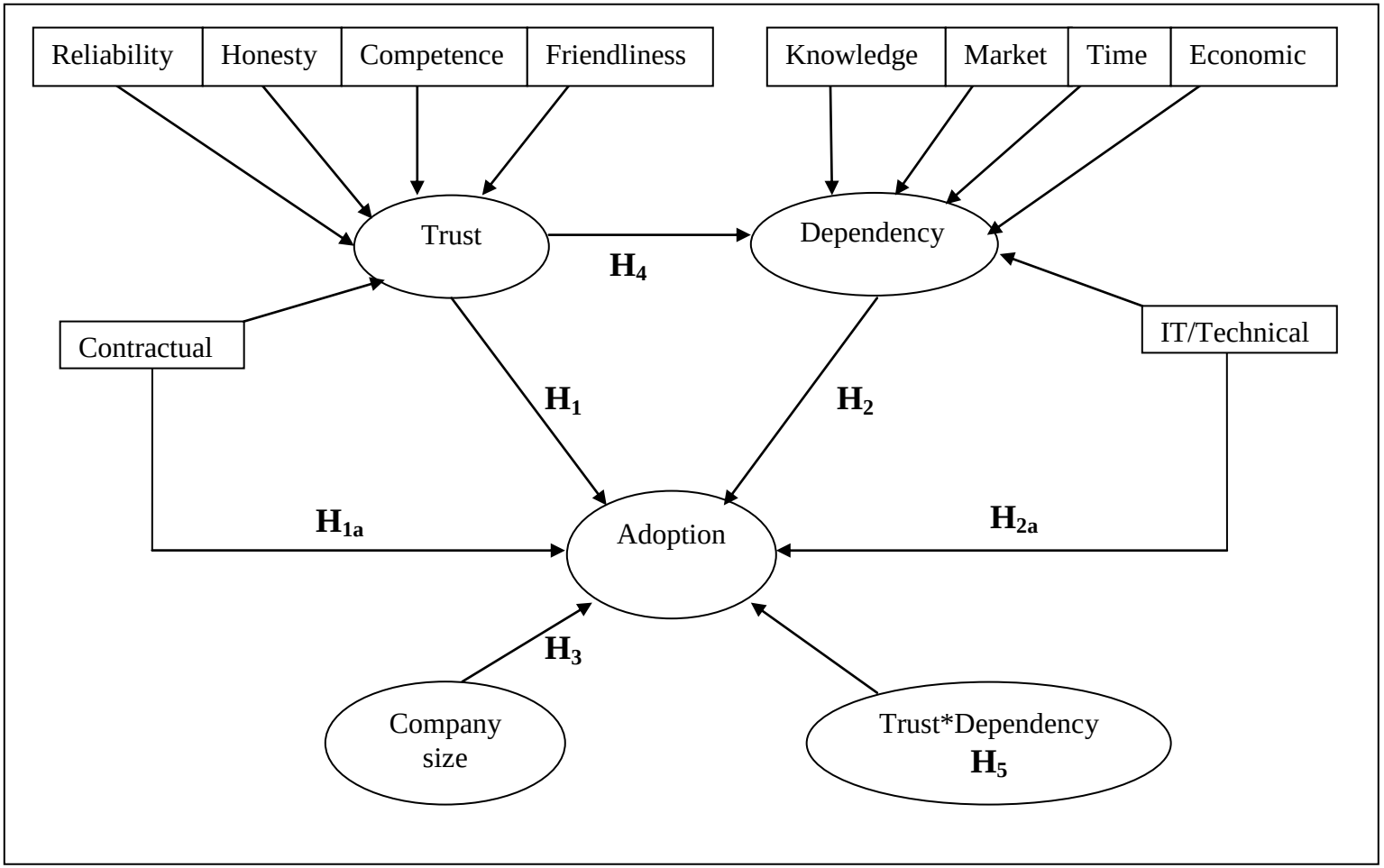
Hypotheses H_1 to H_5 are tested using PLS analysis, while H_6 and H_7 are tested using gap analysis techniques.

6.3 Revised theoretical framework

The revised theoretical framework for this study contains only two independent variables, compared to three previously (Figure 6.1). They are the level of trust and the level of dependency. The level of trust is an aggregate value of the important trust dimensions as identified from the case studies, which are contractual trust, competence trust, dependability/reliability trust, honesty trust and friendliness trust. The level of dependency will also be determined based on the important dependency dimensions identified through case studies, including economic/judicial dependency, time dependency, market dependency, knowledge dependency and IT/technical dependency.

6.4 Conclusion

This chapter was specifically added to discuss the revisions made to the research questions, research objectives and also hypotheses of the study, as the technology attributes variable is removed from further testing. The common findings demonstrated by the case studies interview, with findings from previous study on technology attributes resulted in the removal of this variable. A new theoretical framework was also introduced to reflect the changes.



(Source: Developed for this study)

Figure 6.1: Revised theoretical framework and hypothesis of study

CHAPTER 7: SURVEY QUESTIONNAIRE FINDINGS

7.0 Introduction

As discussed in Chapter 4 (methodology), this research includes the use of a triangulation approach of doing research by utilising both case study and survey research. The case studies were used to validate the initial model created based on the literature, and the survey method is used to provide further indication of the validity of the refined model. This chapter reports the findings and analysis of the survey questionnaire returned by the respondents starting with a discussion of the survey response rate, the non-response bias analysis, the descriptive statistics of the companies and the analysis of the measurement and structural model itself. Finally, the hypothesis of the study is tested based on the findings.

7.1 Survey response rate

An invitation email, together with a URL link to access the online survey, was sent to all selected companies that have their email addresses listed in the FMM directory. However, the outcome of the online survey was not encouraging. Only 18 companies completed the online survey questionnaire, even after follow-up was carried out. There are a few factors identified for the low response to the online survey questionnaires. Firstly, the majority of the invitation emails 'bounced back' for various reasons, including the email address no longer existed, the company's domain name had changed, the email address owner was no longer working at the company, or because the mailbox was full. Secondly, some emails did not get through and bounced back because the respondent had a spam blocker installed so that email from unrecognised email addresses will not enter their mailbox. Thirdly, a telephone follow-up with some non-respondents to the online survey revealed that the majority of those who received the e-mail thought that it was a spam mail, so they deleted it straight away. Some also said that they are not allowed to get involved in academic surveys without permission from their company's top management. After two weeks, a mail survey questionnaire was sent out to companies that did not respond to the online survey.

Due to cost constraints, only 700 companies were selected from the sampling frame, and survey questionnaire packs were mailed to them. In order to encourage a higher response rate, a cover letter was printed on the university's letterhead and a self-addressed, reply-paid envelope was enclosed with the questionnaire. Respondents were also promised anonymity for themselves and their company, in addition to a guarantee of the confidentiality of data they provided. To distinguish which companies did reply and those that did not, a reference number was written on each questionnaire for follow up purposes. Non-respondents were then contacted via phone after a few weeks to encourage more returned questionnaires.

Even with the abovementioned efforts to acquire more returned questionnaires, only 94 of the 700 surveys mailed to companies were completed and returned, which makes the return rate 13.43%. If not because of cost and time factor, more questionnaires would be sent out to increase the response rate. A more direct approach such as visiting the manufacturer's premises to carry out a self-administered survey was also considered. At

the same time, more telephone and e-mail follow-ups will be conducted in order to increase the response rate.

This response rate of 94 questionnaires, however, can be considered as acceptable for a mail survey as evident in other doctoral dissertations or research conducted in developing countries (Jharkharia & Shankar 2006; Thakur & Jain 2006). In Malaysia itself, other research conducted using mail surveys and involving manufacturing companies received even lower response rates of between 9 and 10 percent (Sulaiman 2000). Out of the 94 questionnaires returned, eight of them were incomplete and considered as invalid. Therefore, only 86 valid questionnaires were available for further analysis. As a result, the total number of valid questionnaires available for empirical analysis from both the online and mail survey questionnaires is 104. This number is just a little bit short of the recommended sample size of 112 for a population of 2000 as suggested by Bartlett, Kotrlik and Higgins (2001). Out of the total 104 valid questionnaires, only 78 manufacturing companies or 75% of them are adopters of e-procurement, while the other 26 companies (or 25%) are non-adopters of the system.

7.2 Data analysis technique—Partial least square (PLS) regression

As the number of samples is so small and did not achieve the sample size to use structural equation modelling, a new statistical technique known as partial least squares (PLS) regression analysis is used for this study. The software used for this purpose is known as SmartPLS software version 2.0. PLS is one of the second generation analytical techniques available for evaluating models of relationships among constructs (Wold 1982). It was developed by Herman Wold for econometrics, but then started to gain popularity in chemo metric research and later in industrial applications. It has since spread to research in education, marketing, and the social sciences. This study has used PLS instead of other structural equation modelling software such as Lisrel or Amos, because of the small sample size of e-procurement adopters (n=78), which is inadequate for Lisrel or Amos as they require a minimum sample size of 200 (Hair et al. 1998). At the same time, PLS is also a components-based structural equation modelling technique that has the ability to model latent constructs under conditions of non-normality (Chin 1998).

Other advantages of PLS include the ability to simultaneously model the structural paths, the theoretical relationship among latent variables; and measurement paths, which is the relationships between a latent variable and its indicators. Rather than assume equal weight for all indicators on scale, PLS algorithms allow each indicator to vary in how much it contributes to the composite score of the latent variable. Thus, indicators with weaker relationships to related indicators and the latent constructs are given lower weighting (Chin, Marcolin & Newsted 2003). Disadvantages of PLS include greater difficulty in interpreting the loadings of the independent latent variables (which are based on cross product relations with the response variables, not based on correlations among the manifest independents), and since the distributional properties of estimates are not known, the researcher cannot assess significance except through bootstrap induction. Overall, the mix of advantages and disadvantages means that PLS is favoured as a predictive technique and not as an interpretive technique, except for exploratory

analysis as a prelude to an interpretive technique such as multiple linear regression or structural equation modelling (Garson 2008).

7.3 Non-response bias

Due to the relatively low response rate, an examination for non-response bias was conducted using the time trend extrapolation method recommended by Armstrong and Overton (1977). It is assumed that persons responding later are assumed to be more similar to the non-respondents. Data obtained from the first 20% of respondents (the theoretical respondent) are compared with the last 20% (the theoretical non-respondent) using descriptive items in the questionnaire, which are the industries, the number of employees, the paid-up capital and revenue. These descriptive items were chosen since they have been used in previous research when analysing for non-response bias (Mirchandani & Lederer 2006; Hall 2007). To identify if there is a significant mean difference between the groups, a Mann Whitney U test was conducted and the hypotheses for testing are:

H_o : There is no significant difference between the two groups
H_1: There is a significant difference between the two groups.

Table 7.1 shows the results of the analysis. The Mann Whitney U test shows that the mean sample between the theoretical respondent (early) is not significantly different to the mean of the non-theoretical respondent (late) for all items included in this test ($p > 0.05$). Therefore, there is enough evidence to accept the null hypothesis and conclude that the data collected for this study is free from non-response bias.

Table 7.1: Mann Whitney U Test results

	Mean		
	Early	Late	P-value
Industry	22.08	18.93	0.398
Employees	19.27	21.73	0.512
Capital	21.61	17.39	0.246
Revenue	20.97	17.13	0.284

7.4 Demographic Data

Type of industry

Manufacturers from the electrical and electronics product industry are the largest group that participated in this study with a total of 25 companies (Table 7.2), followed by the automotive industry with 22 companies. Cumulatively, the two industries make up 45.2% of the total number of companies that returned the survey questionnaire. Household products, telecommunications and chemical products had 6 companies each respond (5.8%), medical and health industries have four respondents (3.8%), plastic product and computer related product industry both have 2 companies, while only one company each came from the oil and gas industry and the textile and garment industries. No missing cases are recorded in the industry data as each respondent indicated the

industry they come from.

Table 7.2: Industry

Industry	Frequency	Percentage
Electrical & electronics	25	24.0
Automotives	22	21.2
Food & beverages	12	11.5
Household products	6	5.8
Telecommunications	6	5.8
Chemical products	6	5.8
Medical & health	4	3.8
Plastic products	2	1.9
Computer related products	2	1.9
Oil & gas	1	1.0
Textile & garments	1	1.0
Others	17	16.3
Total	**104**	**100**

Type of company

The majority of companies that completed the survey questionnaire (48.1%) are local companies, with a total of 50 companies (Table 7.3). Of the respondents, 32 (30.8%) are joint venture companies, while 20 (19.2%) identified themselves as a multinational company (MNC). Only 2 (1.9%) companies are publicly listed companies in this sample. Again, no missing cases were recorded in this type of company data.

Table 7.3: Type of company

	Frequency	Percentage
Local	50	48.1
Joint Venture	32	30.8
MNC	20	19.2
Public listed	2	1.9
Total	**104**	**100.0**

Number of employees

The majority of the companies that participated in the survey are medium size companies as most of them have between 101 to 500 employees in their company. Atogether, there are 43 companies or 42.3% of the total participants that fall under this

category and 38 others have less than 100 employees. The two categories constitute almost 78% of the total respondents and, therefore, it is assumed that the majority of respondents are from small and medium sized companies. Fifteen companies have more than 500 employees but less than 1000 (14.4%), while only 8 are large companies and employ more than 1000 employees (7.7%). No missing cases were identified in the number of employees data (Table 7.4).

Table 7.4: Number of employees

Number of employees	Frequency	Percentage
Less than 100	38	36.5
101 - 500	43	41.3
500 - 1000	15	14.4
More than 1000	8	7.7
Total	**104**	**100.0**

Paid up capital and revenue

Table 7.5 indicates that the majority of companies, or 46 of them, have paid up capital of between 1 and 20 million Malaysian Ringgit (MYR) and these make up 44.2% of the total number of companies (MYR 1 = USD 0.282 as of 5 May 2009). In addition, 20 companies have paid up capital of less than 1 million ringgit (19.2%). Another 16 companies have paid up capital between 21 to 40 million ringgit (15.4%). Cumulatively, there are 13 companies that have paid up capital of between 41 and 100 million, or 12.5%. Only 5 companies (4.8%) have paid up capital exceeding the 100 million ringgit mark. Four companies chose not to fill out the paid up capital section of the questionnaire.

Table 7.5: Paid up capital

Paid up capital (MYR)	Frequency	Percentage
Less than 1 Mil	20	19.2
1 to 20 Mil	46	44.2
21 to 40 Mil	16	15.4
41 to 60 Mil	4	3.8
61 to 80 Mil	3	2.9
81 to 100 Mil	6	5.8
More than 100 Mil	5	4.8
Missing	4	3.8
Total	**104**	**100**

Table 7.6 shows that majority, 44 companies, have revenue of between 1 million and 50 million ringgit (42.3%), while only 10 companies earn less than that (9.6%). For an

income in between 51 and 100 million ringgit, there were 26 companies or 25% of the total number of companies. Following this, 7 companies earn between 501 million to 1 billion (6.7%), while the other 3 companies earn more than 1 billion ringgit annually (2.9%). A total of 5 missing cases were identified in the company revenue data.

Table 7.6: Company revenue

Revenue (MYR)	Frequency	Percentage
Less than 1 Mil	10	9.6
1 to 50 Mil	44	42.3
51 Mil to 100 Mil	26	25.0
101 Mil to 500 Mil	9	8.7
501 Mil to 1 Bil	7	6.7
More than 1 Bil	3	2.9
Missing	5	4.8
Total	**104**	**100**

7.5 E-procurement adoption

Table 7.7 describes the number of adopters and non-adopters of an e-procurement system among the 104 companies. Only 78 companies or 75% of the total number of companies that returned the survey questionnaire used e-procurement, while the other 26 companies did not (25%).

Table 7.7: Use of e-procurement

Use of E-procurement	Frequency	Percentage
Yes	78	75.0
No	26	25.0
Total	**104**	**100.0**

Analysis of the adopters reveals that the majority of them, 41 companies or 52.6%, use e-procurement at both sides of their supply chain: both their suppliers and customers (Table 7.8). The other 22 companies or 28.2% only use e-procurement when dealing with their customers, or in other words when selling their products, while 15 companies use such a system when dealing with their suppliers only (19.2%), or when purchasing components or materials for their business.

Table 7.8: System linkage among adopters

System linked with	Frequency	Percentage
Suppliers only	15	19.2
Customers only	22	28.2
Both suppliers and customers	41	52.6
Total	**78**	**100.0**

Analysis of 78 adopters of e-procurement reveals that 26, or 33%, reportedly make between 1 to 25% of their materials or components purchases electronically from their suppliers (Table 7.9). Only 10 companies, or 12.8% of the total adopters, make between 26 to 75% of their purchases through an e-procurement system. Meanwhile, 20 companies can be classified as full adopters of e-procurement systems within their purchasing activities as they make between 76 and 100% of material or component purchases needed electronically (25.6%). The final 22 reported that they did not use e-procurement when dealing with their suppliers, but used it when selling their products to their customers only. In terms of adopting e-procurement within selling activities, Table 7.9 indicates that 17 (or 21.8%) of adopting companies can be considered as full adopters of e-procurement within their outbound supply chain activities, as they state that about 76 to 100% of their selling activities are done electronically. Of the companies, 32 (or 41%) indicate that they use e-procurement around 26 to 75% when selling their products to their customers. Another 14 companies, or 17.9%, sell between 1 to 25% of their product through e-procurement, while 15 companies indicated that they did not use any sort of e-procurement system in their selling activities.

Table 7.9: E-procurement purchasing and selling levels

		Frequency	Percentage
Purchase Level	1 - 25%	26	33.3
	26 - 75%	10	12.8
	76 - 100%	20	25.6
	0% (Sell only)	22	28.3
	Total	**78**	**100.0**
Selling Level	1 - 25%	14	17.9
	26 - 75%	32	41.0
	76 - 100%	17	21.8
	0% (Purchase only)	15	19.2
	Total	**78**	**100.0**

Most adopters of e-procurement use more than one type of e-procurement system. Table 7.10 shows that e-sourcing is the most popular application as it has the highest number of companies that use it, with a total of 47 companies. Web-based portals are used by 29 companies, while 26 of them use E-MRO/web-based ERP applications. E-informing is also a popular choice among adopters as 17 of them stated that they use this type of system.

Table 7.10: E-procurement system type

	Use	Did not use	Total
E-sourcing	47	31	78
E-MRO/web-based ERP	26	52	78
Web-based portal	29	49	78
E-reverse auction	8	70	78
E-tendering	6	72	78
E-informing	17	61	78
E-collaboration	2	76	78
Others	34	44	78

E-reverse auctions are used by 8 companies, e-tendering by 6 companies, while e-collaboration has 2 users. Of the companies, 34 state that they also use some other type of system. Most of them are customized systems developed by the company itself, or it could be bought from software developers. Many respondents wrote in the name of this specific system, such as SAP, Coda and Sage in the empty spaces provided when they choose 'others' on the questionnaire.

The intention of this research is to study how trust and dependency towards partners influence adoption decisions. Both are external factors in decision-making and, therefore, this study investigates the level of influence partners have on the decision. The majority of companies chose 4 on a scale of 1 to 7, which indicates that there is a mutual decision between both parties when considering whether or not to adopt e-procurement and that partners' influence was somewhat important (Table 7.11). Furthermore, 11 companies said that it was 100% the partners' decision, compared to only 9 that said it was fully their own decision. Overall the mean score for the decision to use e-procurement is 3.96. Thus, it can be said that both parties have some influence on e-procurement decision-making. Further testing using PLS analysis will provide more insight into this finding.

Table 7.11: Decision to use E-procurement

		Frequency	Percentage
Decision to use	1	9	11.5
1 = Totally own decision	2	8	10.3
7 = Totally partner's decision	3	13	16.7
	4	24	30.8
	5	6	7.7
	6	7	9.0
	7	11	14.1
	Total	**78**	**100.0**
Mean		**3.96**	

7.6 Overview and reason for using PLS

The structural equation modelling technique using the Partial Least Square (PLS) regression approach was used to validate the measurement instrument and research model as a replacement to the structural equation modelling technique, as the number of samples collected did not fulfil the required number for SEM. The reason why PLS is chosen for the analysis is because of its ability to model latent constructs under conditions of non-normality and small to medium sample sizes as it places minimal restrictions on measurement scales and residual distribution (Chin, Marcolin & Newsted 2003). PLS is also referred to as a soft modelling technique that relaxes many of the data constraints imposed by maximum likelihood estimation techniques. Furthermore, this multivariate statistical technique is more suitable than Lisrel, based on covariance analysis and when exploratory studies with small samples is carried out (Gefen, Straub & Marie-Claude 2000). PLS is also considered appropriate for this study as it has been used in many management related studies, specifically ones concerned with trust, adoption and power/dependency such as the work by Mackenzie (1992) and Chandler (2007). SmartPLS software version 2.0 was used for these purposes.

A standard rule of thumb regarding the minimum sample size for PLS analysis, as stated by Chin, Marcolin and Newsted (1996), is that the sample size should be equal to the larger of the following:

- Ten times the scale with the largest number of formative (i.e., causal) indicators; or
- Ten times the largest number of structural paths directed at a particular construct in the structural model.

The number of samples for data analysis with PLS is 78, as only data collected from the adopters of e-procurement will be analysed using this technique. Therefore, both rules of thumb as stated above are fulfilled. The minimum number of samples required is 60 for the first rule, as the largest number of indicators in the structural model is six, which is for trust. For rule number two, the largest number of structural paths is directed at the

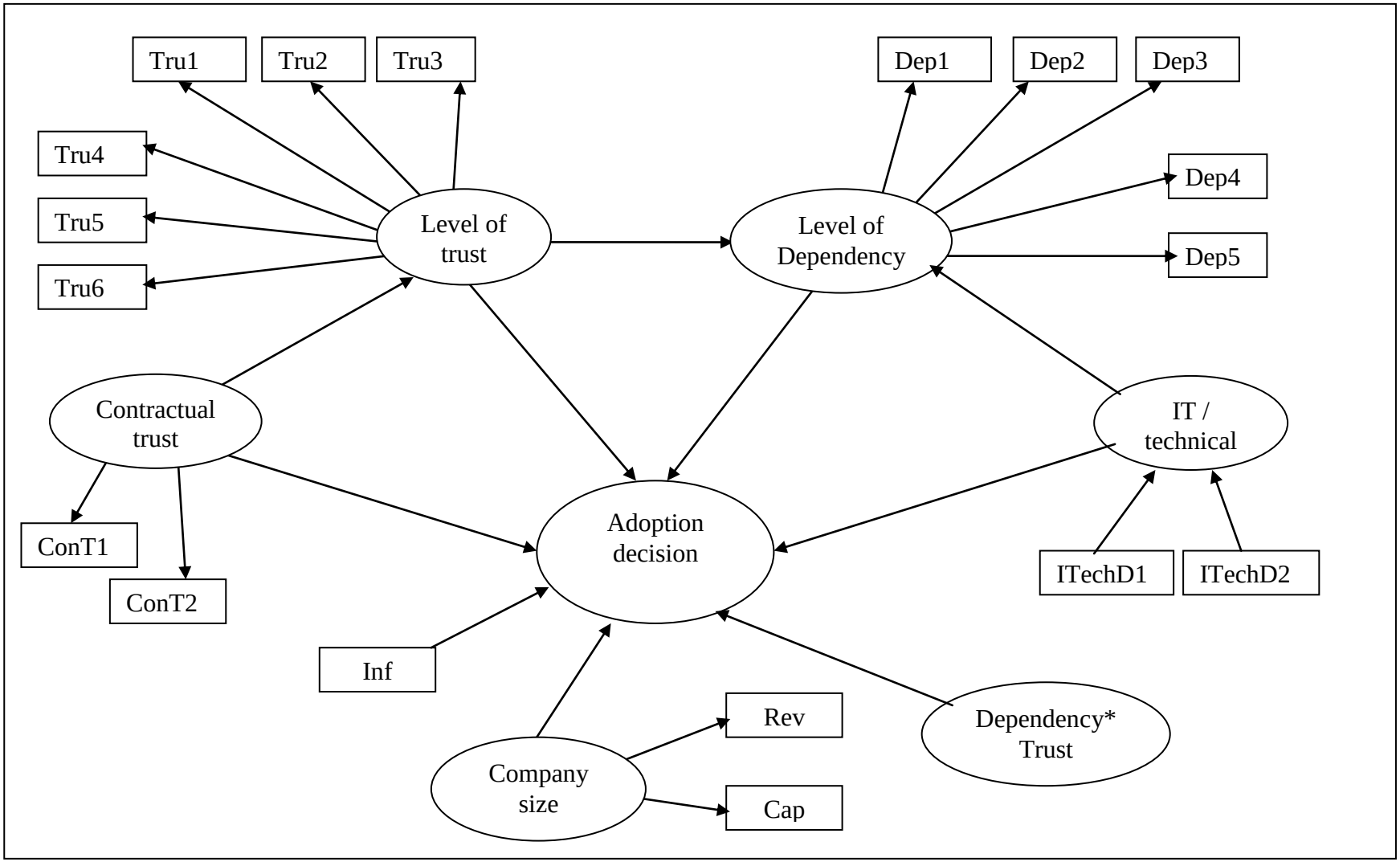
adoption decision construct, where it has six structural paths directed to it. Again, the minimum number of samples required based on rule number two is 60. Therefore, the sample of 78 adopters is considered sufficient and meets the requirement of PLS for further analysis.

PLS analysis involves two stages. The first one is the assessment of reliability and validity of the measurement model established. The objective is to make sure that the construct measures are valid and reliable before attempting to draw the conclusions (Hulland 1999; Barclay, Higgins & Thompson 1995). During this stage, the convergent and discriminant validity of the research instrument was conducted based on factor loading, Cronbach alpha and the average variance value. The second stage is the assessment of the structural model itself and a bootstrap re-sampling procedure with 500 samples was used to calculate the significance of path coefficients in the research model. The bootstrap approach treats the collected research sample as a population from which a large number of samples are drawn with continuous replacement such that the probability of selection for any given case remains equal over every random draw (Mallinckrodt et al. 2006). These two stages ensure that the construct measurement is reliable and valid enough to draw conclusions from the structural model. This two stage approach is recommended when faced with measures that are less reliable or theory that is only tentative, with a view to maximising the interpretability of both measurement and structural models (Hair et al. 2003).

7.7 PLS Model

Figure 7.1 shows the initial PLS model to be tested in this study. The model has seven constructs: level of trust; contractual trust; level of dependency; IT/technical dependency; company size; interaction between trust and dependency factor (dependency*trust); and, adoption decision. Each construct has multiple indicator or item measurement, except adoption decision which has only one item (labelled as INF). Level of trust has 6 indicators, contractual trust has 2, dependency has 5, IT/technical dependency has 2, while company size, which is the control variable, has 2.

The interaction between the trust and dependency construct does not have any indicator, but is calculated based on the product indicator approach as suggested by Chin, Marcolin and Newsted (2003). In this method, the interaction terms are calculated by multiplying every indicator in the moderator (trust) by every indicator in the independent variable (dependency). Each indicator in the interaction effect is normalised or standardised by subtracting the mean from each indicator and dividing by its standard deviation. Each of the constituting indicators is then multiplied to create the interaction construct.



(Source: Developed for this study)

Figure 7.1: PLS initial model

7.8 Analysis of the measurement model

The assessment of the measurement model can be done by examining the indicator reliability, convergent validity and discriminant validity. The output of the partial PLS regression analysis using SmartPLS provided the information needed to test the reliability and validity of the instrument. They were tested by looking at the reliability of individual items and the convergent validity of the measures associated with individual constructs.

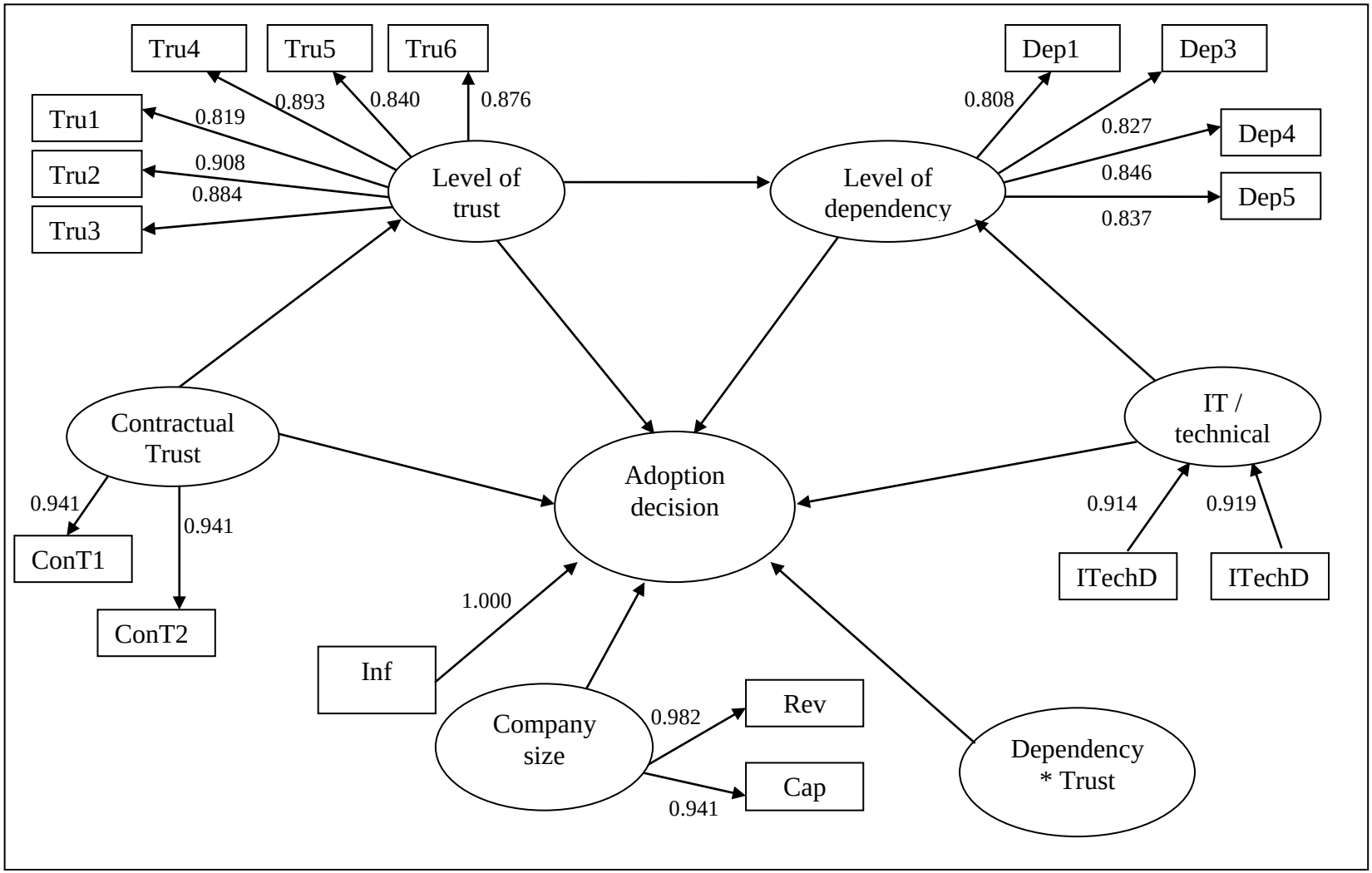
Content validity: All scales used in this study were derived from previous studies related to trust, dependency and technology adoption. A first draft of the questionnaire was discussed with a few lecturers before it was pilot tested via two separate phases: first through a mail survey questionnaire that involved 32 manufacturing companies; and then followed by a face-to-face discussion with officers in charge of purchasing or procurement at 5 companies. An earlier questionnaire with more than 60 items measuring technology attributes, trust and dependency were replaced with the final version that had only 15 items after going through the process discussed in the previous chapter. Therefore, content validity is assumed to be fulfilled in this study.

Convergent validity and construct reliability: Item loadings for each individual item measurement for each latent variable helped determine the convergent validity. Table 7.12 shows that all of the standardised loadings for each item for both supplier and customer data were well over the cut-off level of 0.7 (Chin 1998), except for item Dep2 in the supplier analysis that has a loading of only 0.671. Loadings of more than 0.7 indicate that there is more shared variance between the constructs and their measure than error variance (Hair et al. 1998). As a result, item Dep2 was subsequently removed from the construct in the supplier sample, as well as the customer sample, to ensure consistency in the measures and also to allow direct comparison of findings later on. Figures 7.1 and 7.2 show the results after the model were re-run without the item that was not loading satisfactorily (Dep2).

Construct reliability shows whether or not a common factor can be shown to exist underlying several measurements using different observable indicators. It is analysed using the composite reliability value of each latent construct. It is said to be a better estimate of construct reliability than using Cronbach Alpha (Werts 1974). Table 7.13 shows the composite reliability for each construct or latent variables for both suppliers and customers. All of them have a composite reliability value of more than 0.7, which is the minimum recommended value for construct reliability. In addition to composite reliability and factor loadings, Average Variance Extracted (AVE) value can also be used to assess convergent validity. Items that have an AVE value of more than 0.5 are said to have high convergent validity (Diamantoupoulos & Winklhofer 2001). Table 7.13 also shows that all constructs have an AVE value of more than 0.5 at both sides of the supply chain (supplier and customer). Therefore, it can be concluded that the model has an adequate convergent validity.

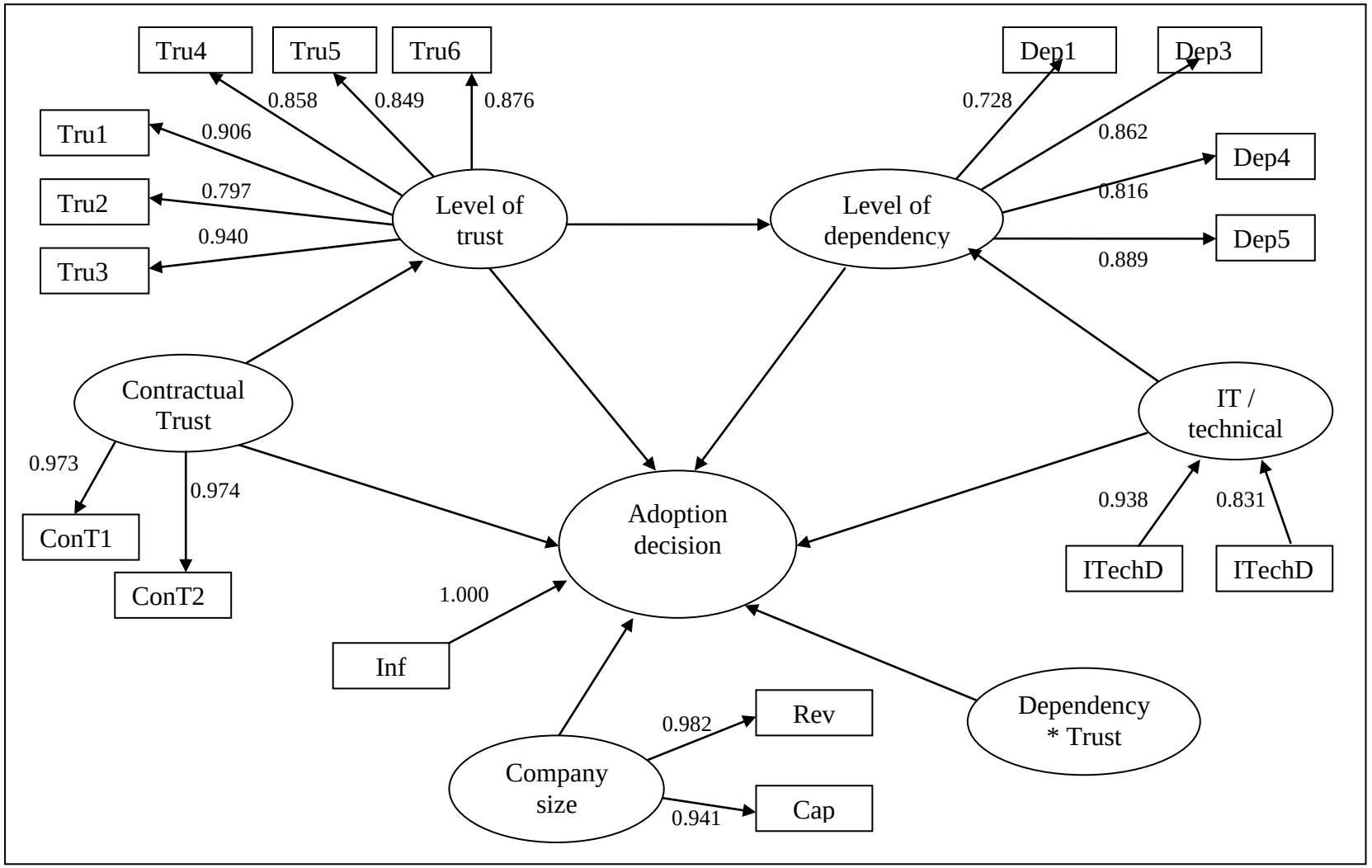
Table 7.12 Survey items descriptive statistics and loadings

Items	Suppliers			Customers		
	Mean	Standard deviation	Items loadings	Mean	Standard deviation	Items loadings
ConT1	4.59	1.343	0.941	4.87	1.221	0.973
ConT2	4.59	1.263	0.941	4.79	1.188	0.974
Tru1	4.87	1.454	0.819	5.19	1.228	0.906
Tru2	4.72	1.347	0.908	4.83	1.253	0.798
Tru3	4.90	1.325	0.884	5.05	1.068	0.940
Tru4	4.82	1.403	0.893	4.99	1.211	0.857
Tru5	4.90	1.254	0.839	5.01	1.051	0.848
Tru6	4.92	1.439	0.876	5.05	1.127	0.877
Dep1	5.00	1.269	0.815	5.09	1.130	0.741
Dep2	4.53	1.492	**0.671**	5.00	1.368	0.895
Dep3	4.18	1.421	0.836	4.54	1.501	0.832
Dep4	4.38	1.444	0.806	4.69	1.638	0.772
Dep5	4.67	1.316	0.830	5.23	1.485	0.911
ITechD1	3.06	1.283	0.913	3.50	1.492	0.933
ITechD2	3.17	1.343	0.920	3.64	1.486	0.837



(Source: Developed for this study)

Figure 7.2: PLS model with items loadings for each construct (Supplier)



(Source: Developed for this study)

Figure 7.3: PLS model with items loadings for each construct (Customer)

Table 7.13: Average variance extracted (AVE) and composite reliability value

	Supplier		Customer	
Items	**AVE**	**Composite reliability**	**AVE**	**Composite reliability**
Company size	0.925185	0.961122	0.925185	0.961122
Contractual trust	0.886106	0.939614	0.947477	0.973030
Dependency*Trust	0.791239	0.989116	0.766569	0.987421
Dependency	0.688745	0.898463	0.681989	0.895082
IT/technical dependence	0.839917	0.912994	0.784772	0.879021
Trust	0.757680	0.949334	0.760469	0.949995

Discriminant validity: Discriminant validity describes the degree to which the operationalisation is not similar to other operationalisations that it theoretically should not be similar to. Campbell and Fiske (1959) introduced the concept of discriminant validity within their discussion on evaluating test validity. A successful evaluation of discriminant validity shows that a test of a concept is not highly correlated with other tests designed to measure theoretically different concepts. The AVE statistics are then again used to determine the discriminant validity of the model. The square root of the average variance extracted (AVE) statistics were calculated using Microsoft Excel and compared with the correlations among the latent variables using the latent variable correlation matrix output of PLS (Chin, Marcolin & Newsted 2003) as indicated in Table 7.14 and Table 7.15.

Correlations between constructs are displayed in the lower left off-diagonal elements in the matrix. Average variance shared between the construct and its measures should be greater than the variance shared between the construct and other constructs in the model (Fornell & Larcker 1981). Both tables show that the diagonal elements in bold (square root of AVE) are greater than the off-diagonal elements at both corresponding rows and columns. For example, the square root of AVE for contractual trust of customers (0.962) is higher than the correlation of contractual trust and company size (0.039). It is also higher than contractual trust's correlation with other constructs (Dependency*Trust = - 0.015, dependency = - 0.018, IT/Technical = 0.133, Trust = 0.009). Therefore, it can be concluded that the findings of the PLS measurement model analysis show evidence of discriminant validity, where all constructs are statistically discriminated from the others.

Table 7.14 Latent variable correlation matrix (supplier)

	Comp Size	Contractual	Dep * Tru	Dependency	IT/technical	Trust
Company Size	**0.962**					
Contractual	0.039	**0.941**				
Dep * Tru	-0.015	0.675	**0.890**			
Dependency	-0.018	0.526	0.813	**0.830**		
IT/Technical	0.133	0.165	0.438	0.476	**0.916**	
Trust	0.009	0.794	0.786	0.689	0.301	**0.870**

Note: Dep*Tru = Dependency*Trust

Table 7.15 Latent variable correlation matrix (Customer)

	Comp size	Contractual	Dep * Tru	Dependency	IT/Technical	Trust
Comp size	**0.962**					
Contractual	-0.021	**0.973**				
Dep * Tru	0.054	0.717	**0.876**			
Dependency	0.028	0.634	0.744	**0.826**		
IT/Technical	0.024	0.406	0.463	0.435	**0.886**	
Trust	0.078	0.769	0.869	0.716	0.334	**0.872**

Note: Dep*Tru = Dependency*Trust

7.9 Analysis of the structural model

The second step after the assessment of the measurement model is the assessment of the structural model itself by looking at the sign and magnitude of path coefficients. It is then followed by the test of whether the paths are statistically significant. Path coefficients indicate the change in the dependent construct, expressed in standard deviations, that result from one standard deviation change in an independent construct holding all other independent constructs in the model constant (MacKenzie 1992).

The bootstrap procedure with 500 re-samples as recommended by Chin, Marcolin and Newstead (2003) was used to calculate the significance of the path coefficients (*t*-value). The bootstrapping procedure generates random samples of observations from the original data set by using a sampling through replacement technique. The path coefficients were then re-estimated using each one of these random samples of observations. These parameter estimates were subsequently used to calculate the parameter means and standard errors, before it was then used to compute *t*-statistics as estimates of the significance of path coefficients. The path coefficients in the PLS model represent standardised regression coefficients.

Previous studies using PLS have typically considered path coefficient of above 0.20 as having a strong relationship, path coefficients of between 0.10 to 0.20 as moderate, and path coefficients below 0.10 as weak (Johnson 1997). Meanwhile, the degree to which

the PLS model accomplishes its objectives of minimising errors or to maximise the variance explained, can be determined by examining the R^2 values (Lertwongsatien 2000). R^2 is a measure of the proportion of the total of the dependent variables, which is explained by independent variables. Falk (2005) suggests that the R^2 value should be more than 0.1, as any value lower than that informs very little even though it is statistically significant.

7.9.1 Analysis of path coefficients

Table 7.16 details the path coefficients, their t-values and the level of significance for each of them. Both the data sets of suppliers and customers will be discussed together as there are some similar findings observed between the supplier and customer data. One-tailed t-tests were used to determine whether the path is significant or not, because all the hypotheses in this study are one-directional in nature.

The findings of the PLS path analysis for the supplier and the customer data indicates that both have seven and eight path that are significant at least at $p < 0.1$ level respectively. However, some of them were not in the direction as proposed in the hypothesis of the study. For the supplier data, four strong and significant relationships ($p < 0.01$) with the same direction as proposed in the hypothesis was evident in the relationship between contractual trust and level of trust (0.79), level of trust and level of dependency (0.60), IT/technical dependence and level of dependency (0.30), and between company size and adoption (-0.29). For the customer data, there are three paths that achieve the same level of significance ($p < 0.01$) and are proven to have a strong relationship with adoption decisions: contractual trust to the level of trust (0.77); level of trust and level of dependency (0.64); and, company size to adoption (-0.29).

For the supplier data, three paths are significant but just at the $p < 0.1$ level: contractual trust to adoption; level of dependency to adoption; and, the interaction of trust and dependency to adoption. The path between contractual trust and adoption can be considered as having a weak relationship (0.11), while the other two are strong (0.51 and 0.95 respectively). In contrast, the customer data has one relationship that is significant at $p < 0.05$ and has a strong relationship, which is an IT/technical dependency to the level of dependency. There are four paths that are significant for customers at the $p < 0.1$ level which are between: contractual trust to adoption (0.16); level of trust to adoption (-0.47); level of dependency to adoption (0.38); and, finally, the interaction of trust and dependency to adoption (0.83). Findings also indicate that the path between IT/technical dependency to level of dependency for customers is also significant at the $p < 0.05$ level and the direction is positive as expected (0.22).

Table 7.16: Path coefficient, t-value and significance

	Supplier				Customer			
	Sign	Path	T-Value	Sig	Sign	Path	T-Value	Sig
Contractual → Level of trust	+	0.79	14.24	***	+	0.77	14.45	***
Contractual → Adoption	+	0.11	1.24	*	+	0.16	1.26	*
Level of trust → Dependency	+	0.60	7.32	***	+	0.64	7.1	***
Level of trust → Adoption	-	0.31	0.91		-	0.47	1.32	*
IT/technical → Level of dependency	+	0.30	3.32	***	+	0.22	1.86	**
IT/technical → Adoption	+	0.04	0.65		+	0.23	0.72	
Level of dependency → Adoption	+	0.51	1.34	*	+	0.38	1.25	*
Company size → Adoption	-	0.29	3.06	***	-	0.29	2.52	***
Dependency*Trust → Adoption	+	0.95	1.28	*	+	0.83	1.35	*

Significant at * $p < 0.1$ ** $p < 0.05$ *** $P < 0.01$ (one-tailed test)

7.9.2 Analysis of variance explained

Table 7.17 shows the variance explained values (R^2) for each of the variables in this study. The model explains 63% and 59% of the variance in the level of trust for both supplier and customer respectively. Also, 56% of the variance in the level of dependency for suppliers and 58% for customers are explained by the level of trust and IT/technical dependency.

Overall, the model explains 17% of the variance in the adoption decision for suppliers, and 25% for customers. Therefore, this model reflects the e-procurement adoption decision with customers more than the adoption with supplier with a difference of 8%. The variances achieve the desired level of at least 0.1 (10% variance) as suggested by Falk and Miller (1992), who state that the R^2 value should be more than 0.1 to be considered meaningful. Figure 7.3 shows the detailed structural model specification as generated using SmartPLS. The model consists of the estimation of path coefficients, which indicates the strengths of the relationships between variables, their t-statistics and the significance based on one-tailed t-test (as all hypotheses of this study are one directional) and also the variance explained value (R^2) that represent the amount of variance explained by the relationship.

Table 7.17: R2 values

Construct	R^2 supplier	R^2 customer
Level of trust	0.63	0.59
Level of dependency	0.56	0.58
Adoption decision	0.17	0.25

7.10 Test of hypotheses

Analysis of the hypotheses was undertaken by looking at the sign of the path coefficient and its associated t-value. The following discussion will analyse each hypothesis of the study and determine whether the findings of the data analysis using PLS shows support or not.

H_1: *The level of trust will positively influence e-procurement technology adoption decisions.*

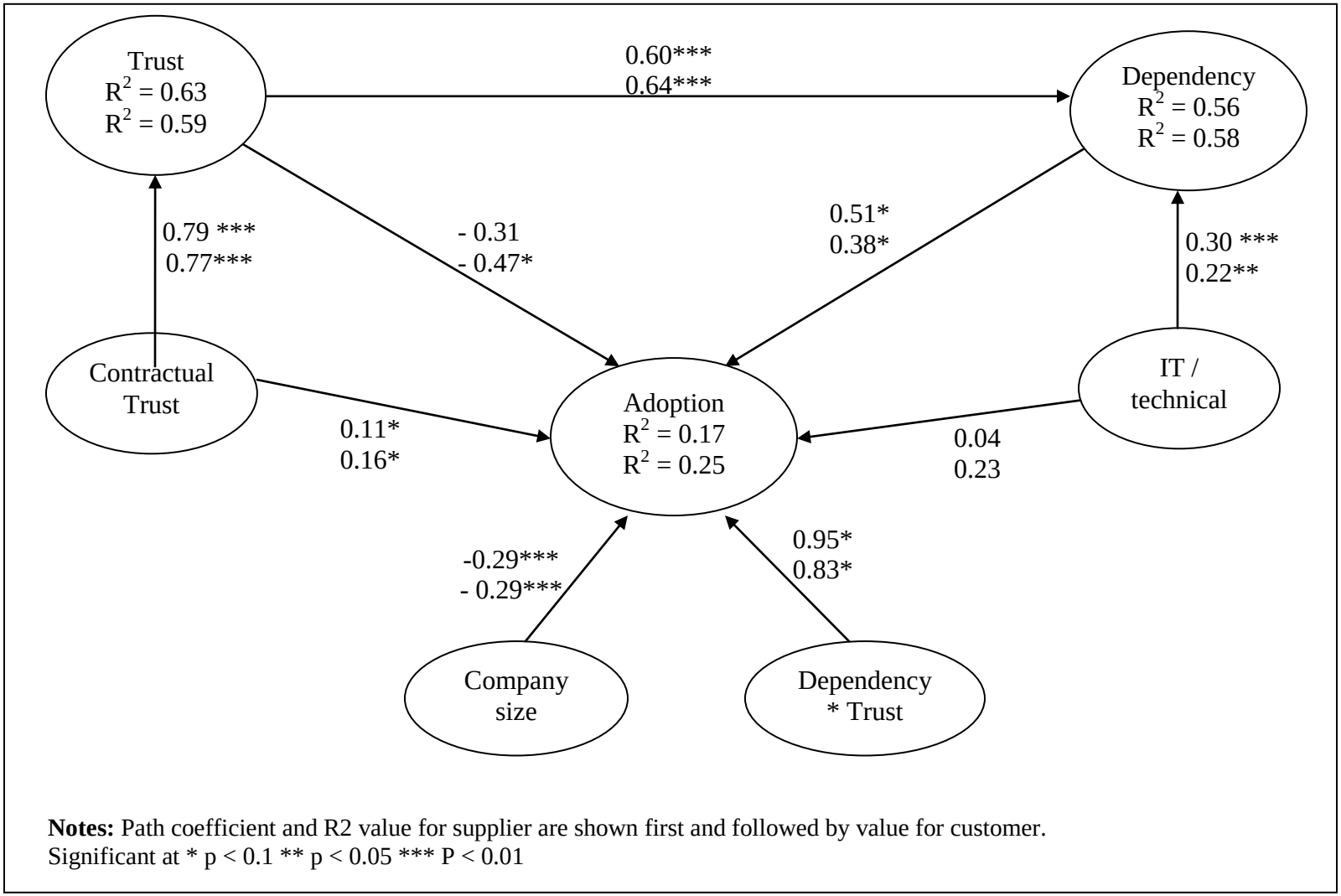
For suppliers, the t-value is not significant at all, but for customers, it is significant (-0.47, $p < 0.1$). However, the relationship is negatively related and not positive as hypothesised. Therefore, H_1 that hypothesised a positive relationship between the level of trust and adoption decisions is not supported for both the supplier and the customer data.

H_{1a}: *Contractual trust will positively influence e-procurement technology adoption decisions*

The relationship between contractual trust and adoption is significant for both supplier (0.11, $p < 0.1$) and customer (0.16, $p < 0.1$). The direction is also positive as hypothesised. Therefore, hypothesis H_{1a} that predicted a positive relationship between contractual trust and adoption decision is supported for both the supplier and the customer data.

H_2: The level of dependency will positively influence e-procurement technology adoption decisions

Level of dependency also has a significant positive relationship with adoption decision at both sides of the supplier (0.51 $p < 0.1$) and customer (0.38, $p < 0.1$) data. Therefore, hypothesis H_2 that hypothesized a positive relationship between the level of dependency and adoption decision is also supported for both supplier and customer data.



(Source: Developed for this study)

Figure 7.4: PLS analysis structural model

H_{2a}: The level of information technology and technical dependency will positively influence the e-procurement technology adoption decisions.

Information technology and technical dependency have no significant relationship with e-procurement adoption decision. Therefore, this hypothesis H_{2a} that hypothesized a positive relationship between IT/technical dependency and adoption decision is not supported.

H_3: The size of company will negatively influence the e-procurement technology adoption decisions.

Company size demonstrated a significant negative relationship with adoption decision for both supplier (-0.29, $p < 0.01$) and also customer (-0.29, $p < 0.01$). Therefore, hypothesis H_3 that hypothesized a negative relationship between size of company and adoption decision is supported.

H_4: Trust will positively increase the level of dependency between one company and another.

This hypothesis is supported as both supplier and customer data show a positive significant relationship between trust and dependency respectively (0.60, $p < 0.01$ and 0.64, $p < 0.01$).

H_5: The interaction between the level of trust and the level of dependency positively influence adoption.

The interaction between trust and dependency has a significant positive relationship on adoption decision for supplier (0.95, $p < 0.01$) and customer (0.83 $p< 0.01$). Therefore, this hypothesis is supported.

7.11 Non Adopters Analysis

Table 7.18 shows the descriptive report of the reasons why the non-adopters of e-procurement in this study did not use the system during the time of the study. Using a Likert scale with 7 values, non-adopters have to indicate which factor is most appropriate in the context of their company, with 1 being the least appropriate than 7, which is the most appropriate. The reason considered as the most appropriate and that scored the highest mean is that the benefit of e-procurement is not good enough with 5.15 and a standard deviation of 1.08. It is followed by concern over security of data (4.69), and the expense of establishment and maintenance (4.15). Other reasons include lack of knowledge of e-procurement and difficulty of use, which have a mean of 4.08 and 4.00 respectively. The fact that e-procurement is not a requirement of their business partner is the factor considered the most inappropriate as it scores the lowest mean value of 3.54 with a standard deviation of 1.64. It is then followed by a lack of commitment from top management of the company (3.65), lack of trust in partners (3.92), lack of trust in partners (3.92) and lack of professional IT staff (4.00).

Table 7.18: Reason for non-adoption

	N	Minimum	Maximum	Mean	Std. deviation
Benefit is not good enough	26	2	6	5.15	1.084
Data security concerns	26	2	6	4.69	1.123
Expensive to establish & maintain	26	2	6	4.15	1.64
Lack of knowledge on e-procurement	24	2	7	4.13	1.454
Difficult to use	26	2	6	4.08	1.383
Lack of professional IT staff	26	2	7	4.00	1.233
Lack of trust in partner(s)	26	2	6	3.92	1.468
Lack of commitment from top management	26	2	6	3.65	1.093
Not required by partners	26	1	6	3.54	1.64

A cross-tab analysis was conducted to identify the size of the non-adopting companies and it is shown in Table 7.19. The majority of non-adopters who returned the survey had less than 100 employees (14 companies, 53.8%). Only one company out of the 26 total non-adopters were large companies with more than 1000 employees. There is a clear trend where the number of non-adopters decreases as the number of employees, indicating the size of the company increases.

Table 7.19: Non-adopters and company size

No of employees	No of companies	Percentage
Less than 100	14	53.8%
101 - 500	8	30.8%
500 - 1000	3	11.5%
More than 1000	1	3.8%
Total	**26**	**100.0%**

7.12 Gap analysis

This section focuses on comparing the gap or differences between the manager's perception of the level of trust and the level of dependency towards their suppliers and customers. The objective of this analysis is twofold: to identify which trust and dependency factors have critical differences between suppliers and customers; and to identify whether there is a significant difference between the level of trust and dependency manufacturers have on their suppliers, compared to the level of trust and dependency towards their customers. In order to determine which trust and dependency factor is the most critical in determining the level of trust and dependency, a combination of three gap analysis methods is adopted for this study.

First, a t-test analysis is used to determine the significance value of each item, followed by the weighted mean gap analysis method that identified the top three factors with the highest weighted mean gap values. Finally, the third method is the unweighted Important Performance Analysis (IPA) method to identify which factors fall under the 'critical' area within the IPA matrix (Patterson, Grimm & Corsi 2003). Determination of criticality is based on which factors satisfy all following three criteria:

- Obtains a value less than the 0.05 significance level required for the paired sample t-test analysis;
- falls within the top three factors based on the highest weighted mean gap values in the weighted mean gap analysis; and
- located within the "critical" quadrant of the IPA matrix.

Finally, another paired samples t-test analysis was conducted on the aggregate mean for both level of trust and dependency as the findings will provide answers to the two final hypotheses of this study, which are H6 and H7 as described in the previous chapter.

7.12.1 Analysis of individual scale items for trust

Table 7.20 details the output of the t-test analysis and the mean value for each trust item for both supplier and customer, together with the mean gap value and the significance level. One notable trend from this table is that the mean for each trust item for suppliers is always lower than the mean for customers. As a result, the mean difference in the level of trust between supplier and customer is always a negative value. This negative or positive value of the mean gap give an indication of which one is the highest, and since the mean gap for level of trust is shown as a negative value, it means that the level of trust towards customers is always higher than the suppliers. The highest gap between suppliers and customers is evident in item 3, "Our partners always try to inform us if problem occurs", and followed by item 1 "Our partners do not breach agreements to their benefit". This high gap indicates firms' customers are more sincere in supply chain relationship as they always notify the manufacturer of any problem. The large gaps indicate that companies rely more on their customers. Customers are also perceived higher than suppliers in terms of honouring the agreements related to the relationship, based on these findings.

Meanwhile, the lowest gap was recorded in item numbers 4 and 7, as both recorded a mean difference of 1.15. Meanwhile, output of the t-test analysis indicates whether the mean difference between suppliers and customers is significant or not. The t-test reveals that only two out of the eight items for trust have a significant difference at either the $p < 0.05$ or $p < 0.01$ levels. They are item 1, "Our partners do not breach agreements to their benefit" and item 3, "Our partners always try to inform us if problem occurs". Six other items had no significant difference between the mean for suppliers and mean for customers. To determine whether those two factor with significant gaps are critical or not, it will be tested with two other gap analysis techniques as previously mentioned.

Table 7.20: Paired sample t-test for trust

		SUPPLIER		CUSTOMER		GAPS		
	Item	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation	Sig. (2-tailed)
1	Our partners do not breach agreements to their benefit	4.59	1.34	4.87	1.22	-0.282	0.881	0.006**
2	Our partners are always sincere and do not alter facts to get what they desire	4.59	1.26	4.79	1.19	-0.205	0.972	0.066
3	Our partners always try to inform us if problems occur	4.87	1.45	5.19	1.23	-0.321	1.157	0.017*
4	Our partners always provide the correct information we require	4.72	1.35	4.83	1.25	-0.115	0.897	0.259
5	Our partners always listen and seriously responses to our proposals.	4.90	1.33	5.05	1.07	-0.154	1.070	0.208
6	Our partners are always cooperative.	4.82	1.40	4.99	1.21	-0.167	1.178	0.215
7	Our partners always treat us kindly	4.90	1.25	5.01	1.05	-0.115	1.151	0.379
8	Our partners commit to maintain and develop our relationship	4.92	1.44	5.05	1.13	-0.128	0.917	0.221

**** Significant at p < 0.05, ** p < 0.01***

7.12.2 Weighted mean gap analysis for trust factor

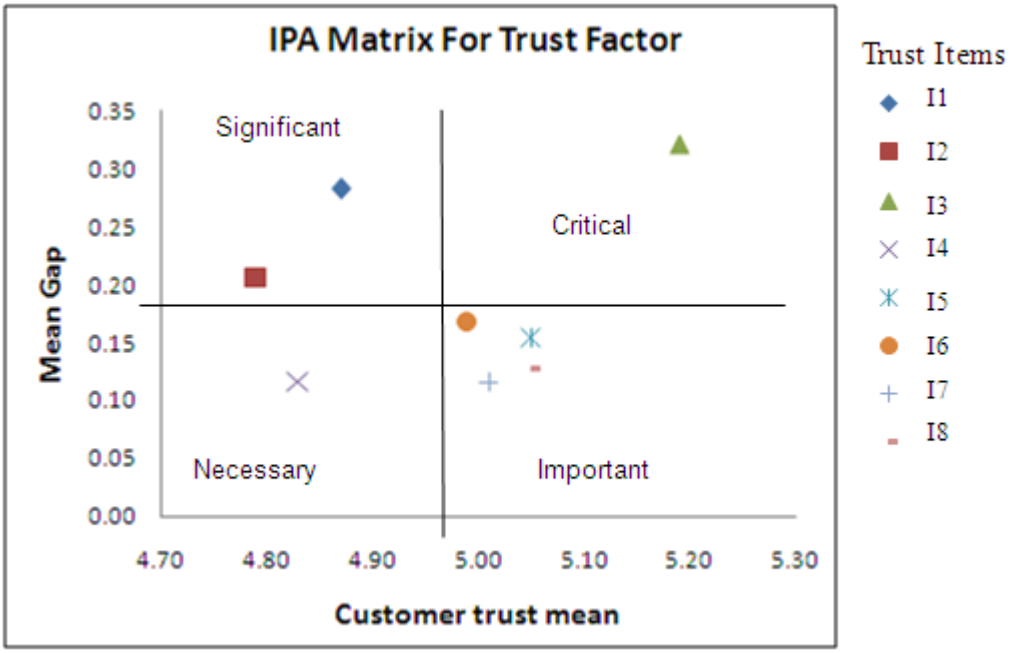
In order to obtain the weighted mean gap value, the mean for each trust factor from the customer data was multiplied with its mean gap value. Only customer data was used as the mean value is always higher than the mean for supplier. The negative value of mean gap was omitted as it only shows the difference between the mean gap of supplier and customer. Table 7.21 provides the weighted mean gap value for each trust factor and is ranked based on the highest weighted mean gap to the lowest.

Table 7.21: Weighted mean gap value for trust

	Item	Mean	Mean gap	Weighted mean gap
3	Our partners always try to inform us if problem occurs	5.19	0.321	1.666
1	Our partners do not breach agreements to their benefit	4.87	0.282	1.373
2	Our partners are always sincere and do not alter facts to get what they desire	4.79	0.205	0.982
6	Our partners are always cooperative.	4.99	0.167	0.833
5	Our partners always listen and seriously response to our proposals.	5.05	0.154	0.778
8	Our partners commit to maintain and develop our relationships	5.05	0.128	0.646
7	Our partners always treat us kindly	5.01	0.115	0.576
4	Our partners always provide the correct information we require	4.83	0.115	0.555

7.12.3 Unweighted IPA matrix analysis for trust factor

Using this technique, each trust factor was plotted against the matrix according to their mean and also gap values. The matrix is divided into 4 areas also known as quadrants. Each quadrant is labelled ‘critical’, ‘significant’, ‘important’ and ‘necessary’ in order to categorise each dependency factor and determine which ones fall into a critical factor category. To identify which area is critical, significant, important and necessary, the quadrant cross hairs are determined based on the total mean for trust factor as the x axis and the total mean gap as the y axis. The total mean for trust (customer) as provided by the SPSS output is 4.94 while the total mean gap is 0.19. Figure 7.4 shows the IPA matrix and the trust factors that fall under each quadrant. The matrix clearly shows that only one factor falls in the critical quadrant, which is factor 3. A summary of all the factors based on which quadrant they fall into is shown in Table 7.22.



(Source: Developed for this study)

Figure 7.5: IPA Matrix for trust factor

Table 7.22: List of trust factors and their quadrant

Significant quadrant		Critical quadrant	
I1	Our partners do not breach agreements to their benefit	I3	Our partners always try to inform us if problems occur
I2	Our partners are always sincere and do not alter facts to get what they desire		
Necessary quadrant		**Important quadrant**	
I4	Our partners always provide the correct information we require	I5	Our partners always listen and seriously respond to our proposals
		I6	Our partners are always cooperative
		I7	Our partners always treat us kindly
		I8	Our partners commit to maintain and develop our relationships

7.12.4 Identification of trust factor with most critical gap

Table 7.23 shows that the first test, which is the t-test, identified only two factors that are significant (item 3 and 1), before they were ranked based on the weighted mean gap value identified using the second method. Only factor 3, 'Our partners always try to inform us if problem occur', is considered as having the most critical gap as it fulfilled all three requirements: is significant under the t-test; ranked first in the weighted mean gap; and falls under the critical quadrant in the unweighted IPA method. It shows that there is a large difference between customer and supplier when it comes to communicating whatever problems they face to the manufacturer. Since this item is related to the honesty trust dimension, it can be said that one party in the relationship is more honest than another. Item one, although significant under the first t-test analysis, is not considered as having a critical gap as it fall under the significant quadrant of the Unweighted IPA Matrix test.

Table 7.23: Trust factor with most critical gap

	Item	Test 1: t-test	Test 2: Weighted mean gap	Test 3: Unweighted IPA method
3	Our partners always try to inform us if a problem occurs	0.017**	0.321	Critical
1	Our partners do not breach agreements to their benefit	0.006**	0.282	Significant
2	Our partners are always sincere and do not alter facts to get what they desire	0.066	0.205	Significant
6	Our partners are always cooperative.	0.215	0.167	Important
5	Our partners always listen and seriously respond to our proposals.	0.208	0.154	Important
8	Our partners commit to maintain and develop our relationship	0.221	0.128	Important
7	Our partners always treat us kindly	0.379	0.115	Important
4	Our partners always provide the correct information we require	0.259	0.115	Necessary

7.12.5 Analysis of the individual scale items for dependency

The output of t-test analysis and the mean value for each dependency factor for both supplier and customer, together with the mean gap value and the significance level, is available in Table 7.24. Just like trust, the perception of the level of dependency towards the supplier is also lower for each item compared to the customer, resulting in a negative value in the mean gap. Again, the negative or positive value of the mean gap indicates whether the level of dependency between supplier or customer is the highest. Since all mean gaps indicate a negative value, it shows that the level of dependency towards the customer is always higher than the supplier. The highest mean gap was recorded by item number 5, 'Our firm's partners influence our reputation in the marketplace' with the mean difference reaching 0.564, followed by items 2 and 7 with 4.74. It reveals the

importance of customers in helping these companies to gain a reputation in the industry. Servicing large well-known customers will provide a good reference in securing more business with other companies. Meanwhile, item 1, 'Our firm is well aware of its partner's strengths and weakness', has the lowest mean difference with only 0.90 separating supplier and customer.

The result of the paired sample t-test for the level of dependency between supplier and customer also indicates that in six out of seven items that measure the level of dependency there is a very significant difference between supplier and customer. Furthermore, all six items were significant at the $p < 0.01$ level. Only item 1 did not have a significant difference. Therefore, to further distinguish which dependency factor has a critical gap between supplier and customer, the other two methods of gap analysis are conducted.

7.12.6 Weighted mean gap analysis for dependency factor

In order to obtain the weighted mean gap value, the mean for each dependency factor from the customer data was multiplied with its mean gap value. Like trust, only customer data was used, as the mean is always higher than for suppliers. The negative value of the mean gap was omitted as it only shows the difference between the mean gaps of supplier and customer. Table 7.25 provides the weighted mean gap values, ranked in descending order according to its respective value for dependency factors. The highlighted section of the table indicates the top three factors with the highest ranked weighted mean gap. They are: item 5, 'Our firm's partners influence our reputation in the marketplace' (2.95); item 2, 'Our firm activities are developed through the knowledge that is interchanged with its partners' (2.37); and, item 7, 'Our firm strives to maintain a common IT standard of hardware and software with its partners' (1.73).

Table 7.24: Paired sample t-test for dependency

		SUPPLIER		CUSTOMER		GAPS		
	Item	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Sig. (2-tailed)
1	Our firm is well aware of its partners' strengths and weaknesses.	5.00	1.27	5.09	1.13	-.090	.871	0.365
2	Our firm activities are developed through the knowledge that is interchanged with its partners.	4.53	1.49	5.00	1.37	-.474	1.276	0.002 **
3	Partners' skill is crucial to our firm's operation and very difficult to be replaced.	4.18	1.42	4.54	1.50	-.359	1.044	0.003 **
4	Our firm's partners do not improve our firm's goodwill.	4.38	1.44	4.69	1.64	-.308	.997	0.008 **
5	Our firm's partners influence our reputation in the marketplace.	4.67	1.32	5.23	1.49	-.564	1.146	0.000 **
6	Our firm's IT investments are adapted to the partners' decision on IT solutions.	3.06	1.28	3.50	1.49	-.436	1.420	0.008 **
7	Our firm strives to maintain a common IT standard of hardware and software with its partners.	3.17	1.34	3.64	1.49	-.474	1.483	0.006**

**** Significant at p < 0.05, ** p <0.01***

Table 7.25: Weighted mean gap for dependency factors

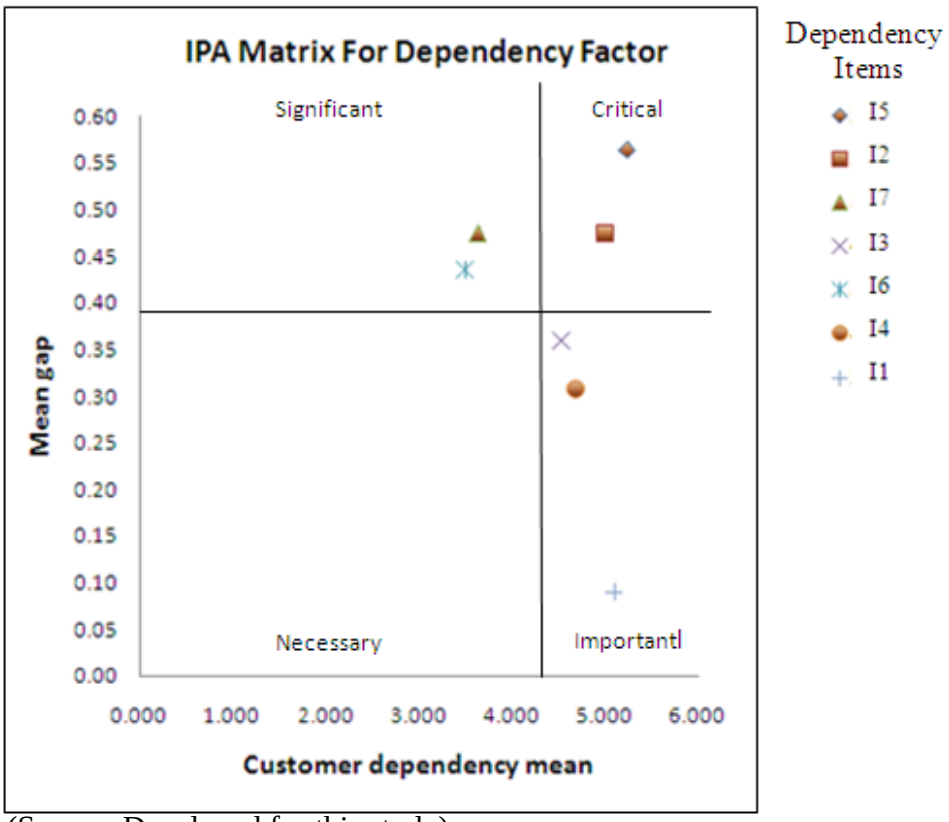
	Item	Mean Customer	Mean Gap	Weighted Mean Gap
5	Our firm's partners influence our reputation in the marketplace.	5.230	0.564	2.950
2	Our firm activities are developed through the knowledge that is interchanged with its partners.	5.000	0.474	2.370
7	Our firm strives to maintain a common IT standard of hardware and software with its partners.	3.640	0.474	1.725
3	Partners' skill is crucial to our firm's operation and very difficult to be replaced.	4.540	0.359	1.630
6	Our firm's IT investments are adapted to the partners' decision on IT solutions.	3.500	0.436	1.526
4	Our firm's partners do not improve our firm's goodwill.	4.690	0.308	1.445
1	Our firm is well aware of its partners' strengths and weaknesses.	5.090	0.09	0.458

7.12.7 Unweighted IPA matrix analysis for dependency factor

All dependency items were plotted against the matrix according to their mean and also their gap values. Like the trust factors earlier, the matrix was divided into 4 quadrants and labelled as 'critical', 'significant', 'important' and 'necessary'. To identify which area is critical, significant, important and necessary, the quadrant cross hairs were determined based on the total mean dependency factor as the x axis and the total mean gap as the y axis. The total mean for dependency as provided by the SPSS output is 4.53, while the total mean gap is 0.39. Figure 7.5 shows the IPA matrix and dependency factors that fall under each quadrant. It indicates that only two factors have a critical gap, which is item 5 and item 2. A summary of all items based on which quadrant they fall into is shown in Table 7.26.

7.12.8 Identification of the most critical dependency factors

Table 7.27 helps determine which dependency items are critical between suppliers and customers, based on all three analyses conducted. The first t-test analysis identified six factors that are significant ($p < 0.05$), before all these items were ranked based on their weighted mean gap value, resulting in identification of the three top factors. During the third analysis, two factors with critical gaps were identified and, at the same time, fulfilled all the three criteria as mentioned before. They were factor number 5, 'Our firm's partners influence our reputation in the marketplace', and factor number 2, 'Our firm activities are developed through the knowledge that is interchanged with its partners'.



(Source: Developed for this study)

Figure 7.6: Unweighted IPA matrix for dependency factors

Table 7.26: List of dependency factors and their quadrant

Significant quadrant		Critical quadrant	
I7	Our firm strives to maintain a common IT standard of hardware and software with its partners.	I5	Our firm's partners influence our reputation in the marketplace.
I6	Partners' skill is crucial to our firm's operation and is very difficult to replace.	I2	Our firm activities are developed through the knowledge that is interchanged with its partners.
Necessary quadrant		**Important quadrant**	
		I3	Partners' skill is crucial to our firm's operation and very difficult to be replaced.
		I4	Our firm's partners do not improve our firm's goodwill.
		I1	Our firm is well aware of its partners' strengths and weaknesses.

Table 7.27: Most critical dependency factors

Item	Dependency Factor	Test 1: Paired-Samples T-Test	Test 2: Weighted Mean Gap Analysis Method	Test 3: Unweighted IPA Method
5	Our firm's partners influence our reputation in the marketplace.	0.000 **	1	Critical
2	Our firm activities are developed through the knowledge that is interchanged with its partners.	0.002 **	2	Critical
7	Our firm strives to maintain a common IT standard of hardware and software with its partners.	0.006**	3	Significant
3	Partners' skill is crucial to our firm's operation and very difficult to be replaced.	0.003 **	4	Significant
6	Our firm's IT investments are adapted to the partners' decision on IT solutions.	0.008 **	5	Important
4	Our firm's partners do not improve our firm's goodwill.	0.008 **	6	Important
1	Our firm is well aware of its partners' strengths and weaknesses.	0.365	7	Important

7.12.9 Analysis of the total level of trust and total level of dependency

To obtain conclusive evidence of whether there is a significant difference between the level of trust and dependency towards suppliers and customers, another paired sample t-test that analysed the cumulative mean for both level of trust and level of dependency towards suppliers and customers was conducted. Table 7.28 shows the findings of a t-test analysis for the total level of trust and level of dependency between suppliers and customers. Again, the mean for level of trust and level of dependency towards customers was found to be higher than the mean value for suppliers. Therefore, companies involved in this study seem to trust, and at the same time depend, more on their customers rather than their suppliers. The mean difference is higher for the level of dependency (-0.386) compared to the level of trust (-0.186). In order to test the two final hypotheses H6 and H7, the paired sample t-test result is analysed.

Table 7.28: Paired sample statistics for trust and dependency (total)

		N	Mean	Std. Dev.	Mean Gap	Std. Dev.	Sig. (2-tailed)
Pair 1	Level of trust (Supplier) – Level of trust (Customer)	78	4.789	1.152	-0.186	0.603	0.008**
		78	4.974	0.997			
Pair 2	Level of dependency (Supplier) – Level of dependency (Customer)	78	4.141	0.982	-0.386	0.754	0.000**
		78	4.527	1.072			

**** Significant at ** p <0.01***

Based on the results as shown in the same table, the results of the hypothesis testing are as follows:

H_6: *There are significant differences between the level of trust towards suppliers and level of trust towards customers.*

There is enough evidence to reject the null hypothesis as $p < 0.01$ (Sig. 2-tailed value). In other words, the findings indicate that there is a significant difference in the level of trust towards suppliers and the level of trust towards customers in this study.

H_7: *There are significant differences between the level of dependency towards suppliers and level of dependency towards customers.*

There is also enough evidence to reject the null hypothesis as $p < 0.01$ (Sig. 2-tailed value) for the differences in the level of dependency towards suppliers and customers. Findings indicate that there is a significant difference in the level of dependency towards suppliers and the level of dependency towards customers in this study.

7.12.10 Significance of gap by industry

The final gap analysis of this study is to identify if there is any significant difference between the level of trust and dependency among manufacturers based on industry. Before the analysis was conducted, the companies were grouped based on their industries, where some industries that were almost similar in their nature of business being grouped together. Only four groups were created out of 13 industries listed in the survey questionnaire. Group 1 consisted of companies from the automotive industry only (n = 20), group 2 consists of electrical and electronics, telecommunication and computer related industries (n = 27), group 3 is made up of companies from food and beverages, plastic, paper and household products (n = 14), and the last group consists of companies from all the other industries (n = 25). Table 7.29 details the output of a paired sample t-test analysis for each group of industries in terms of their level of trust and level of dependency with their business partners.

One notable trend from the output is the fact that all the mean gaps except one (group 3: level of trust) have a negative value, which indicates that both the level of trust and the level of dependency towards customers is always higher than the level of trust and dependency towards suppliers, regardless of the industry. However, only group 1, which consists of companies from the automotive industry, have a

significant gap ($p < 0.01$) for both the level of trust and the level of dependency towards their suppliers and customers. Group 2 and group 3 show a similar pattern where only the level of dependency between their suppliers and customers shows a significant difference at the $p < 0.05$ level. All other results of the paired sample t-test show a non-significant difference and these findings are summarised in Table 7.30.

Table 7.29: Paired sample statistics for each group of industry

		N	Mean	Std. Dev.	Mean Gap	Std. Dev.	Sig. (2-tailed)
Group 1	Level of trust (supplier) – Level of trust (customer)	20	4.744	0.915	-0.394	0.549	0.005**
		20	5.138	0.865			
	Level of dependency (supplier) – Level of dependency (customer)	20	4.207	0.754	-0.779	1.033	0.003**
		20	4.986	0.833			
Group 2	Level of trust (supplier) – Level of trust (customer)	27	4.449	1.363	-0.130	0.826	0.422
		27	4.579	1.248			
	Level of dependency (supplier) – Level of dependency (customer)	27	4.011	1.057	-0.280	0.553	0.014*
		27	4.291	1.170			
Group 3	Level of trust (supplier) – Level of trust (customer)	14	0.545	0.802	0.125	0.395	0.258
		14	0.542	0.790			
	Level of dependency (supplier) – Level of dependency (customer)	14	4.551	0.870	-0.337	0.536	0.035*
		14	4.888	0.807			
Group 4	Level of trust (supplier) – Level of trust (customer)	25	4.720	0.990	-0.075	0.492	0.453
		25	4.800	0.969			
	Level of dependency (supplier) – Level of dependency (customer)	25	4.057	1.123	-0.177	0.557	0.125
		25	4.234	1.130			

**** Significant at *p < 0.05 ** p <0.01***

Table 7.30: Summary of paired sample statistics for each group of industry

Industry group	Trust	Dependency
Group 1 (Automotive)	Significant	Significant
Group 2 (Electrical, Telecommunication, Computer)	Not significant	Significant
Group 3 (Food, Plastics, Paper, Household)	Not significant	Significant
Group 4 (Others)	Not significant	Not significant

7.13 Conclusion

This chapter discussed the empirical results of this study based on the output of PLS analysis and gap analysis. It detailed the survey response rate, non-response bias analysis, followed by the descriptive statistics of the companies that returned the survey questionnaire. Then followed an assessment of both the measurement and the structural model of PLS analysis where all the measurement items and constructs of interest fulfilled the reliability and validity test as required. Analysis of the structural model revealed some interesting findings that are somewhat different from previous studies and this is discussed in detail within the next chapter. Tests of the hypotheses also revealed that some of the hypotheses created for this study were significant and some of them were not. Analysis of non-adopters was also conducted to identify the reasons why these companies did not use e-procurement in their dealings with suppliers and customers. This chapter then concluded with the gap analysis that was conducted to test the last two hypotheses of the study, which could not be answered by PLS. The findings indicated that there is a significant gap between the level of trust and levels of dependency towards suppliers and towards customers.

CHAPTER 8: DISCUSSIONS AND CONCLUSIONS

8.0 Introduction

This chapter will further discuss the findings of data analysis as described in the previous chapter and is organised based on the hypotheses of the study. It is then followed by discussions on the limitation of the study, and contribution to both the theoretical and organizational aspects. It then concludes with the conclusion and direction for future research.

8.1 Hypothesis discussion

The major objective of this study is to identify the importance of two factors, the level of inter-organizational trust and the level of inter-organizational dependency on an e-procurement adoption decision between manufacturers, their suppliers and also customers. Findings of the PLS analysis on 78 manufacturers indicate that there are differences that exists between the two factors, and also between the relationship with the suppliers and the customers itself. Table 8.1 shows the results of hypotheses testing as conducted in chapter 7. It details each proposed relationships and whether it is supported or not, together with the strength of the relationship.

8.2 Trust and e-procurement adoption

The level of trust has been cited by many previous researchers as one of the key elements in business relationships, especially in supply chain management (Paterson, Maguire & Al-Hakim 2008; Dwyer, Schurr & Oh 1987). The centre of attention for this study is on how trust and its antecedents influence e-procurement adoption decision. Findings indicate that out of two antecedents of trust, only one antecedent, contractual trust, was found to have a significance influence on e-procurement adoption decision. The relationship, however, is rather moderate. This finding is consistent with some other literatures that also identify a positive relationship between contractual trust and adoption (Ryan, Giblin & Walshie 2004; Sako & Helper 1998; Gattiker 1989). The term contractual trust here refers to the degree of reliance on formal documents as opposed to oral agreements. Within the context of this study, the supplying or buying entity had to engage in formal written contract with the manufacturer before doimg business with them. Studies even identified that contracts have long been the necessary means for supply chain firms to overcome vulnerability and power asymmetry (Handfield & Bechtel 2002). One of the clauses in the contract might relate to an agreement to adopt any kind of IT system that will link partners together and is considered as crucial to their business relationship. Therefore, contract provision regarding e-procurement adoption will definitely encourage companies to adopt the system. Findings from the case study also support this relationship as the majority of companies interviewed said that the requirement details in the agreement did influence them to adopt any kind of information system required by their partners. This study also empirically validates the supposition that contractual trust directly influences adoption decisions, instead just being a determinant of level of trust.

In contrast to contractual trust, the hypothesis that the level of trust will positively influence adoption decision is not supported. Although it is not supported, the fact that it is different and somewhat surprising compared to previous study is worth a discussion. Most literature on trust and IT adoption such as the logistics information systems (Tung, Chang & Chou 2008), electronic markets (Ba & Pavlou 2002), online

Table 8.1: Hypothesis testing results

		Supplier		Customer	
	Hypothesis	**Support**	**Strength**	**Support**	**Strength**
H_1	The level of trust will positively influence the e-procurement technology adoption decisions.	Not supported		Not supported	
H_{1a}	Contractual trust will positively influence the e-procurement technology adoption decisions.	Supported	Moderate	Supported	Moderate
H_2	The level of dependency will positively influence the e-procurement technology adoption decisions	Supported	Strong	Supported	Strong
H_{2a}	The information technology and technical dependency will positively influence the e-procurement technology adoption decisions.	Not supported		Not Supported	
H_3	Size of company will negatively influence the e-procurement technology adoption decisions.	Supported	Strong	Supported	Strong
H_4	Level of trust positively increase the level of dependency between one company to another	Supported	Strong	Supported	Strong
H_5	Interaction between the level of trust and the level of dependency positively influence adoption	Supported	Strong	Supported	Strong
H_6	There are no significant differences between the level of trust towards supplier and level of trust towards customer.	Supported	-	Supported	-
H_7	There are no significant differences between the level of dependency towards supplier and level of dependency towards customer.	Supported	-	Supported	-

banking (Mukherjee & Nath 2003) and EDI (Ratnasingam 2001) demonstrate that level of trust will positively lead to adoption. Even though analysis indicates that it is significant at $p < 0.1$ level for customer data, the direction of relationship for both suppliers and customers are negative, instead of positive value as the early expectation. There are two assumptions that can be made from these findings First, the higher the level of trust; it is less likely for a company to adopt e-procurement. The reason is that if the suppliers or customer are highly trusted and always perform their duties well, there is no need for a system such as e-procurement to link these partners together, as everything can be managed manually. The objective of using e-procurement is to solve procurement issues such as errors in ordering, high cost and slow business processes. If such issues did not occur in firms' supply chain relationships and all partners are competent and can be trusted, then adoption of e-procurement is considered unnecessary.

Another assumption about this finding is that trust is not an important consideration at all when making an e-procurement adoption decision within the context of Malaysian manufacturers. The level of trust they have on either their suppliers or customers is not one of the important factors considered by manufacturers that participated in this study when deciding whether they are going to use e-procurement or not in their organization. Although this finding was different from the majority of previous studies, there are some other studies that indicate that trust is not necessary at all in the supply chain relationship (Ireland & Webb 2007). Gefen et al. (2005) in their study found that trust is not an important consideration in IT adoption when other factors such as the culture diversity is large. Therefore, trust is not considered as an important factor in e-procurement adoption among Malaysian manufacturers because high level of dependency towards their partners outweighs the importance of trust. However, the fact that the small number of samples for this study might have a strong influence on the findings on trust should also be taken into consideration. There is a possibility that a different outcome might be observed if the number of samples were large enough. Therefore, this finding should be treated with great concern.

8.3 Dependency and e-procurement adoption

The findings of this study on the relationship between inter-organizational dependency and e-procurement adoption decision are consistent with past research on other e-business or IT application (Frambach 1993; Patterson, Grimm & Corsi 2003; Teo, Wei & Benbasat 2003). All of these studies report a positive relationship between the level of dependency and adoption. Results of the PLS analysis on the relationship between level of dependency and e-procurement adoption decision confirm the validity of the proposed research hypothesis by revealing a significant positive relationship between both variables ($p < 0.1$). Furthermore, the path coefficient indicates a strong relationship between these two factors for both suppliers' and customers' data. Dependency is even stronger towards customers as identified by both PLS and gap analysis study. It indicates that manufacturers who participated in this study rely more on their customers, rather than suppliers. Case study findings have further explained this phenomenon where small and medium size companies rely heavily on their customers for business, hence increasing their level of dependency. Beside business, some companies also involved in a vendor development program that helps them in terms of financial, technical, technology and knowledge sharing.

This study, however, did not support the role of information technology and technical dependency on encouraging e-procurement adoptions, as the hypothesis is not significant at all for both suppliers' and customers' data. This is in contrast to the positive relationship reported by other similar studies on IT, or other technology adoption (Kulp et al. 2006; Hong Cheong 2005). What can be interpreted from this finding is the fact that supply chain partners did not totally depend on their partners to supply them the e-procurement system, as some of them might not really need it or might have their own capability to adopt the system by themselves. Furthermore, the cost of hardware and software needed for an e-procurement system is becoming much more affordable these days. The result also indicates that some other antecedents of dependency such as market, economic and time are more important dimensions that influence the level of dependency manufacturers have towards their suppliers or customers.

8.4 Company size and adoption

Studies on the relationship between company size and IT adoption identify that size did influence adoption, but in terms of the direction of the relationships, it was not always in agreement with each other. Dawn and Larry (2008) and Germain, Droge and Daugherty (1994) found that larger size companies are more likely to adopt new technology, while others identify smaller companies as more likely to do so. For this study, analysis on the company size shows that it has a significant and strong negative impact on e-procurement adoption decision as hypothesised. It means that the smaller the size of the manufacturing company compared to their partners, it is more likely for them to adopt e-procurement. Therefore, these findings are in agreement with the study by Atkinson (2007) and Kulp et al.(2006), that small firms were found to be more proactive in adopting IT initiatives when making a purchase or when buying, and not the opposite. The argument for this finding can be related back to previous discussion on the importance of dependency factor. Small and medium size companies that rely heavily on their large partners will tend to adopt the e-procurement system that will link them together, either because they are forced or even suggested by their partners to do so.

8.5 Trust and dependency

Hypothesis testing for the relationship between the level of trust and the level of dependency shows that it is strongly supported. Trust is identified as having a positive relationship with the level of dependency. It means that an increase in the level of trust will eventually increase the level of companies' dependency towards their partners. It is noted that the more trust one firm places towards its partners; the more it magnifies the extent of dependency on this particular partner. As a result, it will increase the possibility in which that partner can act opportunistically (Ireland & Webb 2007). Therefore, the results are consistent with this theoretical prediction on the relationship between the level of trust and the level of dependency.

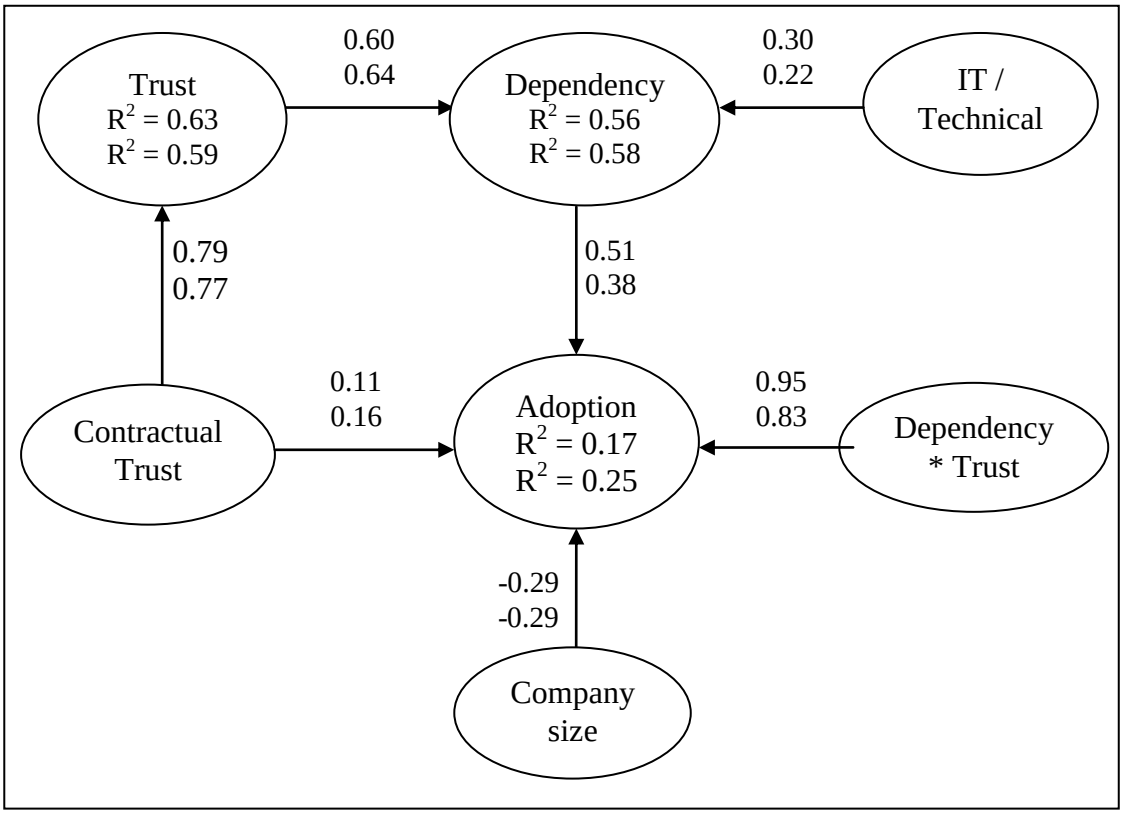
8.6 Interaction effect of trust and dependency on adoption

This study has investigated the interaction effect that the level of trust and level of dependency has on e-procurement adoption decisions. Findings indicate that the hypothesis is strongly supported and has a positive relationship with adoption decision as expected. It shows that the high level of dependency one company has have over the other, coupled with the trusting relationship developed between them, will further encourage adoption of an e-procurement system. Although the

relationship between levels of trust alone with adoption is identified as not significant and negatively related before, it produces a different finding when it is considered together with the level dependency. This findings is in line with the suggestion by Bachmann (1999) that most social relationships are based on a mixture of trust and power. In this case, the interaction between both factors is proven to encourage coordination between supply chain partners and results in the adoption of a common e-procurement system that link them together.

8.7 Discussion of the final PLS model

The main intention of this study is to analyse what the influence of the level of trust and the level of dependency have towards adoption decision. Only dependency has the significant relationship with adoption decision as shown in Figure 8.1. Trust, however, did influence the level of dependency firms have over their partners. In contrast, contractual trust did have a moderate level of influence on adoption decisions. Company size meanwhile has a negative but strong influence on adoption, while the interaction between trust and dependency has a strong influence with adoption decision. The model explains 17% of the variance in e-procurement adoption for suppliers, but somewhat higher for customers, which is 25% (R^2 suppliers = 0.17 and R^2 customers = 0.25 respectively). Relatively, these low variances values indicate that there are some other important factors that may influence an e-procurement adoption decision that were not incorporated in this study. In this case, some other factors besides the level of trust, the level of dependency, company size and the interaction between trust and dependency influence 83% of the adoption decision by the supplier and 75% for the customer.



(Source: Adopted for this study)

Figure 8.1: Final PLS model showing supported path

Other than technology attributes factor, which is obviously the most important factor as identified from previous study, case study interview and pilot study, a look back at literature on IT adoption could provide some of the other reasons that play an important role when it comes to the e-procurement adoption decision making. Hogarth-Scott (1999). together with Phillips, Calantone and Lee (1994), identifies the firm internal aspect such as organisational culture and attitude of people as factors that influence IT adoption. Ungan (2005), together with Gunasekaran and Ngai's (2008) study, shows that a company's management structure and their support, their mission and strategy play an important role, while Wu et al. (2008) established that leadership, organizational learning, and IT resources are the internal factors that positively impact IT adoption. Another internal factor that could influence adoption decision is the financial situation of the company. Studies have identified that strong financial position will positively encourage adoption (Gunasekaran & Ngai 2008).

Influence to adopt might also come from the outside of the company, especially when it is conducting business within a very competitive environment. Besides dependency to either their suppliers or customers, firms that are operating in a complex and competitive environment will feel more pressure to create competitive advantage by adopting an IT system to help commercialize their product (Vilaseca-Requena et al. 2007). Besides competitors, social networks where the firm or the management of it belongs could also influence adoption, as firms try to behave the way of their social networks which consist of trade association, accreditation agencies or channel members' views as appropriate. This phenomenon is also known as normative pressure. Atkinson (2007) recognised that normative pressure did have a significant effect on the adoption intent of business to business (B2B) marketplace in his study.

8.8 Gap analysis discussions

Gap analysis reveals three important findings. First, test of hypotheses reveals that there is a significant difference between both the level of trust and the level of dependency manufacturers have towards their suppliers and customers. It indicates that manufacturers have a different perception between their suppliers and customers. Mean gap for the level of trust and the level of dependency towards customer is also found to be higher than the supplier. Even when the companies are grouped into four major industries, the same trend is also evident. It shows that companies in Malaysia rely and even trust their customers more than suppliers, regardless of what industries they are in.

However, not all mean differences identified from gap analysis based on industry are significant. Only automotive industry displays significant differences between both the level of trust and the level of dependency towards suppliers and customers. This finding indicates the extent of power customers have over manufacturers, as they are always higher than the supplier. This trend could also be related back to the size of companies that participated in this study, as the majority of them are small and medium size companies. They depend more on their customer for business rather than the suppliers—who can easily be replaced by another suppliers. Customers, however, are difficult to replace, and losing business with major customers could ruin their business.

Second, detailed analysis on the individual items that measure trust found one factor that has a critical gap between the suppliers and customers: 'Our partners always try to inform us if problem occurs'. This factor refers to the honesty trust dimension in the list of trust dimension discussed before. As the mean value for customer is higher than supplier, it indicates that customers are more honest in their relationships, as they communicate well enough with the manufacturer if there is a problem.

The third and final findings from the gap analysis identified two dependency factors with critical gap: 'Our firm's partners influence our reputation in the marketplace'; and 'Our firm activities are developed through the knowledge that is interchanged with its partners'. It indicates that the possible improvement in reputation could make manufacturers more dependent on their customers rather than their suppliers, as doing business with a large reputable company may help improve their reputation and help secure more business with other companies. For the second critical factor, findings indicate that manufacturers critically depend more on their customers rather than suppliers for knowledge and technology transfer. This notion is very much supported by case study findings where manufacturers did receive assistance in terms of finance, knowledge and technology through the special vendor development programs developed by large customers. Findings also show that customers are more important to them than suppliers, as they can help them improve their reputation, provide more knowledge and technology transfer. As a result, manufacturers will try their best to make sure that the system they use is compatible with their customers' systems to enable linkages between them.

8.9 Contributions of the study

There are a number of significant contributions of this study to both academia and business practitioners. The following sub-sections highlight the contributions of this research and the applicability of the final research model to the information system adoption related research and how it can be put into practice by the management of a company.

8.9.1 Theoretical contributions

The research issues of this study are not new problems, as the importance of trust and dependency in business relationships has been the centre of attention of many previous studies. However, this study provides a new theoretical paradigm, especially on study of trust and dependency as it also includes the interaction effect of both factors on e-procurement adoption. At the same time, findings on the influence of trust on e-procurement adoption provide a new perspective on trust related literatures where the majority posit a positive influence of trust on adoption decisions, even from different perspective of study, such as e-government adoption (Belanger & Carter 2008; Horst, Kuttschreuter & Gutteling 2007), EDI adoption (Ratnasingam 2001) or in a general technology adoption research (Bahmanziari, Pearson & Crosby 2003). This research determined that it is not always the case, especially when other factors are taken into consideration. It indicates that the importance of trust diminishes as the level of dependency between supply chain partners increase. This situation occurs probably because small companies who are a vendor to a larger organization had to adopt the system as required by their partners, regardless whether they trust them or not. Disagreement to comply might result in losing the business with their partners. The same situation is also evident in the study by Gefen et al.(2005) where trust becomes less important in IT adoption when

cultural diversity is large, and can no longer reduce social uncertainty. Furthermore, Ireland & Webb (2007) stressed that more powerful firms tend to act opportunistically by exercising coercion that might ultimately undermine trust within the relationship.

By adopting the trust and resource dependency theory, this research has succeeded in developing and testing a new conceptual model that shows the relationship between trust, dependency and company size on e-procurement adoption. The model was comprehensively tested using two research methods, namely, case studies and survey questionnaires, which facilitated triangulation of the results obtained. Thus, this research was able to clearly explain the relationship between trust and dependency, where trust is identified as one of the important elements that increases the level of dependency between partners. It also means that the level of trust indirectly influences adoption decisions by becoming one of the determinants of dependency, instead of having a direct relationship with adoption decisions. The conceptual model presented also provides a strong foundation for further research on the relationship between trust and dependency on information technology related research in the future.

Studies also identified that knowledge is the source of power (Kelly 2007). Firms with more critical or non-substitutable knowledge have higher power than firms that are lower on these knowledge attributes (Wong, Ho & Lee 2008). However, both studies did not empirically test this relationship. This study, therefore, extends the body of literature on knowledge as the source of power by providing empirical proof of the above argument. Findings indicate that firms which are lacking in terms of critical or non-substitutable knowledge will have a higher level of dependency towards their supplier or customer who has this knowledge. As a consequence, the superior firm is deemed as having a higher power over their business partners. Furthermore, results of the gap analysis also reveal that the need for knowledge has a negative value and also identified as the item with most critical gap between supplier and customer. It means that in Malaysia, customers have more power than the suppliers because manufacturers rely more on them more for knowledge transfer.

Literature on business-to-business operation argues that the relationship should be regarded as the unit of analysis (Izquierdo & Cillan 2002). Incorporation of manufacturers' view on their level of trust and dependency towards both their suppliers and customers provide another important theoretical contribution to the literature. Existing studies on IT adoption either in marketing, supply chain management or even business management in general were conducted by assessing respondents' perception within one side of the business chain only, which is either the supplier or customer perceptions (Bohme et al. 2008; Zhuang & Zhou 2004; Gassenheimer & Ramsey 1994). This study moved one step further by incorporating manufacturers' views on their level of trust and level of dependency towards both their suppliers and customers, and how it influenced their e-procurement adoption decisions as the unit of analysis. Data for empirical analysis were collected based on manufacturers' perception on both their suppliers and customers so that the influence on e-procurement adoption decision can be studied from both perspectives. Gap analysis which compares the perception on trust and dependency towards suppliers and customers, together with the identification of the most critical factors, were also conducted—an area which has not been explored by previous studies.

The next theoretical contribution of this study relates to the methodology adopted in reducing the number of survey items to make it short, but concise. The initial construct was developed based on previous studies, before being revised based on case study findings. A first draft of the questionnaire was then mailed to the selected managers for the pilot study. Upon analysis of the pilot study questionnaires, a few set of different questionnaires were then discussed with managers from five manufacturing companies to decide which one is the most appropriate to answer the research questions. The first draft questionnaire with more than 160 items was reduced to just 15 items after case study interview, pilot study survey and also based on professional judgement (removing duplicate, ambiguous and even unnecessary items). Technology attribute factors were completely removed from the research objectives as case study findings were found to be identical with the existing literatures. It is expected that it will not provide any new knowledge from theoretical perspective, accept re-approving the previous study findings. This process is necessary as respondents may not answer a questionnaire if it is too long or too difficult to answer. They may superficially scan and randomly chose the answers they think apply to end the process quickly. With the reduction in response rate as evident in many studies conducted in Malaysia specifically, and in developing countries generally (Shariff, Kalafatis & Samouel 2005; Jharkharia & Shankar 2006; Sulaiman 2000), these survey items reduction processes may served as a guideline for future researchers in order to improve their survey response rate. At the same time, this effort will ensure quality feedback and thus reduce bias as data would be more accurate.

Another important theoretical contribution of this study is in terms of the incorporation of three methods for gap analysis; paired sample T-test, weighted mean gap and un-weighted IPA matrix method to identify trust and dependency factor with the most critical gap, and to identify whether there is a significant gap between the level of trust and dependency between supplier and customer. By combining all the above three methods, this study has provided far more conclusive evidence on the most critical gap between supplier and customer, rather than just using a paired sample T-test as it can produced plenty of factors with significant differences. There are few studies that used the combination of these three methods (Paterson, Maguire & Al-Hakim 2008; Peiro, Martinez-tur & Ramos 2005). However, the interest of all these studies was to identify the existence of a gap between the prediction or expectation and the actual performance as perceived by the subject of the study. This study shows that these three methods can be improvised and applied to determine the critical gap between two groups of samples, rather than comparing prediction or expectation and performance. Based on the findings, improvements can be undertaken in order to minimize the critical gap between groups of study.

Finally, this study contributes to the literature on organizational information technology adoption decisions specifically within the context of developing countries like Malaysia. Most studies that thoroughly investigate the relationship between trust and dependency in supply chain relationships to date have been conducted in developed countries such as the United States, United Kingdom, Australia and Europe.

8.9.2 Managerial contributions

In practice, findings and the final conceptual model developed by this study could provide the management of a company with a better understanding on e-procurement adoption and how it relates to the issues of trust and dependency with their supply chain partners. Findings of this study indicate that dependency factors have a strong influence on the supply chain member's business-to-business relationships. By understanding the individual components of the conceptual model, managers will be in a better position to make e-procurement adoption decisions as decisions made by them could influence the business operations of the other supply chain members who depend on them for business. In other words, when making a decision about any information systems adoption, managers are obliged to ensure that the system will benefit each supply chain members who will have the system linked to them. Small and medium size companies especially might be lacking in terms of IT knowledge and resources that make them rely very much on their partners to help them. It is important that the management of both companies to understand each other's needs so that they can work with each other effectively and help smaller size partners benefit from information technology adoption.

This study has also proved the fact that there was a significant difference in information system adoption behaviour between firms in developed and in developing countries such as Malaysia. When making policies on IT adoption within the supply chain, managers need to consider various technological and organizational factors that can influence adoption within their own, and also within their partner's, organization. These factors include the attributes of technology itself, the level of trust and the level of dependency factors. Understanding these factors will ensure effective adoption and even cultivate stronger relationships that will last for a long time. They must also study and understand the situation in the country itself, rather than being based on the observation made in another country as factors that influence adoption decisions are different, as evidenced in this study.

Another important issue raised by this study was the fact that it is very important for manufacturers to consider their supply chain partner's position when making an e-procurement adoption decision and to ensure that the benefit of the implementation will also be enjoyed by their suppliers or customers. The positive relationships between the interaction of trust and dependency with adoption decision indicate that relationships built based on both trust and dependency can help prosper the relationship. Furthermore, Ireland & Webb (2007) also stress that by understanding the dynamics of trust and dependency, firms can strategically adjust their social relationship with each other to achieve the desired outcomes. By having a well-balanced element of trust and dependency between each partner within the supply chain, each party will be able to have the benefit of more support in utilizing new technology. Mixture of trust and dependency between partners will also make each of them strive to ensure the success of their relationship and e-procurement initiative.

Management of a company should understand that lack of trust between supply chain partners and the existence of power imbalance can create problems in supply chain relationships. Therefore, it is important for firms to address this issue. This study has successfully provided a comprehensive gap analysis method that can be used by companies to measure and identify whether there is any critical gap in their

relationship. Based on the analysis, managers can identify which part of their relationships has the most critical gap and they can then try to reduce this gap by undertaking the necessary actions. Power imbalance, for example, can be reduced by stipulating a long-term contract, entering a joint venture or, at the extreme, merging with the dependent organization wherein the dominant party would lose part or all of its discretion over the allocation of its critical resource to the dependent party (Blois 1997). This gap analysis method is a powerful tool that can help companies identify the gap and fix the critical issues in order to create well balanced and long lasting relationships with their partner.

The final managerial contribution of this study is that it could also serve as a guide for business managers or policy makers in Malaysia when creating policies related to information technology adoption in general. More attention could be given to the appropriate factors that may ensure effective adoption of e-procurement with supply chain members. Issues such as technology and knowledge transfers, availability of IT resources, management support and financial situation play a major role in IT adoption as identified during the analysis of non-adopters and also during the gap analysis. Moreover, the important factors that influence e-procurement adoption as identified in this study may also serve as a guide for any other type of information technology adoption within the company.

8.10 Limitation

The first limitation of this study is that the generalisability of the findings is limited as this study focuses only on manufacturers in Malaysia. Generalizing these findings to an organization in other country and within another cultural environment must be held with caution. Furthermore, the majority of the participants of both the case study interviews and the survey questionnaires are small and medium size companies (77.8% of survey respondents have less than 500 employees) as evidenced in the descriptive statistics presented in the previous chapter. Essentially, this high number of small and medium size companies might influence the findings on the importance of trust and dependency as described by the outcome of the data analysis process. A well-distributed size from small to big size company might improve the generalisability of these research findings and provide far more conclusive evidence on the role of trust and dependency.

Another limitation of this study is that the questionnaire was completed by a single informant from each company. Although the questionnaires were initially sent out to the person responsible for procurement who was assumed to have a good knowledge about the e-procurement adoption decisions, single informant responses to access organizational-level constructs can sometimes be problematic even though they are very popular in organizational level IT adoption studies (Bajwa et al 2008). The voluntary nature of questionnaire respondents is also inevitably subjected to self-selection bias, which refers to the situation where those who were interested in, had used, or currently using the e-procurement system were more likely to respond than those who did not (Tung, Chang & Chou 2008).

The final limitation acknowledged from this study is the fact that partial least square regression used during the data analysis stage has some inherent limitations. PLS is used as an alternative to the proposed SEM technique, as the number of samples did not reach the desired number for SEM. The first limitation of PLS is that under the

goal of parameter estimation, it is not clear whether PLS weights and loadings (and thus PLS scores) are as generalizable across different samples as those obtained from SEM. Even with distributional violation, the maximum likelihood estimation procedure for SEM can be quite robust and may produce better estimates of the population parameters compared to PLS. The generalizability issue for multiple group comparisons also needs be considered with caution as SEM provides better statistical basis using a chi-square test for multiple group comparison. The generalizability of PLS scores for group comparisons, however, has yet to be determined (Chin 1995). Another limitation of PLS is in terms of how it handles the missing data. PLS replaces missing values with the means of the respective variables and could provide an incorrect representation of the population values because the shape of the distribution is distorted by adding the values equal to mean (Little & Rubin 1989).

8.11 Conclusions

The main objective of this study was to find out whether inter-organizational trust and inter-organizational dependency between manufacturers and their supply chain partners (suppliers and customers) have an influence on the decision making process, especially when it comes to the implementation of information technology initiatives such as e-procurement. Although there are a few limitations to this study, the findings have both theoretical and managerial implications as discussed before. Some of the results of data analysis are consistent with previous study and some are not. Theoretically, this study has shown that the level of dependency, contractual trust, size of company and the interaction effect of trust and dependency had a significant effect on e-procurement adoption decisions. Meanwhile, the level of trust and information technology and technical dependency factors was not identified as an important factor. This is a new empirical contribution to the growing literature on trust and IT adoption, the majority of which indicate a positive relationship between these two factors. There are a few assumptions that can be made in the wake of these differences, based on studies of the related literatures and also from case studies that were conducted earlier.

First, the majority of studies on IT adoption were conducted in developed countries where the manufacturing industry is mature and consists of large size manufacturers. In a developing country such as Malaysia, this study proves that the perspective is different, since the manufacturing industry in this country is considered as still in the growing stage. The majority of firms are small and medium size industries which rely very much on their larger size partners for survival. This study further proves the above argument as size of company, which is the control variable, did have a significantly strong effect on e-procurement adoption decisions. The second assumption that can be made for these differences was because previous studies were conducted for a different kind of information systems developed specifically for a different kind of business activities such as Radio Frequency Identification system (RFID), Management Information System (MIS), Sales Information System (SIS), Automatic Telling Machine (ATM), or Warehousing Information System (WIS). As mentioned in the first chapter, adoption of different IT systems could have different antecedents as each system is unique and serves different purposes.

Third, results of case studies and pilot study indicate that the technological attributes factors' influence on e-procurement adoption is similar to other studies. Three

attributes of technological innovation, namely, relative advantage, compatibility and complexity have been identified as having the most consistent significant relationships to technological adoption. In contrast to the influence of trust, it indicates the similarity of the Malaysian manufacturing environment with other western countries in relation to the effect of technology attributes.

Finally, case study findings also reveal that most companies involved in a vendor development program as a supplier to large local manufacturers or MNCs do have a high level of dependency towards their partners. They not only depend on their partners for business, but also for technology and knowledge transfer. Failure to adopt e-procurement might jeopardize their business dealings and all the other benefits that this small and medium size company receive from its partner. Therefore, findings of case study and empirical data analysis are in support of each other. Both analyses indicate that when the influence of dependency on adoption decision is high enough, it might reduce the importance of inter-organizational trust as posited by other studies.

8.12 Direction for future research

There are a few issues that arise from this study which could provide an opportunity for further research. First, data collected for this study is small due to cost and time constraints. It is also collected within the context of supply chain relationships within Malaysia only. This definitely limits the generalizability of the findings. Future research could extend this study by making a replication in other developing, or less developed countries to test whether the same findings are observed or not. Studies that compare how level of trust and dependency influence e-procurement adoption between two or more different countries could also be conducted, as cross-national or cross-culture context of the study could provide more valuable findings under different political, institutional, economic and cultural settings. Second, the final research model indicates that trust and dependency explain only 17% and 25% of the variance in adoption decisions for supplier and customer respectively. This is a relatively low percentage of variance and, therefore, it shows that there are many other antecedents relevant to e-procurement adoption beside trust, dependency and size of company that were not addressed by this study and should be explored by other researchers. The theoretical model at best represents the reality as more variables can be added into any other future research on e-procurement adoption decision.

Third, Hart & Saunders (1997) indicate that dependency or power is an important persuasive mechanism that influences companies in adopting electronic data interchange. Trust, however, is an important factor after the system is adopted as it determines the extent of use of the newly adopted system. This study has validated the first proposition as dependency is indeed identified as an important factor for adoption of e-procurement system. However, the second proposition on how trust influences the usage level of e-procurement system could not be explained by this study. Therefore, future study may identify companies that have already adopted an e-procurement as recommended by their supply chain partners and seek whether trust has an important influence on the system usage level. Fourth, trust and dependency are two external factors that influence adoption, while only one internal factor, the size of company, was incorporated in this study as a control variable. Studies acknowledged that a company's internal factors such as the management of the

company itself, financial situation, IT resources and organisational culture could also influence adoption decisions (Ungan 2005; Gunasekaran & Ngai 2008; Wu et al. 2008). Future research could take into consideration the importance of both internal and external factors and draw a comparison on which factors have more influence on an e-procurement adoption decision. Researchers could also study the interaction effect of these two categories of factors.

Finally, the interest of this study is on e-procurement systems in general only. In reality, e-procurement systems are a collection of many different applications such as e-sourcing, e-reverse auction, web-based ERP/MRP and a few others. Users' perception and the factors that influence adoption of each single e-procurement application could be different between one another. Future research should differentiate and conduct a comprehensive study on each e-procurement application individually, as it may provide a valuable insight on whether the factors that influence adoption decisions are similar for each different e-procurement application or not.

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Appendix A: Mailed questionnaire for pilot study

SECTION A: COMPANY INFO & E-PROCUREMENT ADOPTION

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. Please choose which best describes your company in all 3 categories:

No of employees	Paid-up Capital (RM)	Revenue (RM)
□ < 100	□ < 10 Mil	□ < 100 Mil
□ 100 - 1000	□ 10 – 50 Mil	□ 101 – 500 Mil
□ 1001 - 2000	□ 51 – 100 Mil	□ 501 Mil – 1 Bil
□ > 2000	□ > 100 Mil	□ > 1 Bil

4. Did your organization adopt an e-procurement system in purchasing/selling activities?

□ Yes □ No (Please proceed to Section B)

5. Please specify with which parties your e-procurement system is linked with?

□ Suppliers only □ Customers only □ Both

6. In percentage, please indicate your purchasing and selling activities that were conducted electronically.

Purchasing	□	0 – 25%	□	26 – 75%	□	76 – 100%
Selling	□	0 – 25%	□	26 – 75%	□	76 – 100%

7. Which type(s) of e-procurement system is currently being employed in your organization? (Select as many as apply)

□ E-sourcing	□ E-collaboration
□ E-tendering	□ E-MRO and Web-based ERP
□ E-informing	□ E-reverse auction
□ Web-based Portal	□ Others (Please specify): _____

8. Please indicate whether the decision to use e-procurement is part of internal requirement or external requirement (to match the requirement of partners). Circle 1 if it is totally company's own decision or 7 if it is totally an external requirement.

   If it is a mixed decision, please circle one of the number in the middle that reflect the degree of own and partner's influence on the adoption decision.

Totally own decision (100%)	1	2	3	4	5	6	7	Totally partner's decision (100%)

SECTION B: TECHNOLOGY ATTRIBUTES INFLUENCE ON ADOPTION

This section deals with your perception on how the attributes of technology itself influence an e-procurement adoption decision by your company. Please indicate your perception on each statement below based on the scale of 1 (Strongly disagree) to 7 (Strongly agree). If your opinion is less strong, tick one of the numbers in the middle.

Ref.	FACTOR	PERCEPTION 1 (Strongly disagree) 7 (Strongly agree).
B1.	**Relative advantage**: *Degree to which the technology is perceived as being better than the idea it supersedes expressed as economic profitability, social prestige or other benefits*	
	E-procurement provides a better way to do procurement than the way we used to do it manually	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	E-procurement is an effective purchasing tools	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Mistakes are more likely to occur with e-procurement	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	E-procurement facilitate better management of our purchasing activities	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	E-procurement creates the best way for us to purchase from our suppliers	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	We found that using e-procurement is convenience	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	The disadvantages of using e-procurement system far outweigh the advantages	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
B2.	**Compatibility**: *Degree to which the technology is perceived as consistent with existing socio-cultural values, past experiences and needs of potential adopters*	
	The E-procurement system cover all my needs involved in my job	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	E-procurement system fits well with the way we manage our procurement activities	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our employees enjoy working with the e-procurement systems	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	I realize that e-procurement system is compatible with all aspects of work in my organization	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
B3.	**Complexity**: D*egree to which the technology is perceived as relatively difficult to understand and use*	
	We found out that e-procurement system is user friendly	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our employees had no trouble learning how to use e-procurement	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	The best thing about the e-procurement system is that it is easy to use	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$

	Mistakes are more difficult to get fixed when using e-procurement	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	The directions are adequate for our employees to figure out how to operate an e-procurement system.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	It took our employees a lot of training to figure out how to use e-procurement	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	E-procurement system is cumbersome to use	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
B4.	**Trialability**: *Degree to which the technology may be experimented with on a limited basis*	
	Our employees have the opportunity to try various e-procurement system applications before we decide to use it.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our employees are familiar with the e-procurement system before we use it.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	We know what this particular e-procurement system could do since we are permitted to use it on a trial basis for long enough.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
B5	**Observability**: *Degree to which the results of the technology are visible to others, easily observed and communicated to others*	
	We have seen what others do using their system	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	We have seen others gain benefits from using e-procurement	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	There are enough advantages for us to consider using e-procurement	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

SECTION C: INFLUENCE OF TRUST ON ADOPTION

This section deals with your opinion on the perceived level of trust between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields.

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. If a partner is not applicable to your organisation, just leave that column blank. Ex: *If your firm is in a retail industry and your customer is a general consumer, just fill in your perception on trust with your suppliers only.*

Ref.	**FACTOR**	**SUPPLIERS** 1 (Strongly disagree) 7 (Strongly agree).	**CUSTOMERS** 1 (Strongly disagree) 7 (Strongly agree).
C1	**Dependability/Reliability**: *Expectation that partners will not undertake opportunistic behaviour or increase our vulnerability to the risk of opportunistic behaviour*		
	Our partners do not breach formal / informal agreements to their benefit	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners do not exaggerate needs or alter facts to get what they desire	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	We have confidence in all our partners	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners always keep their promises	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
C2	**Honesty :** *Expectation that partners will do business with fairness and had no motivation to lie.*		
	We believe that our partners are always sincere and honest.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners always try to inform us if problem occurs	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners always provide the information we require	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
C3	**Competence:** *The ability of partners to perform their role and duties*		
	When our partners promise to do something at certain time, they will do it.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners' are very competent.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our partners seldom give good advice.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$

	We have to monitor our partners' work closely to ensure their conformance to safety and quality requirements.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners always give us correct information	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners are apt to changes to our specifications at short notice	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
C4	**Orientation**: *Level of altruism, business sense and judgement of partners.*		
	Our partners always listen and seriously response to our proposals.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners are always cooperative.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our company always receive good response from its partners.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
C5.	**Friendliness/Benevolence**: *Believe that the other party is caring and wants to do good for us, aside from profit motive*		
	Our partners always treat us kindly	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners always satisfy our needs and expectations	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners always are polite	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners commit to maintain and develop our relationships	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
C6	**Contractual**: *The believe that the other party will carry out their duties as agreed*		
	Agreement with our partners are well-detailed and obviously reflect our aims from the agreements	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	We are confident that our partner carries out work / provides services at the time they agreed to do it.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	We are confident that our partner carry out work / provides services with the standard and performance as agreed.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	The high skill and knowledge of our partners in their area of expertise derived our agreement.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

SECTION D: INFLUENCE OF DEPENDENCY ON ADOPTION DECISIONS

This section deals with your opinion on the perceived level of dependency between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields.

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. If a partner is not applicable to your organisation, just leave that column blank. Ex: *If your firm is in a retail industry and your customer is a general consumer, just fill in your perception on trust with your suppliers only.*

Ref.	FACTOR	SUPPLIERS 1 (Strongly disagree) 7 (Strongly agree).	CUSTOMERS 1 (Strongly disagree) 7 (Strongly agree).
C1	**Technical**: *The instance when two companies use compatible equipment and adapt their mutual business activities to each other in a technical sense.*		
	Our firm has adapted its activities to its partners in a technical sense.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our firm has a high degree of technical agreement with its partners.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	We have made significant investments in tooling, equipment and production systems dedicated to our relationship with our partners.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
C2	**Time**: *The instance when two companies have a time-based need or synchronization of their mutual business activities*		
	Our firm activities have a strong time-based synchronisation with partners' activities	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our firm activities are sometimes badly coordinated with partners' activities	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our partners' promptness of delivery makes them difficult to be replaced.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
C3	**Knowledge**: *The interaction process between two companies where they can learn from each other's strengths and weaknesses. Create knowledge about each other's ability to solve problems.*		
	Our firm is well aware of its partners' strengths and weaknesses.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Our firm activities are developed through the knowledge that is interchanged with its partners.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
	Partners' knowledge is crucial to our firm's operation and very difficult to be replaced.	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

C4	**Social:** *Interaction between two companies which is often base on personal relationships*		
	Our firm has close personal relationships with its partners.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm does not have a well functioning personal chemistry with its partners.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm cooperation with partners goes beyond business relationship but social relationships too.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
C5	**Economic/judicial:** *Monetary or formal dependence that exist such as written agreements*		
	We have made a substantial investment dedicated to our relationship with our partners.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm relationships to its partners are regulated in a written contract.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm's agreements with its partners do not have to be in written.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	We would lose a lot in terms of compensation if we switch to competing suppliers/customers.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
C6	**Market:** *Company's image and status that may positively influence another company's image, status and improve goodwill of the other company in marketplace*		
	Our firm's partners do not improve our firm's goodwill.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm's partners influence our reputation in the marketplace.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
C7	**Information technology:** Two companies may invest in a common IT standard, where the hardware and software to communicate between the two companies must be compatible		
	Our firm's IT investments are adapted to the partners' decision on IT solutions.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
	Our firm strives to maintain a common IT standard of hardware and software with its partners.	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$

SECTION E: RANKING OF FACTORS

From those factors listed in Section B (Technology attributes), Section C (Trust) and section D (Dependency) please list in order of relative importance, which factors you believe are the most important factors in making e-procurement adoption decisions with 1 (Most important) to 3 (Less important). It is only necessary to list the reference number (B, C or D).

Ranking	Factor Reference
1.	
2.	
3.	

SECTION F: FOR NON E-PROCUREMENT ADOPTERS

Below is some of the reason why firm did not use information technology initiative such as e-procurement in their organization. Please rank each factors based on what you believe is the most appropriate reason why your firm did not use e-procurement with "1" being the less appropriate to "7" most appropriate.

	REASONS	PERCEPTION
1	Expensive to established and maintain	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
2	Concern over security of data	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
3	Lack of professional IT staff	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
4	Lack of trust on partners	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
5	Difficult to use	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
6	Lack of knowledge about e-procurement	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
7	Lack of commitment from top management	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
8	Not required by supplier or customer	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$
9	Benefit of the system is not good enough	$\square_1$ $\square_2$ $\square_3$ $\square_4$ $\square_5$ $\square_6$ $\square_7$

THANK YOU

Your assistance and contribution to this research study is greatly appreciated. Please email, fax, or return the questionnaire in the reply paid envelope provided to:

Nik Ab Halim Nik Abdullah:
Faculty of International Studies
Universiti Utara Malaysia
06010 Sintok
Kedah
Tel: (04) 9162916
Fax: (04) 9286602 / 6654
Email: abhalim@uum.edu.my

Appendix B: Actual mail questionnaire used in this study

Dear Participant,

SURVEY ON E-PROCUREMENT ADOPTION

I am a PhD student from the University of Southern Queensland, Australia who are conducting a research on "The role of trust and dependency on e-procurement adoptions: An empirical analysis of Malaysian manufacturers". The purpose of this study is to identify how the above two factors influence adoption decisions, and which factors is becoming more important in today's competitive business environment. Your response is crucial in understanding these important business issues.

I would be grateful if you could spend some of your precious time to answer this survey questionnaire. ***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.***

Once completed, please mail it back to me using the self addressed envelope provided.

You may also fill in this survey online if you prefer to do so. The URL link to the online questionnaire is: http://eproc.webng.com/EprocSurvey3.htm

Thank you in advance for your cooperation. Should you have any questions regarding this research, please feel free to contact me at 04-9162916 (O) or 017-9535347 (HP) or via fax 04-928 6602 / 6654. I can also be reach via email at abhalim@uum.edu.my

Regards,

(NIK AB HALIM NIK ABDULLAH)
Faculty of Business
University of Southern Queensland

SECTION A: COMPANY INFO & E-PROCUREMENT ADOPTION

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. Please choose which best describes your company in all 3 categories:

No of employees	Paid-up Capital (RM)	Revenue (RM)
□ < 100	□ < 10 Mil	□ < 100 Mil
□ 100 - 1000	□ 10 – 50 Mil	□ 101 – 500 Mil
□ 1001 - 2000	□ 51 – 100 Mil	□ 501 Mil – 1 Bil
□ > 2000	□ > 100 Mil	□ > 1 Bil

4. Did your organization adopt an e-procurement system in purchasing/selling activities?
   - □ Yes
   - □ No (Please proceed to Section B)

5. Please specify with which parties your e-procurement system is linked with?
   - □ Suppliers only
   - □ Customers only
   - □ Both

6. In percentage, please indicate your purchasing and selling activities that were conducted electronically.

Purchasing	□	0 – 25%	□	26 – 75%	□	76 – 100%
Selling	□	0 – 25%	□	26 – 75%	□	76 – 100%

7. Which type(s) of e-procurement system is currently being employed in your organization? (Select as many as apply)
   - □ E-sourcing
   - □ E-collaboration
   - □ E-tendering
   - □ E-MRO and Web-based ERP
   - □ E-informing
   - □ E-reverse auction
   - □ Web-based Portal
   - □ Others (Please specify): _____

8. Please indicate whether the decision to use e-procurement is part of an internal requirement or an external requirement (to match the requirement of partners). Circle 1 if it is totally company's own decision or 7 if it is totally an external requirement.

   If it is a mixed decision, please circle one of the numbers in the middle that reflect the degree of own and partners' influence on the adoption decision.

Totally own decision (100%)	1	2	3	4	5	6	7	Totally partner's decision (100%)

SECTION B: INFLUENCE OF TRUST ON ADOPTION

This section deals with your opinion on the perceived level of trust between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields. 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.

Ref.	**FACTOR**	**SUPPLIERS** 1 (Strongly disagree) 7 (Strongly agree).	**CUSTOMERS** 1 (Strongly disagree) 7 (Strongly agree).
1	Our partners do not breach agreements to their benefit	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
2	Our partners are always sincere and do not alter facts to get what they desire	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
3	Our partners always try to inform us if a problem occurs	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
4	Our partners always provide the correct information we require	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
5	Our partners always listen and seriously respond to our proposals	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
6	Our partners are always cooperative	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
7	Our partners always treat us kindly	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
8	Our partners commit to maintain and develop our relationship	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7

SECTION C: INFLUENCE OF DEPENDENCY ON ADOPTION DECISIONS

This section deals with your opinion on the perceived level of dependency between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields. 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.

Ref.	**FACTOR**	**SUPPLIERS** 1 (Strongly disagree) 7 (Strongly agree).	**CUSTOMERS** 1 (Strongly disagree) 7 (Strongly agree).
1	Our firm is well aware of its partners' strengths and weaknesses	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
2	Our firm activities are developed through the knowledge that is interchanged with its partners	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
3	Partners' knowledge is crucial to our firm's operation and is very difficult to replace	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
4	Our firm's partners do not improve our firm's goodwill	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
5	Our firm's partners influence our reputation in the marketplace	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
6	Our firm's IT investments are adapted to the partners' decisions on IT solutions	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7
7	Our firm strives to maintain a common IT standard of hardware and software with its partners	□1 □2 □3 □4 □5 □6 □7	□1 □2 □3 □4 □5 □6 □7

SECTION D: FOR NON E-PROCUREMENT ADOPTERS

Below is some of the reason why firm did not use information technology initiative such as e-procurement in their organization. Please rank each factors based on what you believe is the most appropriate reason why your firm did not use e-procurement with "1" being the less appropriate to "7" most appropriate.

	REASONS	**PERCEPTION** **1= Less appropriate** **7= Most appropriate**
1	Expensive to established and maintain	□1 □2 □3 □4 □5 □6 □7
2	Concern over security of data	□1 □2 □3 □4 □5 □6 □7
3	Lack of professional IT staff	□1 □2 □3 □4 □5 □6 □7
4	Lack of trust on partners	□1 □2 □3 □4 □5 □6 □7
5	Difficult to use	□1 □2 □3 □4 □5 □6 □7
6	Lack of knowledge about e-procurement	□1 □2 □3 □4 □5 □6 □7
7	Lack of commitment from top management	□1 □2 □3 □4 □5 □6 □7
8	Not required by supplier or customer	□1 □2 □3 □4 □5 □6 □7
9	Benefits of the system are not good enough	□1 □2 □3 □4 □5 □6 □7

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

THANK YOU

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Appendix C: Web-based survey questionnaire

SURVEY QUESTIONNAIRE

The role of trust and dependency on e-procurement adoptions: An empirical analysis of Malaysian manufacturers

SECTION 1: GENERAL AND DEMOGRAPHIC DETAILS		
1.1	**Email Address:**	
1.2	**Business industry (In case of multiple industry, choose 1 major industry only):**	
1.3	**Number of employees:**	
1.4	**Paid-up capital (RM)**	
1.5	**Latest company revenue (RM)**	

2.0 E-PROCUREMENT ADOPTION		
2.1	**Did your organization adopt an e-procurement system in purchasing and/or selling activities?**	Yes No
2.2	**Please specify with which parties does your e-procurement system linked with?**	Suppliers only Customers only Both customers & suppliers No system link at all
2.3	**In percentage, please indicate company's purchasing activities that were conducted electronically.**	0% 1 to 25% 26 to 75% 76 to 100%
2.4	**In percentage, please indicate company's selling activities that were conducted electronically.**	0% 1 to 25% 26 to 75% 76 to 100%
2.5	**What type(s) of e-procurement system is currently used in your company? *Select as many as apply.***	E-sourcing E-tendering E-informing

		☐ E-collaboration ☐ E-MRO and Web-based ERP ☐ E-reverse auction ☐ Web-based Portal ☐ Others ☐ No E-procurement system at all
2.6	**Please indicate whether the decision to use e-procurement is part of an internal requirement or an external requirement (to match the requirement of partners).** **Circle 1 if it is totally company's own decision or 7 if it is totally an external requirement. If it is a mixed decision, please circle one of the numbers in the middle that reflect the degree of own and partners' influence on the adoption decision.**	○ 1 (Totally internal decision) ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 (Totally external requirement)

SECTION 3: LEVEL OF TRUST BETWEEN PARTNERS

Instruction: This section deals with your opinion on the perceived level of trust between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields.

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	**Suppliers** 1 = Strongly disagree 7 = Strongly agree	**Customers** 1 = Strongly disagree 7 = Strongly agree
3.1	**Our partners do not breach agreements to their benefit**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
3.2	**Our partners are always sincere and do not alter facts to get what they desire**	○ 1 ○ 2 ○ 3 ○ 4	○ 1 ○ 2 ○ 3 ○ 4

		5 6 7	5 6 7
3.3	**Our partners always try to inform us if a problem occurs**	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.4	**Our partners always provide the correct information we require**	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.5	**Our partners always listen and seriously respond to our proposals**	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.6	**Our partners are always cooperative**	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.7	**Our partners always treat us kindly**	1	1

		○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
3.8	**Our partners commit to maintain and develop our relationship**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

SECTION 4: LEVEL OF DEPENDENCY BETWEEN PARTNERS

Instructions: This section deals with your opinion on the perceived level of dependency between your firm and its partners. The term 'partners' is a reference to your 'suppliers' or 'customers'. The suppliers and customers field are designed to suit your aggregate perception. If the perception is considerably differ between partners and cannot be aggregated, you may consider only one supplier or one customer organisation to fill up the fields.

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	**Suppliers** 1 = Strongly disagree 7 = Strongly agree	**Customers** 1 = Strongly disagree 7 = Strongly agree
4.1	**Our firm is well aware of its partners' strengths and weaknesses**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
4.2	**Our firm activities are developed through the knowledge that is interchanged with its partners**	○ 1 ○ 2 ○ 3 ○ 4	○ 1 ○ 2 ○ 3 ○ 4

		○ 5 ○ 6 ○ 7	○ 5 ○ 6 ○ 7
4.3	**Partners' knowledge is crucial to our firm's operation and is very difficult to replaced**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
4.4	**Doing business with our partners improve our firm's goodwill**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
4.5	**Doing business with our partners increase our reputation in the marketplace**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
4.6	**Our firm's IT investments are adapted to the partners' decisions on IT solutions**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
4.7	**Our firm strives to maintain a common IT standard of hardware and software**	○ 1	○ 1

	with its partners.	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

SECTION 5: FOR NON E-PROCUREMENT ADOPTERS ONLY

Instructions: Below is some of the common factors why firm did not use information technology initiative such as e-procurement in their organization. Please rank each factors based on what you believe is the most appropriate reason why your firm did not use e-procurement with "1" being the less appropriate to "7" the most appropriate. If your opinion is less strong, tick one of the numbers in the middle.

Reminder: Skip this section if your company did use E-procurement

	Factors	**Factor Ranking (1 = Less appropriate, 7 = Most appropriate)**
5.1	**Expensive to established and maintain**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.2	**Concern over security of data**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.3	**Lack of professional IT staff**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.4	**Lack of trust on partners**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.5	**Difficult to use**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.6	**Lack of knowledge about e-procurement**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.7	**Lack of commitment from top management**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.8	**Not required by supplier or customer**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
5.9	**Benefits of the system are not good enough**	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7
	Submit Form	

Appendix D: Data analysis output for Non-response bias test

Mann-Whitney Test

Ranks

	Non Response Bias Test	N	Mean Rank	Sum of Ranks
Industry	Early	20	22.08	441.50
	Late	20	18.93	378.50
	Total	40		
No of employees	Early	20	19.27	385.50
	Late	20	21.73	434.50
	Total	40		
Paid-up capital	Early	19	21.61	410.50
	Late	19	17.39	330.50
	Total	38		
Revenue	Early	18	20.97	377.50
	Late	19	17.13	325.50
	Total	37		

Test Statistics[b]

	Industry	No of employees	Paid-up capital	Revenue
Mann-Whitney U	168.500	175.500	140.500	135.500
Wilcoxon W	378.500	385.500	330.500	325.500
Z	-.879	-.700	-1.206	-1.104
Asymp. Sig. (2-tailed)	.379	.484	.228	.270
Exact Sig. [2*(1-tailed Sig.)]	.398[a]	.512[a]	.246[a]	.284[a]

a. Not corrected for ties.

b. Grouping Variable: Non Response Bias Test

Appendix E: PLS analysis output for supplier data (First Run)

PLS Overview

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Adoption	1.000000	1.000000	0.153803	1.000000	1.000000	0.086028
Comp size	0.925185	0.961122		0.925241	0.925185	
Contractual	0.886106	0.939614		0.871467	0.886106	
Dep * Tru	0.757122	0.989401		0.989107	0.757122	
Dependency	0.630658	0.894589	0.529187	0.853605	0.630657	0.102353
IT/Technical	0.839892	0.912978		0.809454	0.839892	
Trust	0.757684	0.949335	0.630775	0.935813	0.757684	0.476701

Latent Variable Correlations

	Comp size	Contractual	Dep * Tru			
Comp size	1.000000					
Contractual	0.039491	1.000000				
Dep * Tru	-0.010672	0.656943	1.000000			
Dependency	-0.018021	0.497451	0.905129	1.000000		
IT/Technical	0.133633	0.165008	0.407009	0.449104	1.000000	
Trust	0.009996	0.794213	0.786906	0.681003	0.301346	1.000000

Outer Model (Weights or Loadings)

	Comp size	Contractual	Dep * Tru	Dependency	IT/Technical	Trust
Cap	0.941037					
ConT1		0.941217				
ConT2		0.941447				
Tru1						0.819365
Tru2						0.907987
Tru3						0.883836
Tru4						0.892532
Tru5						0.839452
Tru6						0.876269
ITechD1					0.912724	
ITechD2					0.920173	
Dep1				0.815223		
Dep1*Tru1			0.861125			
Dep1*Tru2			0.854266			
Dep1*Tru3			0.870047			
Dep1*Tru4			0.867722			
Dep1*Tru5			0.838681			
Dep1*Tru6			0.863286			

Dep2				0.671079		
Dep2*Tru1			0.797508			
Dep2*Tru2			0.813507			
Dep2*Tru3			0.823741			
Dep2*Tru4			0.864103			
Dep2*Tru5			0.816146			
Dep2*Tru6			0.815441			
Dep3				0.836295		
Dep3*Tru1			0.890045			
Dep3*Tru2			0.921617			
Dep3*Tru3			0.931392			
Dep3*Tru4			0.929143			
Dep3*Tru5			0.939113			
Dep3*T6			0.922020			
Dep4				0.805858		
Dep4*Tru1			0.836955			
Dep4*Tru2			0.862244			
Dep4*Tru3			0.852850			
Dep4*Tru4			0.877499			
Dep4*Tru5			0.855666			
Dep4*Tru6			0.882573			
Dep5				0.830395		
Dep5*Tru1			0.856693			
Dep5*Tru2			0.874674			
Dep5*Tru3			0.870927			
Dep5*Tru4			0.903626			
Dep5*Tru5			0.878170			
Dep5*Tru6			0.909764			
Rev	0.982252					

Path Coefficients

	Adoption	**Comp size**	**Contractual**	**Dep * Tru**	**Dependency**	**IT/Tech**	**Trust**
Adoption							
Comp size	-0.293023						
Contractual	0.091527						0.794213
Dep * Tru	0.803941						
Dependency	0.380241						
IT/Technical	0.056175				0.268246		
Trust	-0.244870				0.600168		

Appendix F: PLS analysis output for supplier data (Final Run)

PLS Overview

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Adoption	1.000000	1.000000	0.164971	1.000000	1.000000	0.085961
Comp Size	0.925185	0.961122		0.925241	0.925185	
Contractual	0.886106	0.939614		0.871467	0.886106	
Dep * Tru	0.791239	0.989116		0.988836	0.791239	
Dependency	0.688745	0.898463	0.555031	0.849803	0.688745	0.132620
IT/Technical	0.839917	0.912994		0.809454	0.839917	
Trust	0.757680	0.949334	0.631006	0.935813	0.757680	0.476710

Latent Variable Correlations

	Comp Size	Contractual	Dep * Tru	Dependency	IT/Technical	Trust
Comp Size	1.000000					
Contractual	0.039490	1.000000				
Dep * Tru	-0.015415	0.675392	1.000000			
Dependency	-0.018095	0.525799	0.812893	1.000000		
IT/Technical	0.133054	0.164819	0.437861	0.476788	1.000000	
Trust	0.009863	0.794359	0.786421	0.689475	0.301187	1.000000

Outer Model (Weights or Loadings)

	Comp	Contractual	Dep *	Dependency	IT/Technical	Trust
Cap	0.941037					
ConT1		0.941213				
ConT2		0.941451				
Tru1						0.818995
Tru2						0.907879
Tru3						0.883744
Tru4						0.893023
Tru5						0.839739
Tru6						0.876029
ITechD1					0.913660	
ITechD2					0.919271	
Dep1				0.808315		
Dep1*Tru1			0.855773			
Dep1*Tru2			0.851823			
Dep1*Tru3			0.864707			
Dep1*Tru4			0.870902			
Dep1*Tru5			0.835775			

Dep1*Tru6			0.854995			
Dep3				0.827044		
Dep3*Tru1			0.886476			
Dep3*Tru2			0.920491			
Dep3*Tru3			0.926882			
Dep3*Tru4			0.930929			
Dep3*Tru5			0.933426			
Dep3*T6			0.915222			
Dep4				0.846452		
Dep4*Tru1			0.862322			
Dep4*Tru2			0.894146			
Dep4*Tru3			0.879025			
Dep4*Tru4			0.909774			
Dep4*Tru5			0.883475			
Dep4*Tru6			0.907530			
Dep5				0.837332		
Dep5*Tru1			0.863412			
Dep5*Tru2			0.887879			
Dep5*Tru3			0.880552			
Dep5*Tru4			0.918642			
Dep5*Tru5			0.888312			
Dep5*Tru6			0.915682			
Rev	0.982252					

Path Coefficients

	Adoption	**Comp Size**	**Contractual**	**Dep * Tru**	**Dependency**	**IT/Tech**	**Trust**
Adoption							
Comp Size	-0.285097						
Contractual	0.107357						0.794359
Dep * Tru	0.948866						
Dependency	0.511933						
IT/Technical	0.039093				0.295976		
Trust	-0.306249				0.600330		

Appendix G: PLS analysis output for customer data (First Run)

PLS Overview

	AVE	**Composite Reliability**	**R Square**	**Cronbachs Alpha**	**Communality**	**Redundancy**

Adoption	1.000000	1.000000	0.241256	1.000000	1.000000	0.086022
Comp size	0.925185	0.961122		0.925241	0.925185	
Contractual	0.947478	0.973031		0.944577	0.947478	
Dep * Tru	0.777210	0.990511		0.990548	0.777210	
Dependency	0.693624	0.918350	0.575414	0.887504	0.693624	0.113324
IT/Technical	0.786360	0.880096		0.738764	0.786361	
Trust	0.760681	0.950051	0.590366	0.937252	0.760681	0.430586

Latent Variable Correlations

	Comp size	**Contractual**	**Dep * Tru**	**Dependency**	**IT/Technical**	**Trust**
Comp size	1.000000					
Contractual	-0.021781	1.000000				
Dep * Tru	0.041058	0.709645	1.000000			
Dependency	-0.001822	0.619311	0.942167	1.000000		
IT/Technical	0.026154	0.403834	0.465374	0.458092	1.000000	
Trust	0.079260	0.768353	0.880257	0.722687	0.333121	1.000000

Outer Model (Weights or Loadings)

	Comp size	**Contractual**	**Dep * Tru**	**Dependency**	**IT/Technical**	**Trust**
Cap	0.941037					
ConT1		0.972621				
ConT2		0.974148				
Tru1						0.906368
Tru2						0.797822
Tru3						0.939842
Tru4						0.857064
Tru5						0.847673
Tru6						0.877298
ITechD1					0.933458	
ITechD2					0.837482	
Dep1				0.740766		
Dep1*Tru1			0.805439			
Dep1*Tru2			0.800186			
Dep1*Tru3			0.835292			
Dep1*Tru4			0.826252			
Dep1*Tru5			0.818873			
Dep1*Tru6			0.785146			

Dep2				0.895116		
Dep2*Tru1			0.895407			
Dep2*Tru2			0.879814			
Dep2*Tru3			0.922688			
Dep2*Tru4			0.908355			
Dep2*Tru5			0.921929			
Dep2*Tru6			0.888014			
Dep3				0.831897		
Dep3*Tru1			0.923036			
Dep3*Tru2			0.907632			
Dep3*Tru3			0.929577			
Dep3*Tru4			0.914616			
Dep3*Tru5			0.892573			
Dep3*T6			0.926843			
Dep4				0.771769		
Dep4*Tru1			0.859290			
Dep4*Tru2			0.834751			
Dep4*Tru3			0.867079			
Dep4*Tru4			0.843467			
Dep4*Tru5			0.852745			
Dep4*Tru6			0.837868			
Dep5				0.911303		
Dep5*Tru1			0.919289			
Dep5*Tru2			0.907018			
Dep5*Tru3			0.946893			
Dep5*Tru4			0.904777			
Dep5*Tru5			0.924602			
Dep5*Tru6			0.933468			
Rev	0.982252					

Path Coefficients

	Adoption	**Comp size**	**Contractual**	**Dep * Tru**	**Dependency**	**IT/Tech**	**Trust**
Adoption							
Comp size	-0.290925						
Contractual	0.163517						0.768353
Dep * Tru	0.752138						

Dependency	-0.329247						
IT/Technical	0.233988				0.244479		
Trust	-0.459488				0.641246		

Appendix H: PLS analysis output for customer data (Final Run)

PLS Overview

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Adoption	1.000000	1.000000	0.248627	1.000000	1.000000	0.086027
Comp size	0.925185	0.961122		0.925241	0.925185	
Contractual	0.947477	0.973030		0.944577	0.947477	
Dep * Tru	0.766569	0.987421		0.987602	0.766569	
Dependency	0.681989	0.895082	0.576619	0.842224	0.681989	0.098289
IT/Technical	0.784772	0.879021		0.738764	0.784772	
Trust	0.760469	0.949995	0.591471	0.937252	0.760469	0.430681

Latent Variable Correlations

	Comp size	Contractual	Dep * Tru	Dependency	IT/Technical	Trust
Comp size	1.000000					
Contractual	-0.021781	1.000000				
Dep * Tru	0.053884	0.716548	1.000000			
Dependency	0.027833	0.634225	0.943601	1.000000		
IT/Technical	0.024024	0.405538	0.463113	0.435498	1.000000	
Trust	0.078794	0.769072	0.869021	0.716435	0.333972	1.000000

Outer Model (Weights or Loadings)

	Adoption	Comp size	Contractual	Dep *	Dependency	IT/Tech	Trust
Cap		0.941037					
ConT1			0.972614				
ConT2			0.974154				
Tru1							0.905696
Tru2							0.796673
Tru3							0.939804
Tru4							0.857878
Tru5							0.848802
Tru6							0.876463
ITechD1						0.937776	
ITechD2						0.830736	

Dep1					0.727695		
Dep1*Tru1				0.781101			
Dep1*Tru2				0.774818			
Dep1*Tru3				0.813089			
Dep1*Tru4				0.807883			
Dep1*Tru5				0.805459			
Dep1*Tru6				0.758846			
Dep3					0.861655		
Dep3*Tru1				0.935182			
Dep3*Tru2				0.919036			
Dep3*Tru3				0.944752			
Dep3*Tru4				0.931064			
Dep3*Tru5				0.909945			
Dep3*T6				0.937000			
Dep4					0.816306		
Dep4*Tru1				0.875160			
Dep4*Tru2				0.850811			
Dep4*Tru3				0.884203			
Dep4*Tru4				0.860746			
Dep4*Tru5				0.871488			
Dep4*Tru6				0.851215			
Dep5					0.888600		
Dep5*Tru1				0.904562			
Dep5*Tru2				0.892331			
Dep5*Tru3				0.932974			
Dep5*Tru4				0.894316			
Dep5*Tru5				0.918898			
Dep5*Tru6				0.915717			
Rev		0.982252					

Path Coefficients

	Adoption	Comp size	Contractual	Dep * Tru	Dependency	IT/Tech	Trust
Adoption							
Comp size	-0.292148						
Contractual	0.155348						0.769072
Dep * Tru	0.829162						
Dependency	0.382785						
IT/Technical	0.224668				0.220863		
Trust	-0.472059				0.642673		

Appendix I: Data analysis output for the reason of non adoption

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Benefit not good	26	2	6	5.15	1.084
Security	26	2	6	4.69	1.123
Expensive to established	26	1	6	4.15	1.642
Lack of knowledge	24	2	6	4.13	1.454
Difficult to use	26	2	7	4.08	1.383
Lack of IT staff	26	2	6	4.00	1.233
Lack of trust	26	2	7	3.92	1.468
Lack commitment from mgmt	26	2	6	3.65	1.093
Not required by partner	26	2	6	3.54	1.272

Appendix J: Data Analysis – Paired sample T-Test for Gap Analysis

Paired Sample T-Test for Trust

Paired Samples Statistics (Supplier data shown first)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Not breech agreement	4.59	78	1.343	.152
	Not breech agreement	4.87	78	1.221	.138
Pair 2	Sincere	4.59	78	1.263	.143
	Sincere	4.79	78	1.188	.135
Pair 3	Inform if problem occurs	4.87	78	1.454	.165
	Inform if problem occurs	5.19	78	1.228	.139
Pair 4	Provide correct information	4.72	78	1.347	.153
	Provide correct information	4.83	78	1.253	.142
Pair 5	Listen & response to proposals	4.90	78	1.325	.150
	Listen & response to proposals	5.05	78	1.068	.121
Pair 6	Always cooperative	4.82	78	1.403	.159
	Always cooperative	4.99	78	1.211	.137
Pair 7	Always treat us kindly	4.90	78	1.254	.142
	Always treat us kindly	5.01	78	1.051	.119
Pair 8	Commit to maintain & develop relationships	4.92	78	1.439	.163
	Commit to maintain & develop relationships	5.05	78	1.127	.128

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Not breech agreement - Not breech agreement	-.282	.881	.100	-.481	-.083	-2.827	77	.006
Pair 2	Sincere - Sincere	-.205	.972	.110	-.424	.014	-1.864	77	.066
Pair 3	Inform if problem occurs - Inform if problem occurs	-.321	1.157	.131	-.581	-.060	-2.448	77	.017
Pair 4	Provide correct information - Provide correct information	-.115	.897	.102	-.318	.087	-1.136	77	.259
Pair 5	Listen & response to proposals - Listen & response to proposals	-.154	1.070	.121	-.395	.087	-1.270	77	.208
Pair 6	Always cooperative - Always cooperative	-.167	1.178	.133	-.432	.099	-1.250	77	.215
Pair 7	Always treat us kindly - Always treat us kindly	-.115	1.151	.130	-.375	.144	-.886	77	.379
Pair 8	Commit to maintain & develop relationships - Commit to maintain & develop relationships	-.128	.917	.104	-.335	.078	-1.235	77	.221

Paired Sample T-Test for Dependency

Paired Samples Statistics (Suppliers data shown first)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Aware of strength & weekness	5.00	78	1.269	.144
	Aware of strength & weekness	5.09	78	1.130	.128
Pair 2	Knowledge interchanged with partners	4.53	78	1.492	.169
	Knowledge interchanged with partners	5.00	78	1.368	.155
Pair 3	Partner's knowledge is crucial	4.18	78	1.421	.161
	Partner's knowledge is crucial	4.54	78	1.501	.170
Pair 4	Partners help improve our firm's goodwill	4.38	78	1.444	.163
	Partners help improve our firm's goodwill	4.69	78	1.638	.185
Pair 5	Partners increase our reputation	4.67	78	1.316	.149
	Partners increase our reputation	5.23	78	1.485	.168
Pair 6	IT investment adapted to partners decision	3.06	78	1.283	.145
	IT investment adapted to partners decision	3.50	78	1.492	.169
Pair 7	Maintain common IT standard with partner	3.17	78	1.343	.152
	Maintain common IT standard with partner	3.64	78	1.486	.168

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Aware of strength & weakness - Aware of strength & weakness	-.090	.871	.099	-.286	.107	-.910	77	.365
Pair 2	Knowledge interchanged with partners - Knowledge interchanged with partners	-.474	1.276	.145	-.762	-.187	-3.282	77	.002
Pair 3	Partner's knowledge is crucial - Partner's knowledge is crucial	-.359	1.044	.118	-.594	-.124	-3.036	77	.003
Pair 4	Partners help improve our firm's goodwill - Partners help improve our firm's goodwill	-.308	.997	.113	-.533	-.083	-2.724	77	.008
Pair 5	Partners increase our reputation - Partners increase our reputation	-.564	1.146	.130	-.823	-.306	-4.346	77	.000
Pair 6	IT investment adapted to partners decision - IT investment adapted to partners decision	-.436	1.420	.161	-.756	-.116	-2.712	77	.008
Pair 7	Maintain common IT standard with partner - Maintain common IT standard with partner	-.474	1.483	.168	-.809	-.140	-2.824	77	.006

Paired sample T-Test for the level of trust and dependency

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Level of trust (Supplier)	4.7885	78	1.15241	.13048
	Level of trust (Customer)	4.9744	78	.99702	.11289
Pair 2	Level of dependency (Supplier)	4.1410	78	.98235	.11123
	Level of dependency (Customer)	4.5275	78	1.07209	.12139

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Level of trust (Supplier) – Level of trust (Customer)	-.18590	.60260	.06823	-.32176	-.05003	-2.725	77	.008
Pair 2	Level of dependency (Supplier) - Level of dependency (Customer)	-.38645	.75386	.08536	-.55642	-.21648	-4.527	77	.000

Paired sample T-Test based on industry group

T-Test - Group 1

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Level of trust (Supplier)	4.7438	20	.91450	.20449
	Level of trust (Customer)	5.1375	20	.86498	.19342
Pair 2	Level of dependency (Supplier)	4.2071	20	.75376	.16855
	Level of dependency (Cust)	4.9857	20	.83286	.18623

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Level of trust (Supplier) - Level of trust (Customer)	-.39375	.54903	.12277	-.65071	-.13679	-3.207	19	.005
Pair 2	Level of dependency (Supplier)- Level of dependency (Cust)	-.77857	1.03273	.23093	-1.26191	-.29524	-3.372	19	.003

T-Test - Group 2

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Level of trust (Supplier)	4.4491	27	1.36326	.26236
	Level of trust (Customer)	4.5787	27	1.24767	.24011
Pair 2	Level of dependency (Supplier)	4.0106	27	1.05718	.20345
	Level of dependency (Cust)	4.2910	27	1.16966	.22510

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Level of trust (Supplier) - Level of trust (Customer)	-.12963	.82587	.15894	-.45633	.19708	-.816	26	.422
Pair 2	Level of dependency (Supplier)- Level of dependency (Cust)	-.28042	.55255	.10634	-.49900	-.06184	-2.637	26	.014

T-Test - Group 3

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Level of trust (Supplier)	5.5446	14	.80205	.21436
	Level of trust (Customer)	5.4196	14	.78997	.21113
Pair 2	Level of dependency (Supplier)	4.5510	14	.86961	.23241
	Level of dependency (Cust)	4.8878	14	.80652	.21555

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Level of trust (Supplier) - Level of trust (Customer)	.12500	.39528	.10564	-.10323	.35323	1.183	13	.258
Pair 2	Level of dependency (Supplier)- Level of dependency (Cust)	-.33673	.53630	.14333	-.64639	-.02708	-2.349	13	.035

T-Test - Group 4

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Level of trust (Supplier)	4.7200	25	.98971	.19794
	Level of trust (Customer)	4.7950	25	.96884	.19377
Pair 2	Level of dependency (Supplier)	4.0571	25	1.12335	.22467
	Level of dependency (Cust)	4.2343	25	1.13005	.22601

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Level of trust (Supplier) - Level of trust (Customer)	-.07500	.49213	.09843	-.27814	.12814	-.762	24	.453
Pair 2	Level of dependency (Supplier)- Level of dependency (Cust)	-.17714	.55678	.11136	-.40697	.05268	-1.591	24	.125