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A STUDY OF BUSINESS-TO-BUSINESS ELECTRONIC MARKETPLACE USAGE FROM THE BUYER PERSPECTIVE

by

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Submitted as partial fulfillment of requirements for

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An Abstract of

A STUDY OF BUSINESS-TO-BUSINESS ELECTRONIC MARKETPLACE USAGE FROM THE BUYER PERSPECTIVE

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Business-to-Business (B2B) Electronic Marketplaces (EMs) have emerged in different industries, supporting the exchange of goods and services of different kinds and promising a huge market potential. However, the rapid rise and sharp fall of EMs within a few short years raises the question about EM usage. Although EMs represent a fast growing segment, firms are still reluctant to utilize them for purchasing.

This research represents one of the first large-scale empirical efforts to explore the EM usage from the buyer perspective. Based upon a comprehensive literature review, a research model was developed proposing four primary factors that have significant

impacts on extent of EM usage: expected benefits of EMs, perceived risks of EMs, purchasing situations, and e-business readiness.

Valid and reliable measures of the constructs were developed and the instrument development process involved structured interviews, a pilot study, and a large-scale survey. The large-scale survey yielded 359 responses from purchasing professionals. Rigorous statistical methods were used to assess and validate the constructs. The methods used were: confirmatory factor analysis and reliability analysis.

The research findings supported the hypotheses that there is a positive relationship between expected benefits and extent of EM usage, a negative relationship between perceived risks and extent of EM usage, and a positive relationship between purchasing situations and extent of EM usage. In addition, the findings also supported the moderating effect of e-business readiness.

This research has some important implications for practitioners. This research provided companies a clear understanding about the expected benefits and perceived risks of EMs, the role of purchasing situations, and the moderating effect of e-business readiness. Moreover, the planned comparison enables the buyers to choose an appropriate type of EMs to participate in based upon their own expectations, risk perception, and purchasing situations.

DEDICATIONS

This dissertation is dedicated to

My parents (Tin D. Truong and Thinh T. Le), whose guidance, encouragements and supports have led my life to the brightest success

Van T. Nguyen, my wife, whose loves have been with me all the time whether it has been a good time or a hard time

NgaMy D. Truong, my daughter and my beautiful angel, who makes my life happier than I ever could have imagined

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

Electronic marketplaces (EMs) are breaking new ground in old industries by providing them with a wealth of supply chain information via the Internet. They are getting more and more popular. They emerge in different industries, supporting the exchange of goods and services of different kinds and promising a huge market potential. It was estimated that over half of the future trading volume in business-to-business (B2B) electronic commerce (e-commerce) would be conducted through EMs (Forrester Research 2000).

Unlike the traditional market in which the meeting place is a physical location, an EM refers to a virtual space on an electronic network (Malone *et al.*, 1987), an interorganizational information system that allows the participating buyers and sellers to exchange information about prices and product offerings (Bakos, 1991; Brandtweiner and Scharl, 1999), “an e-application” (Hoque, 2000), or an Internet-based e-commerce platform (Brook and Cantrell, 2000) that matches multiple buyers and suppliers in transactions. EMs provide an electronic, or online, method to facilitate transactions between buyers and sellers that potentially provide support for all of the steps in the entire order fulfillment process.

In fragmented industries, a host of independent EMs, or third party exchanges, are emerging. Examples include e-Steel for the steel industry, IMX for home mortgage, and PaperExchange for the paper industry. Moreover, many large firms recently have announced their ventures into the realm of business-to-business electronic commerce using Internet protocols. For example, the recent alliance between the big three auto manufacturers (General Motors, Daimler Chrysler, and Ford) to establish Covisint, the launch of RetailLink by Wal-Mart, and the Transfer Process Network by General Electric all fall in this category.

EMs have some advantages over the traditional markets. Transactions between buyers and suppliers in traditional marketplaces begin with a buyer looking for goods or a supplier seeking potential buyers. When searching for each other, both the supplier and the buyer have to pay some costs for advertising, trade shows, brokers, dealers, or a sales force. Even after the contracts have been signed, they still need to pay additional costs for ordering, billing, transportation, confirmation of payment, and acceptance of delivery (Lucking-Reiley and Spulber, 2001). Using information technology and Internet technology, EMs have been shown to be able to reduce search costs, facilitate transactions, offer trust to prevent opportunistic behavior and "maverick" purchase, and broaden the supply and demand base so that buyers have more choices to select and suppliers have access to more buyers (Bailey and Bakos, 1997).

The advantages of EMs over traditional marketplaces and the attractiveness of a potential market have led to the creation of nearly 1,900 public EMs, consisting of 1,501 independent and 287 industry-sponsored e-marketplaces by mid-2000 (Deloitte Research, 2001). Moreover, countless private EMs have also been formed more recently. However,

in such a crowded marketspace, very few EMs have operated well and found sufficient trading volume to sustain their operations. About 400 EMs have been closed down or acquired by others (mySupplyChain, 2001). Market consolidation is supposed to shrink the population of EMs to a few hundred in the near future (Le, 2002).

The rapid rise and sharp fall of EMs within a few short years raise questions about EM usage. The more EMs are utilized by businesses, the more chances they have to survive and succeed. Although EMs represent the faster growing segment, from nearly one-seventh to slightly over half, of B2B e-commerce dollar volume within five year (Forrester Research, 2000), firms are still reluctant to utilize them. The most recently survey carried out by the Institute of Supply Management (ISM) states that by the first quarter of 2003, 88.4 percent of buyers bough indirect materials online and 74.5 percent of them bought direct materials online; but only 32.7 percent of them used EMs to do their transactions (ISM, 2003). In another survey undertaken by Line56 (2002), many respondents (39 percent) indicate that in next 12 months they will participate in only one or two EMs, although 47 percent of them consider EMs strategically important.

The reluctance of firms in utilizing EMs despite their substantive benefits indicates a need to study thoroughly factors influencing the extent of EM usage. The question of EM usage doesn't simply refer to the categorization of user versus non-user; it is more complicated than that. As firms decide to utilize EMs they need to make more decisions: how long they plan to use EMs, what percentage of procurement they spend through EMs, and in what type of EMs they want to participate in. Those questions have not been answered adequately in existing EM literature. The careful examination on those

usage issues and critical factors influencing EM usage is perceived to contribute significantly to the diffusion of EMs in the future.

In order to fill this gap in existing studies, this dissertation aims at examining the extent of usage of EMs from the buyer's perspective, and various factors influencing the extent of EM usage. An extensive literature review addresses several critical factors that have impacts on the extent of EM usage for purchasing: expected benefits, perceived risks, purchasing situations, and e-business readiness. However, those factors have not been sufficiently investigated in existing studies.

Existing research investigates from different angles the benefits EMs create. The major method used in existing studies of EMs is economic analysis which has been perceived as a strong method to investigate EMs' value propositions (Bakos and Kemerer, 1992; Kaufman and Walden, 2001). The maturity, rigor, and analytical techniques make it desirable for the study of EM. In addition, its strong explanatory power with its formal mathematical and analytical modeling methodologies is another advantageous characteristics of economic analysis. According to this literature, the primary benefit EMs create is market aggregation. EMs have been postulated to create values for participants in terms of reduced transaction costs (Mallone *et al.*, 1987), reduced search effort, network externalities, economies of scale and scope (Bakos, 1991, 1997, 1998), increased supplier/buyer base, price transparency, product availability and comparison, reduced product price, disintermediation/reintermediation, less 'maverick' buying, lower catalogue cost, etc. (Chircu and Kauffman, 2000; Gudmundsson and Walczuck, 1999; Kauffman and Walden, 2001; Mahadevan, 2000; Strader and Shaw, 1997, 1999).

In general, economics literature is important for establishing the EMs research stream with numerous theoretical and empirical studies. However, these studies seem to be developed based on a pre-defined assumption that the perceived value of EMs is a unidimensional variable, market aggregation. This assumption oversimplifies the real world of EMs since the primary benefit of EMs is not only reduced cost (Bloch and Catfolis, 2001). Using economic analysis, existing studies have focused primarily on the market aggregation side and largely ignored the collaboration side of EMs, although it is a vital part of EMs perceived values (Bloch and Catfolis, 2001; Brunn *et al.*, 2002; Le, 2002). These authors conduct some rare studies categorizing value propositions of EMs along two dimensions: market aggregation and inter-firm collaboration. *Market aggregation* overcomes market fragmentation, affording suppliers with market access, buyer with more choices, and both with price transparency supply chain efficiency; *inter-firm collaboration* enables market participants to build and deepen their business relationships for the purposes of improving individual business processes and overall supply chain performance. The examination on inter-firm collaboration can be achieved successfully based upon the supply chain management (SCM) literature. However, authors do not comprehensively examine these values nor their impact on sellers' and buyers' adoption of EMs. This is one important gap in the EMs' studies to be bridged in this research.

Beside the expected benefits, potential risks of EMs cannot be ignored since they may make the firms reluctant to utilize EMs. The low percentage of firms utilizing EMs in recent time indicates the important role of perceived risks that inhibit or constrain those firms from purchasing materials/products through EMs. While there have been

many studies focusing on the benefits of EMs, very few studies have emphasized potential risks with which firm may be confronted when joining an EM. High upfront investments, high transaction fees and commissions, information sensitivity and lack of trust relationships with suppliers are some perceived risks of EMs proposed in existing studies (Goldsby and Eckert, 2003; Pires and Asbett, 2003). The lack of framework for perceived risks and empirical evidence for this variable requires a further investigation.

Despite the vital role of expected benefits and risks of EMs, they may not be the single influencing factor in the EM usage model as stated in existing studies. They have necessary, but not sufficient, influence on a firm's decision to utilize EMs. When participating in EMs, firms need to invest in linking and adapting their internal business processes and enterprise systems to the trading platform and applications an EM supports (Le, 2002). That investment represents the importance of capability and readiness of the firms. The study of Rutner *et al.* (2003) indicates that companies that have successfully implemented logistics information systems are significantly more likely to have also implemented some forms of e-commerce than those who have not. Similarly, in order to operate successfully in EMs' systems, firms need to experience technologies and Web site applications, construct a sufficient IS infrastructure and develop employees at a high level of e-business knowledge (Mehrten *et al.*, 2001; Strader and Shaw, 1999). This readiness can enable a firm to exploit potential benefits provided by EMs and, on the other hand, to eliminate possible risks in adopting EMs. However, this issue has never been mentioned in existing studies of EM adoption.

Another important issue in existing EMs' studies is that they have assumed potential users have the same reasons participating in EMs. In fact, firms are very

diversified and they participate in EMs for different transactional purposes, which will result in fragmented usage decisions: length of time to utilize EMs for purchasing, percentage of procurement spending through EMs, number of EMs utilized, and types of EMs to be utilized. From the buyer perspective, the fragmentation is determined by the purchasing situations. The purchasing function has a substantial impact on the potential profit. The variety in purchasing needs, and thus the need to purchase in different ways, is also increasing, which confronts firms with new challenges (Dubois and Pedersen, 2002). Firms cannot effectively manage all purchases in the same way, but must instead develop and implement a set of differentiated purchasing strategies. Numerous organizations have understood the purchasing situation from the product point of view. Some companies such as American Express and Sears launched strategies to take indirect purchase head on, using various free-market approaches (Kapoor and Gupta, 1997). At present, indirect purchases represent roughly 33 percent of operating expenses, and many more firms have purchased indirect materials than direct materials online – 88.4 versus 74.5 percent of the firms surveyed by ISM (2003). As companies begin to reduce the cost of indirect purchases, they may rethink how they manage supplier relationships. The diversification in purchasing situations of firms indicates that buyers may decide to use different EMs depending on purchasing situations. Thus, the purchasing policy of a firm can enhance or prevent the utilization of EMs (Rosenthal *et al.*, 1993). Despite the vital impact of a purchasing situation on EM usage, with the exception of study by Rosenthal *et al.* (1993) it has never been examined empirically in the existing literature on EM usage.

Overall, EM usage is perceived to be a vital issue that influences the survival of EMs and needs to be studied extensively. Despite numerous studies undertaken in EMs,

very few of them focus thoroughly on developing a model of EM usage. Besides, the number of empirical studies in EMs is very limited. Lack of empirical verification may make those studies less persuasive for firms. Thus, an empirical research is necessary to explore different literature in EM usage, develop appropriate and relevant variables and constructs, and prove the relationships among them through a large-scale survey.

1.2 Research Questions

The comprehensive review of EMs' literature indicates some potential issues in EM usage that have not been revealed sufficiently in existing studies: EM usage from the buyer perspective; the perceived market aggregation side of EMs and its influences on the extent of EM usage for purchasing; the perceived inter-firm collaboration side of EMs and its influences on the extent of EM usage for purchasing; perceived risks of EMs and their influence on the extent of EM usage for purchasing; the moderating effect of e-business readiness on the relationship between expected benefits or perceived risks and extent of EM usage; and the influence of purchasing situations on the extent of EM usage.

In order to fill the gap in the EM literature, a research model is developed to explore four critical factors influencing the extent of EM usage - expected benefits of EMs, perceived risks of EMs, e-business readiness, and purchasing situations - and the relationship between them and the extent of usage of EMs for purchasing. This research will address the following questions:

1. Is there a positive relationship between expected benefits of EMs and the extent of EM usage?

2. Is there a negative relationship between perceived risks of EMs and the extent of EM usage?
3. Is there a positive relationship between purchasing situations and the extent of EM usage?
4. Does e-business readiness moderate the relationship between expected benefits and the extent of EM usage?
5. Does e-business readiness moderate the relationship between perceived risks and the extent of EM usage?

1.3 Scope and Contributions of The Research

The research in EM usage can be done from two perspectives: buyer and seller. This research focuses on the buyer perspective since the large number of firms purchasing online indicates a potential market for EMs. For most companies, the purchasing operations play a critical role since the costs of purchased goods and services represent the dominant portion of total costs in both the private and public sectors (Gadde and Håkansson, 2001). Purchasing has become an increasingly significant driver of corporate financial performance. Purchases of goods and services have always played an important role in the corporate cost structure, reaching as high as 80 percent or more of the total cost of goods sold in some industries (Anderson and Katz, 1998). What companies buy has been increasing in importance, size, and complexity, and therefore, how companies buy has changed. Purchasing online is increasing by becoming more and more popular, proven by the fact that by the first quarter of 2003 about more than 80 percent of the firms have purchased direct and indirect input online (ISM, 2003). Thus, a

study on EM usage from the buyer perspective will contribute substantially to the diffusion of EMs in the future.

This research has several potential contributions. First, this is the first study exploring the EM usage issue thoroughly and empirically; a comprehensive model of EM usage is developed. Second, this study fills the gap in the EMs' literature which has focused only on the market aggregation side of expected benefits of EMs and largely ignored the vital role of inter-firm collaboration. By postulating that expected benefits of EMs is a second-order construct, this research explores adequately the benefits EMs create from both sides: market aggregation and inter-firm collaboration. This exploration enables EMs to figure out the important reasons that make firms utilize or not utilize EMs. Third, this research develops a framework to investigate the influence of perceived risks of EMs that have not been sufficiently examined in the current literature. Fourth, differing from other studies this research postulates that the influence of expected benefits and perceived risks on the extent of EM usage will be moderated by the impact of a firm's e-business readiness. Finally, this is the first study investigating empirically the impact of purchasing situations on the extent of EM usage.

1.4 Structure of The Research

The research is organized into six chapters. In Chapter Two, a literature review is presented over the areas deemed relevant to this research. The literature review will categorize definitions of EMs from different aspects, summarizing the theories and experimental findings in the areas of EM usage - economics literature and SCM literature - and describe various constructs of EM usage model.

Chapter Three proposes the research framework on which this study is based, specifically the model of EM usage from the buyer perspective. The chapter addresses the relationships between constructs and hypotheses that the dissertation investigates.

Chapter Four describes the research methodology used in this study. A detailed description of the design of the survey study, variables and measurement items generated, and sampling procedures will be discussed. This chapter also includes pre-testing with practitioners and academicians, and a pilot study using the Q-sort method.

Chapter Five describes the large-scale survey and instrument validation. It begins with the description of steps need to be done in conducting the large-scale survey and profile of respondents. This is followed by analysis of a measurement model including validity and reliability results.

In Chapter Six, the results of hypotheses testing are shown using the multiple regression analysis and planned comparison. Discussions of each hypothesis are also included.

Chapter Seven is dedicated to interpretations, contributions, and implications of the research findings. The limitations and extensions of the research will be discussed, along with suggestions for future research.

CHAPTER TWO: LITERATURE REVIEW

EMs have existed in some forms prior to the Internet era but were seriously constrained by costly deployment of proprietary networks, limited interconnectivity, and sparse functionality. Today's EMs capitalize on the open standards of Internet technology and other advances in information technology (IT) to overcome the limitations of pre-Internet EMs. Although the proliferation of EMs in recent years has attracted a growing number of academic studies on this phenomenon, most studies are conceptual or managerial in their approach; few are empirical. This chapter provides a comprehensive literature on EM usage: (1) EMs concepts and development; (2) literature review on the usage of EDI, the Internet, Web-based e-procurement, and EMs; (3) various factors that influence the extent of EM usage including: expected benefits of EMs, perceived risks of EMs, e-business readiness, and purchasing situations; and (4) the extent and types of EM usage.

2.1 EM Concept and Development

2.1.1 EM Functions

The central role of markets is to facilitate the exchange of information, goods, services, and payments (Bakos, 1997), they provide key functions - aggregation, matching, and facilitation - that support the whole transaction process by electronic means, including information search, price discovery, and transaction settlement (Dai and

Kauffman, 2002). Aggregation helps bring together product information from many suppliers so that buyers can do one-stop shopping on the Internet (Bailey and Bakos, 1997). One common mechanism for aggregation is electronic cataloging. Matching provides the mechanism for sellers to find buyers and buyers to find suppliers, thus matching suppliers' offerings with buyers' needs. It is implemented through dynamic trading processes known as electronic auctions. Facilitation enables market participants to complete a transaction once products and suppliers are identified and prices are set through aggregation and matching. Examples of facilitation include logistics and financial services.

2.1.2 EM Definitions

EMs have received various definitions from different perspectives. New perspectives continue to emerge as more disciplines become interested in the EM phenomenon. Table 2.1.2.1 lists the definitions of EMs into key categories: electronic applications, inter-organizational information systems (IOIS), virtual spaces, and Internet-based e-commerce platforms.

As **electronic applications** (or digital intermediaries), EM functions as an information system or a coordinating mechanism that bring buyers and sellers together, facilitate their transactions (exchange of information, goods, services, and payments), and provides institutional infrastructure (Bichler, 2001; Dai and Kauffman, 2000; Gottschalk and Abrahamsen, 2002; Lindermann and Schmid, 1999; Merz, 1997; Mueller, 2000; Sarkar *et al.*, 1998; Schmid, 1993, 1995). Application of information technology is the key element differentiating between traditional and electronic markets. It helps EMs reduce search and transaction costs thereby reduce coordinating costs. Traditionally,

markets hold an advantage in lower product costs whereas hierarchies holds an advantage in lower coordination costs. By lowering both product and coordination costs through the application of information technology, EMs become more preferable to hierarchies (Malone *et al.*, 1987).

An EM is essentially an **inter-organizational information system (IOIS)** that facilitate information exchange process, partner searching and transaction execution between market participants (Bakos, 1997; Choudhury, 2000). According to this definition, an EM is characterized as a multilateral IOIS to distinguish it from bilateral IOISs such as EDI links, where electronic links are established as one-to-one relationship (Choudhury, 1997, 2000). EMs differ from the traditional IOIS in that they are built on open network infrastructures and connect firms employing different information systems for procurement/distribution activities (Dai and Kauffman, 2002).

As a **virtual space**, an EM electronically connects multiple buyers and sellers (Malone *et al.*, 1987, 1989; Segev *et al.*, 1999). It is no longer a physical space where buyers and sellers can meet face to face, but rather a virtual space created by Internet technologies and standards to distribute product data and facilitate online transactions. Since the buyers and sellers contact to each other through Internet or electronic network technologies, transaction cost is significantly lower compared with traditional marketplaces where the suppliers need to contact to buyers physically (Malone *et al.*, 1987). In addition, the system can provide instant market information to all traders regardless of their location (McCoy and Sarhan, 1988).

Finally, an EM constitutes an **Internet-based e-commerce platform** that supports both transactions and interactions between suppliers and buyers (Ariba, 2000;

Holzmüller and Schlüchter, 2002; Kaplan and Sawhney, 2000; Lipis *et al.*, 2000;). Traditional marketplaces support transactions only. EMs are commerce sites on the public Internet that allow large communities of buyers and suppliers to meet and trade with each other. (Lipis *et al.*, 2000) EMs also support all activities related to transactions and interactions (planning the transformation of goods) between various companies (Holzmüller and Schlüchter, 2002).

Table 2.1.2.1: Definitions of EMs

Categories	Definition	References
Electronic application	EMs bring buyers and sellers together to facilitate commercial exchanges (intermediation)	Sarkar *et al.* (1998)
	EMs function as digital intermediaries that focus on industry verticals or specific business functions. They set up marketplaces where firms participate in buying and selling activities after they obtain membership	Dai and Kauffman (2000)
	EMs leverage information technology to perform three main functions: matching buyers to sellers; facilitating the exchange of information, goods, services, and payments; and providing an institutional infrastructure	Bichler (2001)
	EMs are information systems that link together buyers and sellers to exchange information, products, service, and payments. Through computers and networks these systems function like electronic middlemen, with potentially lowered costs for typical marketplace transactions such as selecting suppliers, establishing prices, ordering goods, and paying bills.	Gottschalk and Abrahamsen (2002)
	EMs are coordinating mechanisms for the market exchange of goods and services, and represent the total – or a certain quantity – of the exchange relationships between potential market partners having equal rights	Lindermann and Schmid (1999)
	EMs are defined as information systems that electronically support market transactions	Schmid (1993, 1995)
	EMs map the abstract co-ordination mechanism of the microeconomic market model onto a distributed computing system to the Internet	Merz (1997)
	EMs allow buyers and sellers to exchange information about product offerings and prices bid and asked	Mueller (2000)

Table 2.1.2.1: Definitions of EMs (cont.)

Categories	Definition	References
Inter-organizational information systems (IOIS)	EMs are inter-organizational information systems that allows the participating buyers and sellers in some market to exchange information about prices and product offerings	Bakos (1991, 1997)
	EMs are inter-organizational information systems through which multiple buyers and sellers interact to accomplish one or more of the following market-making activities: identifying potential trading partners, selecting a specific partner, and executing the transaction	Choudhury *et al.* (1998)
	An e-marketplace is a virtual bazaar which refers to a mass-information systems for the business-to-consumer area	Brandtweiner and Scharl (1999)
Virtual spaces	EMs provide cross-company electronic connections and occupy a virtual space on an electronic networks mgvjju543w	Malone *et al.* (1987, 1989)
	Compared to many other electronic procurement solutions, EMs represent a relatively neutral position between buyer and seller, providing services to both sides of a transaction. EMs represent a virtual place where buyers and sellers meet to exchange goods and services	Segev *et al.* (1999)
	EMs separate the negotiating function from the physical transfer of the product or commodity in which the market trades. It can manage buyers' and sellers' offers and bids, as well as moving products directly from sellers to buyers. The system is open to all buyers and sellers, regardless of their location and can provide instant market information to all traders.	McCoy and Sarhan (1988)
	EMs can be viewed as a public listing of products and their attributes from all suppliers in an industry segment, and available to all potential buyers.	Bradley and Peters (1997)
Internet based e-commerce platforms	EMs are electronic hubs that bring together a large number of buyers and sellers, facilitates the exchange of information and automates their transactions.	Kaplan and Sawhney (2000)
	EMs are commerce sites on the public Internet that allow large communities of buyers and suppliers to meet and trade with each other. They present ideal structures for commercial exchange, achieving new levels of market efficiency by tightening and automating the relationship between supplier and buyer.	Ariba (2000)
	EMs are an Internet-based solution that links businesses interested in buying and selling related goods or services from one another. It can be distinguished from a procurement or distribution system insofar as it must be neutral, taking into account the interest of both buyers and sellers in its governance	Lipis *et al.* (2000)
	EMs are Internet based business system that support all activities related to transactions and interactions (planning the transformation of goods) between various companies	Holzmüller and Schlüchter (2002)

2.1.3 EM Development

The evolution of EMs has attracted a great attention from researchers in economics literature. Malone *et al.* (1987) investigate the evolution from non-electronic marketplaces or from electronic or non-electronic hierarchies to electronic markets. This evolution involves two stages: from biased to unbiased markets, and from unbiased to personalized markets. In biased markets, some of the initial providers of EMs offer competitive bidding among suppliers that allow buyers to get the lowest possible prices. Those biased EMs will hurt supply chain relationship because buyers attempt to exploit the benefits in the marketplaces biased toward them. In the long run, the significant additional benefits to buyers possible from the electronic brokerage effect will drive almost all EMs toward being unbiased channels for products from many suppliers. One of potential problems with unbiased EMs is that buyers might be overwhelmed with more alternatives than they can possibly consider. While this problem will be less important in commodity markets, it may be a big deal in markets for which the product descriptions involve a number of retailed attributes that are compared in different ways by different buyers. In this case, a final stage may be the development of EMs that provide personalized decision aids to help individual buyers select from the alternatives available (Malone *et al.*, 1987).

Hagel and Armstrong (1997) analyze the evolution of EMs postulated by Malone *et al.* (1987) in the context of virtual (electronic) communities. They detect a continual shift of market power to buyers who increasingly have access to more information via online services and, most importantly, to other consumers via electronic chat areas and bulletin boards widely available among electronic communities. In the light of this power

shift, Daniel and Klimis (1999) propose modifications to the evolution of EMs, using case studies of financial service and music industries. The authors predict a proliferation of reverse markets where buyers electronically publish their requirements and suppliers bid for their business on the basis of price and product features.

One predicted change is that EMs will transform the traditional supply chain to allow suppliers to interact and transact directly with buyers, leading to massive disintermediation – the elimination of intermediaries and distributors (Bakos, 1991, 1997; Chircu and Kauffman, 2000; Kauffman and Walden, 2001). Since intermediaries significantly increase the costs of the products, there is a strong incentive for their elimination from the value chain (Benjamin and Wigand, 1995; Prahalad, 1998). Tapscott (1996) points out that those intermediaries that only process transactions without adding value are most likely to be eliminated by the Internet technology. However, some transactions cannot be conducted fully online. For example, in industrial distribution, disintermediation can be applied in physical logistics channels dealing with the storage and delivery of physical goods. Along these lines, research to date points out that disintemediation is not the only possible outcome when electronic technologies become available to the market. Based on transaction cost theory, Sarkar *et al.* (1995) show that one must consider situations in which transaction costs in EMs will be lower when transaction are supported by an intermediary than when they are conducted directly among buyers and suppliers. Focusing upon the changes formed by the Internet on the corporate and leisure travel services industry, Chircu and Kauffman (2000) explore the conditions under which current traditional intermediaries are displaced by EC technology players, and then, over time, are able to reestablish themselves as Internet-able but not

Internet-only intermediaries. The authors refer to this process as reintermediation. They suggest multiple bases for such changes, including the content of the product or service transacted, the amount of co-specialized assets as the disposal of the incumbent, the existing transaction costs, the role of expertise on the part of the intermediary, and the degree of transaction uncertainty. The authors also examine the strategies that Internet intermediaries can use to defend their competitive position in the marketplace in the face of reintermediating traditional firms.

2.2 Overview of EDI, Internet, E-procurement, and EM Usage

Although EMs offer attractive benefits, firms are still reluctant to use them for purchasing of materials, products and services. There are currently very few studies on EM usage, however. The following literature review will have to draw also from other studies in closely related usage context such as EDI, Internet, and e-procurement besides EM usage (see Table 2.2.1).

2.2.1 EDI (Electronic Data Interchange) Usage

Electronic data interchange (EDI) is an IOIS that involves the movement of business documents electronically between or within firms in a structured, machined-retrievable, data format that permits data to be transferred, without re-keying, from a business application in one location to a business application in another location (Hansen and Hill, 1989). EDI has been used for a long time to help firms interact with each other more efficiently with distinctive advantages. It is considered a bilateral IOIS. Despite its benefits, only a small percentage of organizations have used EDI. The high cost and technical limitations of EDI confine its adoption to large firms and its applications to automated processing of common documents in routine business transactions.

Table 2.2.1: Overview of EDI, Internet, E-procurement, and EM Usage

Contexts	Factors influence the usage	References
EDI usage	Inter-organizational and organizational factors	Premkumar and Ramamurthy (1995)
	Power and trust	Hart and Saunders (1998)
	Perceived benefits	Lee *et al.* (1999)
	Advantages of telecommunications and standards, environment of the firm, and internal situation of the firm	Jimenez-Martinez and Polo-Redondo (2001)
	Technology, organization, and environment	Kuan and Chau (2001)
Internet or Web technology usage	Technological component, organizational component, and environmental component	Teo *et al.* (1998)
	Innovation-specific characteristics, and organizational-specific characteristics	Vadapali and Ramamurthy (1998)
	Perceived benefits (direct and indirect benefits)	Poon and Swatman (1998)
	Knowledge barriers, and involvement of supply-side institutions	Nambisan and Wang (2000)
	Perceived benefits and perceived barriers	Walczuch *et al.* (2000)
	Perceived benefits, organizational readiness, and external pressure	Mehrtens *et al.* (2001)
	Contextual factors, and Internet purchasing acceptance factors	Olson and Boyer (2003)
E-procurement usage	Supplier support, and communication convenience	Deeter-Schmelz *et al.* (2001)
	Advantages, and barriers	Kheng and Al-Hawamdeh (2002)
	Perceived benefits, and perceived risks	Davila *et al.* (2003)
	Organizational readiness, user characteristics, and information technology infrastructure	Min and Galle (2003)
EM usage	Purchasing policy (quality, cost reduction, and product differentiation)	Rosenthal *et al.* (1993)
	Positive and negative issues of information transparency	Zhu (2002)
	Operational importance and Strategic importance of B2B EMs	Gottshalk and Abrahamsen (2002)
	Purchasing portfolio	Skjøtt-Larsen *et al.* (2003)

Several studies have focused on different aspects of EDI usage. Bouchard (1993) studies the decisions to use EDI based on what the business partners were doing. Banerjee and Goldhar (1994) examine the positive and negative impacts of various factors on EDI selection decision alongside the impact of EDI on a firm's employees. Premkumar *et al.* (1994) examine the relationships between various innovation characteristics and various attributes of diffusion of EDI-implementing firms. In another study, Premkumar and Ramamurthy (1995) examine the role of inter-organizational and organizational factors on the decision mode for usage of EDI. Hart and Saunders (1998) study the role of power and trust in EDI adoption and use. The study also evaluates the differences between proactive and reactive firms in terms of the extent of adaptation, external connectivity with trading partners and the integration of EDI information. Lee *et al.* (1999) examine benefits of EDI to users and find that EDI users can achieve dramatic performance improvements if EDI networks are used for inter-firm process engineering. Jimenez-Martinez and Polo-Redondo (2001) analyze opinions and behaviors of a sample of Spanish firms of the retailing sector in the utilization of EDI. The study indicates the impact of variables related to the advantages of use of telecommunications and standards, the environment of the firm and the internal situation of the firm on the EDI usage. Focusing on small businesses, the study by Kuan and Chau (2001) propose a perception-based EDI usage model. Factors influencing EDI usage include: technology (perceived direct benefits, perceived indirect benefits), organization (perceived financial cost, perceived technical competence), and environment (perceived industry pressure, perceived government pressure).

2.2.2 Internet or Web Technology Usage

Many companies have jumped on the Internet bandwagon in an attempt to get rich quickly in today's marketplace. Recent reports indicate annual online consumer sales have increased 40 percent in the past year (Moore, 2002). Despite this growth in online retailing, many companies continue to struggle with the development of effective Internet-based systems. While there have been numerous success stories, the amount of reported failures has been extremely high (Olson and Boyer, 2003).

A number of studies have examined the usage of the Internet. Teo *et al.* (1998) develop a contingency model that groups all factors into three main groups: technological component (compatibility, relative advantage), organizational component (technology policy, top management support, and management risk position), and environmental component (competitive intensity, information intensity, and government support). The results of an empirical survey in Singapore show that technological and organizational components are two major factors influencing the Internet usage, while environment component has been proven to have no impact. Vadapalli and Ramamurthy (1998) propose a framework for the Internet usage in which two primary determinants of business use of the Internet are innovation-specific characteristics (the social and technological context) and organizational-specific characteristics (organization boundaries, transaction cost economics, and organizational cognition).

Focusing on Internet usage from small businesses perspective, Poon and Swatman (1998) indicate perceived benefits as the major determinant of Internet usage. Those benefits, in their turn, are determined by other factors such as: industry adoption, value-chain adoption, market scope, product characteristics, management involvement, and

entrepreneurship. From the perspective of organizational learning, Nambisan & Wang (2000) examine the Internet usage in terms of accessibility into Internet, searching information from Internet, and number of transaction activities done via Internet. The authors argue that the differential opportunity to utilize originated from knowledge barriers and varied degrees of involvement of supply-side institutions that could lower these barriers. From the small business perspective, Walczuch *et al.* (2000) explore several factors that influence small businesses in their choice of Internet use: perceived benefits and perceived barriers. This study shows that a number of benefits that small firms are deriving from their Websites can be described as 'border-crossing' (disappearance of distance related barriers now, continuous advertising all around the world). The main barriers to Internet usage and to developing a Web presence are simply the concern that the Internet or the Website would not lead to more efficiency or lower costs and the feeling that the Internet or a Website is not suitable for a particular business. Also focusing on Internet usage from small and medium enterprises (SMEs) perspective, Mehrtens *et al.* (2001) conduct seven case studies to provide a clear understanding of the influences on Internet usage by small firms. The study indicates that Internet usage is influenced by three major factors: perceived benefits, organizational readiness, and external pressure. A recent study on Internet usage by Olson and Boyer (2003) was also conducted through a survey of small businesses. Factors influencing Internet usage are based on the widely supported Technology Acceptance Model (TAM). They include contextual factors (user characteristics, and strategy), and Internet purchasing acceptance factors (perceived ease, perceived usefulness, comfort, and attitude).

2.2.3 Web-Based E-procurement Usage

The emergence of new Internet technologies has a far-reaching impact on the way business is conducted. Notably, it has given the rise of Web-based e-procurement, which is the purchasing transaction via the Internet. Recognizing the importance of the Internet as a powerful business tool, many companies have moved quickly to take advantage of e-procurement. Web-enabled applications for B2B e-procurement are expected to enhance inter-organizational coordination and improve relationships among business partners (Subramaniam and Shaw, 2002). Transaction cost savings and competitive sourcing opportunities are potential benefits of B2B procurement. However, organizations are still unsure whether a Web-based B2B e-procurement system can deliver the promised benefits. Recent market observations indicate that the adoption and integration of e-procurement technologies into the business mainstream is occurring at a much slower than expected pace (Davila *et al.*, 2003).

Very few studies focus on e-procurement usage. Deeter-Schmelz *et al.* (2001) emphasize the important role of supplier on the buyer utilization of e-procurement. Buyers who perceive e-procurement to be more effective and easier to use than other tools are more likely to try it and prefer it. By providing training and guidance, suppliers can emphasize the convenience of e-procurement, thereby making such benefits clear to buyers. Conducting an empirical research in Singapore, Kheng and Al-Hawamdeh (2002) indicate that advantages and barriers would influence the e-procurement utilization decision. The promise of reducing overall purchasing costs seems to be one of the key motivators behind the companies' interest in e-procurement. On the other hand, most companies address competing initiatives as a major barrier to e-procurement usage. This

suggests that despite the increasing recognition of the importance of e-procurement as a strategic function, it has not yet reached the critical level of importance. Through a similar survey conducted in USA, Davila *et al.* (2003) state that e-procurement was still in its infancy and going through growing pains not uncommon to new technologies and changing initiatives. Aggressive users are moving steadily into these technologies and the future outlook indicates that their importance will grow as companies move from experimenting to fully adopting e-procurement technologies. The quantifiable savings as well as the qualitative benefits associated with these technologies indicate that the rate of usage will accelerate as aggressive users share their positive experiences regarding perceived technology and business risks. Finally, the study by Min and Galle (2003) identifies contextual factors (organizational readiness, user characteristics, and information technology infrastructure) that influence the successful usage of e-procurement by examining the differences in survey responses between users and non-users.

2.2.4 B2B EM Usage

First among the few studies investigating EM usage is Rosenthal *et al.* (1993) in which the authors emphasize the important role of purchasing policy in EM usage decision. That purchasing policy is guided by three major business goals: quality, cost reduction, and product differentiation. Data from the chemical industry show firms have little interest in using EMs for transactions. Suppliers are found to be reluctant to distribute product data to unknown prospective buyers who, in the absence of reliable data, have little incentive to use EMs. Zhu (2002) discuss the impact of information transparency on EM usage. With the spread of the Internet and EMs, greater transparency

of information has enabled more efficient pricing and more effective matching of buyers and sellers. However, in contrast to the widely held belief about its benefit, information transparency is indeed a double-edge sword. A transparent environment is not necessarily a good thing for all participants. Competitors can get better information too, which may have negative effect. Thus, firms' incentives to join the EMs are sensitive to the data disclosure rules of the exchange.

Gottschalk and Abrahamsen (2002) point out two factors influencing the plan to use EM for purchasing: operational importance of EMs and strategic importance of EMs. The survey conducted in Norway indicates that most organizations have plans to use EMs for purchasing. Responding organizations plan to purchase significantly more indirect goods than indirect services on EMs. The main benefit expected from utilizing EMs for purchases is transaction cost reduction. Besides, strategic importance of EMs can significantly predict the extent to which responding firm has plans to utilize EMs. The most recent study in EM usage by Skjøtt-Larsen *et al.* (2003) discusses the interrelation between EMs and SCM from a procurement portfolio perspective. Their proposition is that different types of buyer-supplier relationships require different types of EMs. They propose a relationship/EM-grid that should help to identify the right selection for EM in various procurement situations.

2.3 Factors Influencing EM Usage

Four primary factors influencing EM usage can be identified from the literature on EMs: expected benefits, perceived risks, e-business readiness, and purchasing situations. The following literature review provides the conceptual foundation for

formulating the research hypotheses and developing construct measures in the next chapters.

2.3.1 Expected Benefits of EMs

Expected benefits are one of the most important factors which have impacts on the usage decision made by the buyer. There are several ways to explore the benefits created by EMs. Focusing on e-business values, Amit and Zott (2001) identify four sets of benefits being created by e-business: efficiency, complementarities, lock-in, and novelty. Efficiency creates value by lowering costs, expanding product selection range, providing symmetric information, speeding up decision-making, and raising scale economies. Complementarities are present whenever having a bundle of goods together provides more value than the total value of having each of the goods separately. Lock-in refers to the extent to which customers are motivated to engage in repeat transactions and strategic partners have incentives to maintain and improve their associations. Finally, novelty involves innovativeness in the structuring of transaction. Although this framework has been discussed in the context of electronic business it can be adapted to explore the expected benefits of EMs.

From the EMs context, Bakos (1991) identifies a similar list of factors explaining the strategic potential of earlier EM that preceded the current crop of EMs. They include reduced search cost, network externalities, and economies of scale and scope. However, this and subsequent studies by this author (Bakos, 1997, 1998) focus on the economic dimension of EMs, namely benefit creation through great market efficiency, and overlooked the supply chain management dimension, specifically inter-firm business process efficiency.

Addressing this shortcoming, Bloch and Catfolis (2001) discuss two key areas where EMs have generic advantages over traditional marketplaces: market intelligence and supply chain integration. Accordingly, the main advantage of EMs is not lower prices, but the capability to give all participants access to market intelligence; this information helping suppliers to identify unfulfilled needs and giving buyers a broader overview of available products and services (market intelligence dimension). Through transaction automation and increased process transparency, EMs also facilitate supply chain integration. Brunn *et al.* (2002) categorize EM's benefits into three fundamental elements: increased market efficiency, improved supply chain efficiency, and creation of new values. Increased market efficiency is attributable to greater market transparency that allows prospective buyers and sellers identify each other and to match their needs at much lower costs than before. Improved supply chain efficiency is attained through inter-firm interactions and collaborations, and synchronized business process. New values can also be created by enabling buyers and sellers to access to new information based services.

A major contribution by the two studies above is the delineation between market efficiency and supply chain efficiency. The former dimension has been studied in works based on economics theory (notably, Bakos, 1991, 1997, 1998; Malone *et al.*, 1987). The later dimension has not been. Furthermore, several perceived values along these two dimensions have not received adequate attention. First, the above studies overlook the important role of market liquidity, which is described by Bakos (1991) and Kauffman and Walden (2001) as an important value EMs create. Second, the supply chain efficiency dimension described as in these studies focuses mainly on intra-firm integration and

overlooks inter-firm collaboration. Third, the new value creation as proposed by Brunn *et al.* (2002) widely overlaps the benefits included in the other dimensions. Access to new information based services enables wider market reach for suppliers (market efficiency dimension) and greater buyer-seller collaboration and interaction (supply chain efficiency dimension). Many of the value added services EMs create (e.g., authentication, payment, fulfillment) are also relevant to increasing business process efficiency (supply chain efficiency dimension).

Le (2002) proposes a framework that captures the benefits of EMs create along two dimensions: demand and /or supply aggregations and inter-firm collaboration. Aggregation overcomes market fragmentation, affording suppliers with market access, buyer with more choices, and both with price transparency. Participants can gain benefits from EMs through search cost efficiency and market liquidity. Collaboration enables market participants to build and deepen their business relationships for the purposes of improving individual business processes and overall supply chain performance. Those can be achieved through transaction automation and process integration. However, the author did not comprehensively examine these values nor their impacts on usage of EM from the buyer or seller perspective.

Through analyzing above studies, we propose that expected benefits of EMs have two dimensions: market aggregation and inter-firm collaboration. Each of these dimensions will be next discussed in details.

Table 2.3.1.1: Expected Benefits Construct

Constructs	Definition	References
Market aggregation	Usefulness of EM that overcomes market fragmentation, affording buyer with more choices, information about product availability, price transparency, and lower transaction costs.	Barratt and Rosdahl (2002); Bloch and Catfolis (2001); Brunn *et al.* (2002); Bakos (1991, 1997, 1998); Chircu and Kauffman (1999); Evan and Wurster (1999); Kauffman and Walden (2001); Le (2002); Mahadevan (2000); Malone *et al.* (1987); Strader and Shaw (1997, 1999);
Inter-firm collaboration	Usefulness of EM that enables market participants to build and deepen their business relationships for the purposes of improving individual business processes and overall supply chain performance	Barratt and Rosdahl (2002); Bloch and Catfolis (2001); Brunn *et al.* (2002); Le (2002); Narasimhan and Jayaram (1998); Narasimhan and Kim (2001)

2.3.1.1 Market Aggregation

Market aggregation refers to usefulness of EM in overcoming market fragmentation, thus affording buyer with wider choices, more readily available information about product and suppliers, transparent prices, and lower transaction costs. Exchange of goods and services incur many costs (in the form of time, effort and money) that are associated with pre-transaction discoveries (e.g., identifying prospective trading partners, ascertaining product features and availability, and gathering quality and price information). These costs are also known as search costs (Strader and Shaw, 1997, 1999). In fragmented markets, the search process becomes complex and costly, leading to information asymmetry that results in limited product choice and non-optimal prices for buyers. EMs, whether commodity or differentiated markets, reduce search costs in several ways: providing information on sellers and their product availability and prices,

thus facilitating comparison (Bakos, 1991, 1997, 1998; Evan and Wurster, 1999), expanding the supplier base, hence buyers' options (Mahadevan, 2000), allowing buyers to optimize their selection within the constraints of service availability through near-perfect market information, and providing real-time inventory listing (Gudmundsson and Walczuck, 1999). In addition, with low asset specificity and low coordination cost, EMs are perceived to enable lower transaction cost for buyers (Bichler, 2001; Daniel and Klimis, 1999; Domowitz, 2002; Malone *et al.*, 1987). This is the major factor making EMs preferable to electronic hierarchies (Malone *et al.*, 1987). By joining an EM buyers are able to reduce communication cost, reduce significantly paper work, thereby reducing transaction cost. On of widely predicted changes resulting from EMs is the transformation of the traditional supply chain through suppliers being able to interact and transact directly with buyers, with the consequent elimination of intermediaries and distributors (Bakos, 1991; Chircu and Kauffman, 1999; Kauffman and Walden, 2001).

Since EMs enable price transparency and product availability and comparison through the increased supplier base access, buyers can gain much lower product costs. Given the great choices of prices offered in the EMs, buyers are likely to be able to find a price that is lower than in a traditional market (Bichler, 2001; Raisch, 2001). In addition, many EMs enable aggregate buying, which means that multiples buyers can aggregate their purchasing spend, thus reducing the price through purchasing larger quantities (Barratt and Rosdahl, 2002). Finally, since every item is pre-negotiated and catalogued, expensive emergency buying by individual within large organizations is significantly reduced, indicating less maverick buying (Barratt and Rosdahl, 2002).

How well an EM can deliver value through market aggregation depends on its ability to build market liquidity by attracting a critical mass of buyers and sellers. The liquidity of an EM is determined by its ability to achieve critical mass, a fundamental success factor for any EM (Raisch, 2001). Liquidity enables buyers/ sellers to buy/sell the goods and services at fair market prices within a reasonable short time. Thus, the more liquid the EMs, the more benefits the buyers receive (Le, 2002). The value of an EM to each user increases with the size of its user base.

2.3.1.2 Inter-Firm Collaboration

Where as market aggregation creates value for sellers and buyers by overcoming market inefficiencies associated with market fragmentation, inter-firm collaboration seeks improvements in business processes throughout the supply chain. Traditionally, inter-firm collaboration is defined as the extent to which all activities within an organization, and the activities of its suppliers, customers, and other supply chain members, are integrated together (Stock et al, 1998; Narasimhan and Jayaram, 1998; Wood, 1997). The scope of inter-firm collaboration ranges from functional integration to internal integration and then to external integration. Functional integration establishes close relationships between functions such as shipping and inventory or purchasing and raw material management. Internal integration involves the integration of all internal functions from raw material management through production, shipping, and sales. Finally, external integration extends the scope of integration outside the organization to embrace suppliers and customers (Narasimhan and Jayaram, 1998; Narasimhan and Kim, 2001).

From the EM perspective, inter-firm collaboration refers to the usefulness of EM that enables market participants to build and deepen their business relationships for the purposes of improving individual business processes and overall supply chain performance. Inter-firm collaboration basically can be characterized by process integration and inter-firm integration.

A widely recognized element of business process integration is transaction automation. Automatically generated and processed purchase orders contain fewer errors, resulting in lower selling and administration costs for sellers (Bloch and Catfolis, 2001). For buyers, EMs improve the procurement process by making it Web-based (Barratt and Rosdahl, 2002). That involves electronic documents routing through order request, approval and placement in place of costly manual processing (Subramaniam and Shaw, 2002). Properly constructed to support specific access hierarchies, information filtering criteria, business rule and workflow, EMs help buyers effectively manage their transactions, track their market activities, prevent unauthorized activities, and protect confidential information (Le, 2002). The integrated process also enables buyers to shorten concept-to-commercialization cycle time and order-to-delivery lead time. Buyers have instant access to all the raw materials and other production related goods leading to reduced inventory level. This results in lower working capital requirements (Barratt and Rosdahl, 2002).

Beside process integration, inter-firm integration is the driving force of effective supply chain with open and low-cost connectivity, very large, flexible, and multimedia data storage capabilities, systems and channel integration, and higher-level self service capabilities (Horvath, 2001). EMs create the most benefit when they leverage existing

relationships between buyers and suppliers (Bloch and Catfolis, 2001; Brunn *et al.*, 2002; Dai and Kauffman, 2002). By providing participants with collaborative tools such as demand forecasting, inventory management and production planning, EMs help provide increased visibility across several tiers of supply chain. Furthermore, because the way to collaborate is standardized EMs also allow for much more dynamic choice of sourcing partners (Brunn *et al.*, 2002; Le, 2002). In addition, EMs also create values to buyers through collaborative commerce, the use of an online business-to-business exchange to facilitate the flow of business processes in addition to transactions (Raisch, 2001). Buyers can exchange information by using a Web server as an intermediary. Collaborative commerce enables buyers to automate information flows within a multi-channel distribution network and provides a dynamic, Internet-based inter-enterprises business infrastructure that links product and process information and applications boundaries of internal organizations as well as suppliers, partners, and customers (Deloitte Research, 2001). It creates most benefit to buyers when buyer-supplier relationships are well established and the supply chain is multi-tiered and complex (Le, 2002).

2.3.2 Perceived Risks of EMs

EMs have not only benefits. Despite of their advantages, they still can create some potential risks that may inhibit or constraint buyers from procuring materials/products through EMs. Although most studies in EMs emphasize their advantages, the fact that only small number of firms, especially small firms, have utilized EMs for purchases indicating the importance of investigating perceived risks created by EMs. It is crucial that those risks need to be addressed before EMs are widely accepted (Davila *et al.*, 2003).

There are very few studies investigating the potential risks of EMs. From the Internet adoption perspective, Purao and Capbell (1998) postulate that the primary barriers include start-up costs, unfamiliarity with the web, lack of guidance about how to start the process, and security hazards. Abell and Lim (1996) research firms already using the Internet. They come to the conclusion that fruitful use is being hampered by concerns over the security (Abell and Lim, 1996). Focusing on small businesses, Walczuch *et al.* (2000) point out that the main barriers to Internet adoption and to developing a Web presence are simply the concern that the Internet or the Website would not lead to more efficiency or lower costs and the feeling that the Internet or a Website is not suitable for a particular business.

Kheng and Al-Hawamdeh (2002) identify four major challenges for e-procurement. Most serious is the concern about the security of the Internet. Electronic payment systems for Internet-based commerce are relatively new and considered by many prospective users as being too risky for payment transactions. The second stumbling block is the significant investments in hardware, software, staffing and training required by e-procurement. To make extensive use of the Internet, some firms need more expensive telecommunications connection, workstations, or higher-speed computers that can handle transmission of complex graphics. Another issue is the laws and regulations governing e-commerce. At present, they are just being written. The fourth inhibiting factor is the inefficiencies in locating information. At present, most search engines are not sophisticated enough to help locate information in an efficient way. In another study about e-procurement usage, Davila *et al.* (2003) also address four perceived risks of e-procurement. *Internal business risks* refer to the requirement to invest in internal

information infrastructure. *External business risks* are related to the communication with suppliers. For e-procurement to succeed, suppliers must be accessible via the Internet and must provide sufficient catalogue choices to satisfy the requirements of their customers. Lack of critical mass of suppliers accessible through the organization's e-procurement system would limit the network effects that underlie these technologies, further hindering the acceptance and usage of e-procurement. *Technology risks* refer to the lack of a widely accepted standard and a clear understanding of which e-procurement technologies best suit the needs of each company. *E-procurement process risks* refer to the security and control of the e-procurement process itself. Focusing on electronic transportation marketplaces, Goldsby and Eckert (2003) address some potential inhibitors to EM usage decision including information sensitivity and weak capabilities in verifying information about processes and partners.

From above discussions two potential risks of EMs can be figured out from the buyer perspective: financial risks and trust barrier (see Table 2.3.2.1).

Table 2.3.2.1: Perceived Risks Construct

Construct	Definition	References
Financial risks	Costs including initial development investments and recurring operating expenses	Brunn *et al.* (2002); Davila *et al.* (2003); Kheng and Al-Hawamdeh (2002); Purao and Capbell (1998); Walczuch *et al.* (2000)
Trust barriers	Constraints due to the uncertainties in safeguarding sensitive business information and in dealing with unknown suppliers	Abell and Lim (1996); Davila *et al.* (2003); Zhu (2002); Golsby and Eckert (2003); Kheng and Al-Hawamdeh (2002)

2.3.2.1 Financial Risks

Financial risks refer to initial development investments and recurring operating expenses. A study by Walczuch *et al.* (2000) identifies high cost as the most important reason for small firms not to use the Internet in their business. Likewise, high costs can be an important constraint on buyers inhibiting their usage of EMs for business purchases.

Firms are uncertain about whether they have the appropriate resources to successfully implement EMs. In order to utilize EMs successfully, firms must invest in developing the EM platform, information system integration, and business coordination. Brunn *et al.* (2002) indicate that setting up an EM with the right technological platform is of strategic importance as it has direct consequences or the success of the EM. The major criterion for the technological platform of EMs is that it should be able to support the development of advanced marketing tools (different catalogue structures and auction types), integrated procurement tools (searchable catalogues and administrative tools), and advanced collaboration tools. Thus, when buyers decide to utilize EMs, they need to build telecommunication connections, workstations, higher-speed computer systems, and high skill information systems specialists to handle the network connection, search engine, electronic catalogue, and auction (Davila *et al.*, 2003; Kheng and Al-Hawamdeh, 2002). That initial investment can be very high and will become a major barrier for small businesses or firms that have financial problems.

In addition, to ensure that the technology does not become a major obstruction for EM implementation, that technological platform must have the possibility of frictionless integration with information systems and ERP systems of buyers. Also, to make EMs as

efficient as possible, it should operate under open standards (Brunn *et al.*, 2002). All of those requirements will lead to higher information system integration costs.

Finally, the need to coordinate with suppliers for purchasing will also cost buyers more. Since some of business model associated with EMs clearly envision the use of suppliers with whom the buyer has not previously transacted business, companies need to develop mechanisms that provide the buyer with assurances that industry enforced standards relating to supplier quality, service, and delivery capabilities (Davila *et al.*, 2003).

2.3.2.2 Trust Barriers

Making purchases through the Internet, where all related information can be seen by everyone, and doing transaction with suppliers with whom the buyer has not previously contacted and interacted will create the trust barriers for the buyer in utilizing EMs. Trust barriers refer to the constraints due to the uncertainties in safeguarding sensitive business information and in dealing with unknown suppliers.

According to Bakos (1991, 1998), information transparency is one major benefit of EMs. Buyers will be able to access the supplier base, seek information about price and product availability. However, Zhu (2002) postulates that information transparency also has a negative side. The lack of Internet security may lead to the leakage of sensitive business information to competitors. The information that buyers only wish to share with suppliers will not be kept confidential (Golsby and Eckert, 2003; Zhu, 2002). In addition, this insecurity also affects the operation of electronic payment systems that need significant amount of sensitive information from both buyers and sellers (Kheng and Al-Hawamdeh, 2002).

Trust barriers also come from working with unknown suppliers. Cooperation with external partners requires buyers and suppliers to meet the business criteria that organizations have set to accept them in their network (Davila *et al.*, 2003). As mentioned, using EMs allow buyers to contact suppliers through the Internet, therefore, they may have to work with suppliers with whom they have not previously transacted business. This situation will lead to several uncertainties. First, it will be difficult for buyers to ensure that suppliers meet or exceed recognizable and industry enforced standards relating to supplier quality, service, and delivery capabilities (Davila *et al.*, 2003; Goldsby and Eckert, 2003). There are also uncertainties related to verification of the terms and conditions of the contract. Working with unknown suppliers limits the capability of suppliers to participate in the purchasing process and may cause the incompatibility between processes of suppliers and buyers. This will be very risky for buyers since it may lead to misunderstanding or ineffectiveness in their transactions.

2.3.3 E-Business Readiness

EMs expand the connectivity of their trading networks via the systems integration, the implementation of technical standards, and IT outsourcing services (Dai and Kauffman, 2002). Since they are built with Internet technologies, EMs are able to create value for buyers and sellers by opening up more trading opportunities and by connecting more business partners within marketplaces. To attract companies to join the network, Internet market makers provide solutions that integrate participants' back-end enterprise systems with the marketplaces they wish to trade in (Brunn *et al.*, 2002; Dai and Kauffman, 2002). For the same reason, they also integrate with third-party business service providers, such as financial institutions, which offer options to close on-line

business transaction (Dai and Kauffamn, 2002). Furthermore, technical standardization is another mechanism for enhancing the connectivity of a network technology, and it also helps the system integration. Relying on industry-specific eXtensible Markup Language (XML) standards, for example, many EMs standardize the data formats used in exchanging business documents. Also based on XML standards, EMs can implement common business processes among trading partners (Brunn *et al.*, 2002; Dai and Kauffman, 2002). Accordingly, in order to utilize EMs successfully the buyers must have adequate information system infrastructures and resources to be well integrated with EM systems. In addition, experiences in implementing e-business indicated by the extent they utilize information technologies, information systems, and the Internet in purchasing and in enhancing supply chain management also have impacts on the system integration with EMs (Olson and Boyer, 2003; Walczuch *et al.*, 2000).

Thus, the readiness of buyers in using e-business for purchasing will influence their success in utilizing EMs, and thereby influence the extent of EM usage. However, while many researchers have focused on how a company can use e-business for its transaction, the issue of how e-business readiness influences the extent of EM usage has not received sufficient attention. Based upon above discussions, e-business readiness can be measured by the extent to which a company uses information technology and the Internet for facilitating purchasing, and IS/IT for enhancing SCM (see Table 2.3.3.1)

Table 2.3.3.1: E-Business Readiness Construct

Construct	Definition	References
Information technology usage for facilitating purchasing	The extent to which an organization uses relevant information technologies to facilitate the purchasing process.	Akkermans *et al.* (2003); Grover and Malhotra (1997); Lee *et al.* (1999); Prekumar and Ramamurthy (1995); Sriram *et al.* (1997); Sanders and Premus (2002); Sanders and Premus (2002)
Internet usage for facilitating purchasing	The extent to which an organization uses the Internet to facilitate the purchasing process.	Lancioni *et al.* (2000); Olson and Boyer (2003); Vadapali and Ramamurthy (1998); Walczuch *et al.* (2000)
IS/IT usage for enhancing SCM	The extent to which an organization uses IS/IT in its systems to facilitate the supply chain management.	Bardi *et al.* (1994); Bowersox and Daugherty (1995); Narasimhan and Kim (2001)

2.3.3.1 Information Technology Usage for Facilitating Purchasing

Information technology can be defined as technology used to acquire, process, and transmit information for more effective decision making (Grover and Malhotra, 1997). Information technology usage for facilitating purchasing refers to the extent to which an organization uses relevant information technologies to facilitate the purchasing process (Sanders and Premus, 2002; Sriram *et al.*, 1997). Increasingly, the purchasing function is viewed as an integral part of closely coordinated, cross-functional systems such as materials requirements planning (MRP) and just-in-time logistics (JIT), whose

effectiveness can be enhanced by information technologies that serve to develop a shared internal information infrastructure (Sriram *et al.*, 1997). Information technologies are also increasingly being used to automate ordering system processes and purchasing vendor evaluation, performance monitoring activities, and payment activities. Purchasing trade publications are replete with purchasing-specific applications, ranging from software programs to turnkey systems (Sanders and Premus, 2002; Sriram *et al.*, 2002; Stum and Sriram, 1997).

Another arena where information technologies are used to support the purchasing function is the communication linkage with vendors, where traditional telephone messaging and transaction paper flows are being supplanted by electronic data interchange (EDI) (Lee *et al.*, 1999; Prekumar and Ramamurthy, 1995). According to Cannon (1993), the benefit of EDI is not that the customer has replaced a paper document with electronic data transmission, but that the customer has electronically linked its purchasing application to the supplier's ordering application. By doing so, EDI reduces administrative costs, improves the timeliness and accuracy of data, and promotes a closer trading partner relationship.

Finally, information technologies enable companies to integrate many kinds of information processing abilities and place data into a single database through the utilization of Enterprise Resource Planning (ERP) (Akkermans *et al.*, 2003). Prior to ERP, this processing and data were typically spread across several separate information systems. Fore example, a firm could have separate information systems for purchasing, order management, human resources, and accounting, each of which would maintain a separate data source. ERP would subsume these into a single seamless system (Austin

and Nolan, 1999; Buckhout *et al.*, 1999; McAfee. 1998). An ERP system could potentially enhance transparency across the supply chain by eliminating information distortion and increase information velocity by reducing information delays (Akkermans *et al.*, 2003)

2.3.3.2 Internet Usage for Facilitating Purchasing

The greatest potential of the Internet is being realized by speeding up communication between customers and their suppliers, improving service levels, and reducing logistics costs (Lancioni *et al.*, 2000). The Internet has been used in managing the major components of supply chains including transportation, purchasing, inventory management, customer service, production scheduling, warehousing, and vendor relations. In this research, Internet usage for facilitating purchasing can be defined as the extent to which an organization uses the Internet to facilitate the purchasing process.

The use of the Internet in managing purchasing in the supply chains has developed rapidly over the last 10 years. The research demonstrates that the Internet is utilized in a variety of procurement applications including the communication with suppliers, checking supplier price quotes, placing orders from suppliers' catalogs, and tracking order and payment information (Lancioni *et al.*, 2000; Olson and Boyer, 2003; Vadapali and Ramamurthy, 1998; Walczuch *et al.*, 2000). The purchasing function in U.S. firms has been streamlined through the use of the Internet. General Electric, for example, has reduced its purchasing staff by more than 50 percent and permits on-line purchasing from supplier catalogs by each department. The paperwork flows have been reduced, and order-cycle times— the time from when the order is purchased to the time it is delivered to the company—has decreased by 40 percent (Lancioni *et al.*, 2000).

2.3.3.3 IS/IT Usage for Enhancing SCM

Supply chain management (SCM) deals with the control of material and information flows, the structural and infrastructural processes relating to the transformation of materials into value added products, and the delivery of the finished products through appropriate channels to customers and markets so as to maximize customer value and satisfaction (Narasimhan and Kim, 2001). The benefit of supply chain management can be attained through the electronic linkage among various supply chain activities utilizing information technologies and the construction of integrated supply chain information systems (Bowersox and Daugherty, 1995). Through utilization of information systems, companies are able to integrate similar functions spread over different areas as well as curtail unnecessary activities, thus enhancing their capability to cope with sophisticated needs of customers and meet product quality standards (Bardi *et al.*, 1994).

Narasimhan and Kim (2001) postulate three different functions of IT/IS utilization to enhance SCM: for infrastructural support, for value creation management, and for logistical operations. IT/IS utilization for infrastructural support includes network plan/design system, office information system, and accounting information systems. IT/IS utilization for value creation management includes production control system, inventory management system, sales management system, customer management system. Finally, IT/IS utilization for logistical operations includes location selection system, automatic ordering system, resource management system, transportation management system, and forecasting system (Narasimhan and Kim, 2001).

In conclusion, the extent to which a firm uses information technologies and the Internet for facilitating purchasing, and IT/IS for enhancing SCM will indicate its readiness to implement e-business activities, which in its turn will influence the capability of the firm to utilize EMs successfully.

2.3.4 Purchasing Situations

The variety in purchasing needs, and thus the need to purchase in different ways, is also increasing, which confronts firms with new challenges (Dubois and Pedersen, 2002). Firms cannot effectively manage all purchases in the same way but must instead develop and implement a set of differentiated purchasing strategies. Numerous organizations have reflected the purchasing situation from the product point of view. A traditional approach, largely found in the literature, categorizes products on the basis product use such as production materials, components, maintenance materials and supplies, capital equipment, and service (Ammer, 1974; Baily, 1987; Baily and Farmer, 1993; Burt, 1984; Corey, 1978; Dobbler *et al.*, 1990; Davis *et al.*, 1974; Haas, 1976; Mattson, 1988) or as direct or indirect items (Cardozo, 1980). During the last two decades purchasing portfolio models have received a great deal of attention. They have been used in strategic decision making to support resource allocation decision among strategic business units (Olsen and Ellram, 1997). Kraljic (1983) introduces the first and comprehensive approach for the use in purchasing and supply chain management. Its general idea is to minimize supply risk and make the most of buying power (Kraljic, 1983). This explains the choice of dimensions: accounting for risk on the one hand, and using buying power on the other hand. Taking a "product" perspective, Kraljic (1983) classifies a firm's purchased materials along two dimensions: profit impact and supply

risk. The profit impact of these materials can be defined in terms of their purchase volume, percentage of the end product cost, impact on product quality and business growth. Supply risk can be gauged by supply market structure and scarcity, pace of technology changes, and substitution possibilities.

Given the advantageous characteristics of purchasing portfolio model introduced by Kraljic (1983), other authors have used Krajic's basic ideas for the development of similar models. Hadeler and Evans (1994) distinguish four types of supply strategy along two dimensions: technical complexity and value potential. Using one internal and one external dimension, Van Stekelenborg and Kornelius (1994) categorize supply situations into four types: plain supply chain situation, internally problematic supply situation, externally problematic supply situation, and complicated supply situation. Two dimensions used in classification are: control need of the internal market demand (internal dimension) and control need of the external market demand (external dimension).

Aderson and Katz (1998) use three bases of segmenting the purchase portfolio. The first two deal with the complexity of procurement of the relevant category and nature of the impact on corporate performance. The revenue impact/business risk dimension addresses the degree to which a purchase category can influence customers' perception of value. A third dimension has to do with competitive economic potential – that is, to what extent are improvement opportunities available to the buyer given the cost drivers and competitive dynamics in the industry relevant to the purchase.

Taking the "indirect materials" perspective, Croom (2000) develops a purchasing portfolio for MRO procurement (Maintenance, Repair, and Operating). MRO items are

categorized into four main types: acquisition, critical, leverage, and strategic items, along two dimensions: spend and risk. The author argue that a purchasing portfolio may be employed to illustrate how re-positioning of MRO items may benefit the purchasing function and the company as a direct consequence of the informational advantages of electronic procurement.

The above studies introduce purchasing portfolios that are somewhat based upon Kraljic-style portfolio that seems to be the dominant approach in the profession. They provide an effective tool for discussing, visualizing and illustrating the possibilities of differentiated purchasing strategies. This model, however, does not provide guidelines for strategic movement of commodities and/or supplier within the matrix (Gelderman and Van Weele, 2002). Extended from Kraljic's model, Olsen and Ellram (1997) conceptualize a purchasing portfolio model in era of cooperative business relationships. While Kraljic (1983) focuses on exploiting the power balance to the supplier's disadvantage as potentially working against the buyer's long-term interests, they analyze the purchase to ascertain the ideal relationship types for these purchases and recommend such relationships be based on the relative supplier attractiveness and the strength of the relationship. They use two classification dimensions that differ in their focus from, and are more comprehensive in term of their defining factors than those in Kraljic (1983). One dimension, the strategic importance, refers to factor internal to the firm, including not only economic factors but also competence factors and image factors. The other dimension, the difficulty in managing the purchase situation, refers to factors external to the firm. Besides supply market risks and suppliers' power, it also includes others such as product novelty and complexity that require greater attention to buyer-supplier

relationship. Although their portfolio recommends four purchase situations similar to those in Kraljic (1983), its prescribed actions focus on effective management of buyer-supplier relationships.

Given the analysis of exiting studies in purchasing situations with distinctive strengths and weaknesses, in this dissertation the purchasing portfolio is developed based upon the Kraljic's model (1983) regarding the extension of Olsen and Ellram (1997). Purchasing situations are categorized along two dimensions: economic importance of purchases and complexity of purchasing processes. This construct is illustrated in Table 2.3.4.1.

Table 2.3.4.1: Purchasing Situations Construct

Construct	Definition	References
Economic importance of purchases	Impacts of purchased items on the cost and quality of the final products.	Aderson and Katz (1998); Croom (2000); Hadeler and Evans (1994); Kraljic, (1983); Olsen and Ellram (1997)
Complexity of purchasing processes	Supply risks (scarcity and substitution possibilities), logistic requirements, and business relationship.	Aderson and Katz (1998); Hadeler and Evans (1994); Kraljic, (1983); Olsen and Ellram (1997)

2.3.4.1 Economic Importance of Purchases

The economic importance of the purchase refers to impacts of purchased items on the cost and quality of the final products. It has been considered an important dimension in the purchasing portfolio in most existing studies. This dimension refers to profit impact (Kraljic, 1983), value potential (Hadeler and Evans, 1994), revenue impact (Aderson and Katz, 1998), spend (Croom, 2000), and strategic importance of purchase (Olsen and

Ellram, 1997). Possible factors influencing the economic importance of purchase include the volume of purchase, the extent to which the purchase is part of a final product with a great value added, and the strong demand growth.

The purchased items with high economic importance are very critical to the company and the key management strategies are to identify the value added of the purchase and leverage volume across product lines and suppliers (Olsen and Ellram, 1997).

2.3.4.2 Complexity of Purchasing Processes

The complexity of purchasing process describes factors external to the company, which make the purchase require extra attention and effort to manage and monitor. Possible factors influencing the complexity of purchasing process include supply risks (scarcity and substitution possibilities) (Kraljic, 1983), technical complexity (Aderson and Katz, 1998; Hadeler and Evans, 1994), logistic requirements, and business relationship (Olsen and Ellram, 1997).

The purchased items with high complexity of purchasing process are difficult to manage. Key management strategy is the role of supplier as a natural extension of the firm. The company should establish a close relationship with the supplier, focusing on early supplier involvement and joint development of products and services (Olsen and Ellram, 1997).

2.4 The Extent and Types of EM Usage

Given the limited number of existing studies on EM usage, this dissertation is to develop a model for EM usage from the buyer perspective. We discuss below some critical issues for measurements of EM usage.

2.4.1 The Extent of EM Usage

The first measure of EM usage is the extent of EM usage. This measure indicates the extent of current usage of EMs and the extent of usage of EMs planned for future (see Table 2.4.1.1). Current usage of EMs refers to the extent to which an organization currently uses EM for procurement of materials/products. Given the fact that a very low percentage of companies have utilized EMs for purchasing (ISM, 2003), it is necessary to investigate a firm that has a definite plan to use EM (Gottschalk and Abrahamsen, 2002). Planned EM usage refers to the extent to which an organization has a definite plan EM for procurement of materials/products. The extent of current usage of EM can be measured by the length of time an organization has used EM for the procurement of materials/products and/or services, the percentage of procurement spending an organization currently conducts through EM, and the number of EMs an organization currently uses for purchasing. Similarly, the extent of usage of EM planned for future can be measured by the percentage of procurement spending an organization plans to conduct through EM in the future, and the number of EMs an organization plans to use for purchasing in the future. Those measurements have been used successfully in some empirical studies such as the survey conducted in Norway by Gottshalk and Abrahamsen (2002). They will help researchers differentiate the degree to which EMs have been utilized by different firms.

Table 2.4.1.1: The Extent of EM Usage

Construct	Definition	Literature
The extent of current usage of EM	The extent to which an organization currently uses EM for procurement of materials/products • The length of time an organization currently uses EM for the procurement of materials/products and/or services • The percentage of procurement spending an organization currently conducts through EM • The number of EMs an organization currently uses for purchasing	Gottshalk and Abrahamsen (2002); Rosenthal *et al.* (1993); Skjøtt-Larsen *et al.* (2003); Zhu (2002)
The extent of usage of EM planned for future	The extent to which an organization has a definite plan EM for procurement of materials/products • The percentage of procurement spending an organization plans to conduct through EM in the future • The number of EMs an organization plans to use for purchasing in the future	

2.4.2 Types of EM Usage

The second issue in EM usage is the type of EMs to be used. This measure has been used by Skjøtt-Larsen *et al.* (2003), which indicates that different types of EMs can be selected depending on various purchasing situations. This measure is necessary since a firm doesn't need to utilize all types of EMs for its purchases. There may be one or more appropriate EMs to select, depending on situation of the firm.

EM types can be classified from different aspects. According to Le (2002; 2004), EMs can be classified by transaction content, transaction structure, transaction content and structure combined, and transaction governance. In this dissertation, since our focus is the EM usage for purchasing only, transaction content and structure are not really

relevant. When buyers decide to utilize EMs for purchasing, who owns the EMs will be their major concern. From this point, EM classification by transaction governance can be used for our research. Transaction governance refers to the ways in which parties to an exchange control the flows of information, goods and resources (Le, 2002, 2004). It is dictated largely by EM ownership. In this respect, EMs are independent, industry-sponsored, or private. The same classification has been used by UNCTAD (2001), namely independent markets, industry consortia, and private markets. Accordingly, EMs can be classified as Third-Party eXchange (3PX), Industry Sponsored Markets (ISM), or Private Trading Network (PTN). They are discussed below.

Table 2.4.2.1: Different Types of EMs

Construct	Definition	Literature
Third-Party eXchanges (3PXs)	An independent electronic marketplace founded and operated by an independent intermediary that does not participate in a transaction as either the seller or the buyer.	Le (2002, 2004); UNCTAD, 2001
Industry Sponsored markets (ISMs)	An electronic marketplace founded and operated by a consortium formed by leading companies in an industry.	Brown (2000); Le (2002, 2004); Sawhney & Acer (2000); UNCTAD (2001)
Private Trading Networks (PTNs)	A private electronic marketplace founded and operated by a single buyer or seller to link itself with a group of selected business partners.	Boston Consulting Group (2000); Deloitte Research (2001); King (2000); Le (2002, 2004); Spiegel (2001); UNCTAD (2001)

2.4.2.1 Third Party eXchanges (3PXs)

3PXs refer to independent electronic marketplaces founded and operated by an independent intermediary that does not participate in a transaction as either the seller or the buyer (Le, 2002, 2004). Their role is to provide an e-commerce platform for buyers and sellers to find each other and complete online transactions. They rely on order matching and transaction fees for their revenue. A 3PX may be a propriety exchange owned and operated by a single large company functioning as a neutral intermediary (UNCTAD, 2001) or operated by several independent companies that have no affiliation with buyers or sellers. It may, however, also co-operate with leading firms in a given industry, in certain cases receiving equity investment from players in the industry.

They not only provide a new channel for procurement, but are also intended on displacing traditional intermediaries by leveraging their superior search and transaction cost efficiency. Some 3PXs target horizontal markets that serve many industries but specialize in a particular product or service category, typically indirect (or operating) inputs (e.g., FreeMarkets in surplus equipment and eWork Exchange in contract employment of project professionals), or in a customer segment (e.g., Works aggregates purchases from thousands of small- and mid-sized businesses to gain volume discounts from contracted vendors). Other 3PXs target vertical markets that specialize in direct (or manufacturing) inputs for a specific industry (e.g., SciQuest in life sciences, ChemConnect in chemicals, and Houston Street Exchange in energy) (Le, 2002).

3PXs are more likely to grow in markets that are characterized by fragmented demand and supply (Le, 2004). They would tend to succeed in such markets because they can reduce transaction costs by aggregating and matching buyers and sellers. If, however,

only the buy side is fragmented, the benefits for sellers would be reduced, and conversely the benefits on the buy side would be reduced if only the sell-side markets were fragmented.

3PXs are attractive to both buyers and sellers, but their success would largely be dependent on whether they can actually attract sufficient numbers of buyers and sellers into the market place (Le, 2002, 2004). To achieve this, some 3PXs have had to develop partnerships with bricks-and-mortar (BAM) companies. However, 3PXs that accept equity investments either from buyers or sellers may lose their neutrality and hence their attractiveness to one or other side of the market (UNCTAD, 2001). To date, 3PXs have had little success as initially thought, due to their inability to quickly build liquidity, their asymmetric value propositions, their limited functionalities, and their failures to leverage existing business relationships (Le, 2004).

2.4.2.2 Industry Sponsored Markets (ISMs)

Some existing BAM companies have come together to create their own independent EMs, or consortium-based EMs, widely referred to as industry-sponsored marketplaces (ISMs). ISM can be defined as an electronic marketplace founded and operated by a consortium formed by leading companies in an industry. These may be organized by buying companies or by selling companies. Buyer-driven EMs are formed by large enterprises dealing in large-volume purchases. An example of a buyer-driven exchange is Covisint, which is an auto parts EM created by General Motor, Ford, and DaimlerChrysler. Other examples include Trade Ranger (oil refining), eHitex and e2Open (electronics/high-tech sectors), Aerospan and MyAircarft, Exostar and e2Open (UNCTAD, 2001). In these markets the traders are also owners. These may be private,

with content and management being under the buyer, or they may be public with the management being placed under a separate venture such as a consortium. Having established the markets, sellers are either encouraged of forced to trade in the market place. Supplier-or seller-driven EMs are formed by large supply companies. They are less numerous than buyer-driven ones. Their creation may be for defense, aimed at preventing the possibility of their customers setting up buyer-driven exchanges. Alternatively, they may be set up in response to the presence of buyer-driven EMs. Examples of these include Works.com and Grainger.com (UNCTAD, 2001).

Whereas 3PXs are most attractive in fragmented markets, ISMs are likely to emerge at the point of concentration in a supply chain. At that point, a few large sellers or buyers can bring to an ISM substantial volume of business (Sawhney and Acer, 2000). Being industry-sponsored, ISMs are essentially vertical EMs. Some have however misplaced their focus on the procurement of indirect inputs and commodities that their members can easily accomplish through 3PXs. Their attraction is not in aggregation (i.e., price transparency and product cost savings) or simple collaborative functionalities (i.e., process-cost savings through transaction automation). Large founding members can realize such savings on their own by leveraging their huge purchase volume and existing EDI systems. It is the industry-wide collaboration for greater supply chain performance that makes ISMs attractive. The infrastructure and technology for multi-party, multi-tiered collaborative functionalities are still evolving, however. They are also complex and costly. Many ISMs are falling further and further behind on their promises of advanced functionalities (Le, 2004). In addition, since their members are commercial rivals, some other obstacles ISMs facing include difficulties in creating a suitable ownership and

corporate structure and integrating their disparate back-end technologies, failure to provide a neutral trading environment and risk sharing information (Brown, 2000).

2.4.2.3 Private Trading Networks (PTNs)

PTN is defined as a private electronic marketplace founded and operated by a single buyer or seller to link itself with a group of selected business partners. Their objective is to support or enhance their core businesses (King, 2000). There is a growing consensus in the industry that private EMs will become the most preferred business model. For example, Deloitte Research (2001) finds in a study that 73 percent of firms surveyed say that private EMs will become the most important form of collaborative commerce for their business. The study points out that the complex capabilities that public EMs have been struggling to implement were now being successfully implemented in private EMs.

Another study, by Boston Consulting Group (2000) also predict that private EMs will become dominant. The study notes, however, that the ability of single sellers or buyers to set up their own EMs could be overestimated. The study shows that 54 percent of sellers and only 13 percent of buyers expect that single-seller sites will serve as their primary EM for any given product. Overall, however, private EMs are expected to play an increasing role in EMs.

PTNs hold several advantages over public EMs – 3PXs and ISMs. They are designed for reintermediation (not disintermediation) of trading arrangements among already functioning business partners. PTNs are a natural progression from current collaborative efforts. They are also more adaptive to specific supply chain configurations and unique functionalities, simpler in governance structure, and more secure in controlling the flows of sensitive data (Le, 2004).

Despite its attractiveness, PTNs are not a realistic option for all but the largest firms with sufficiently large trading volumes to attract participation from suppliers and buyers. These participants would need to adapt their business processes to individual PTNs, and they are reluctant to deploy several separate processes to connect to multiple PTNs. Development cost for a PTN may range from a few millions to a few hundred millions, e.g., Cisco has reportedly spent $300 million on its PTN (Spiegel, 2001). The infrastructure and technology for system integration are complex, costly and still evolving. Currently available collaborative functionalities involve relatively simple mechanisms for users to access real time information on orders and production schedules, to participate in project management, to configure products online and to share product design specifications. It will take two years before these and other leading-edge collaborative functionalities become widely available, up to five years to be used widely by early EM participants, and longer for smaller lower-tiered suppliers (Boston Consulting Group 2000). Until then, most PTNs will be confined to automating the procurement process, seeking savings from lowering transaction costs, consolidating purchases, and eliminating "maverick" buying (Le, 2002, 2004).

In sum, this chapter discussed the theoretical foundation of EM usage and various constructs in this field. In the next chapter, we will present the overall framework that depicts the relationships between these constructs and the development of research hypotheses.

CHAPTER THREE: THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

When understanding the phenomenon of EM usage, it is helpful to have a framework within which to work and from which testable hypotheses can be drawn. A theoretical framework enables predictions to be made about the firm's decision to use EMs for purchasing, and factors influencing the EM usage. It enables observed business behaviors to be evaluated and therefore provides better explanations of the motivators, inhibitors, and moderators of the EM usage.

3.1 Theoretical Framework

To better understand the EM usage issue a framework is established which describes the correlations between various factors and extent of EM usage. As discussed in Chapter Two, the extent of EM usage can be examined from two aspects: extent of current EM usage and extent of planned EM usage. The type of EMs is also taken into account in the model. Four factors are perceived to have correlations with extent of EM usage: expected benefits of EMs, perceived risks of EMs, e-business readiness, and purchasing situations.

The relationships among those variables are shown in the research framework (Figure 3.1.1). Expected benefits are one of the most important influencing factors in the EM usage model. Expected benefits can be classified into two categories: market

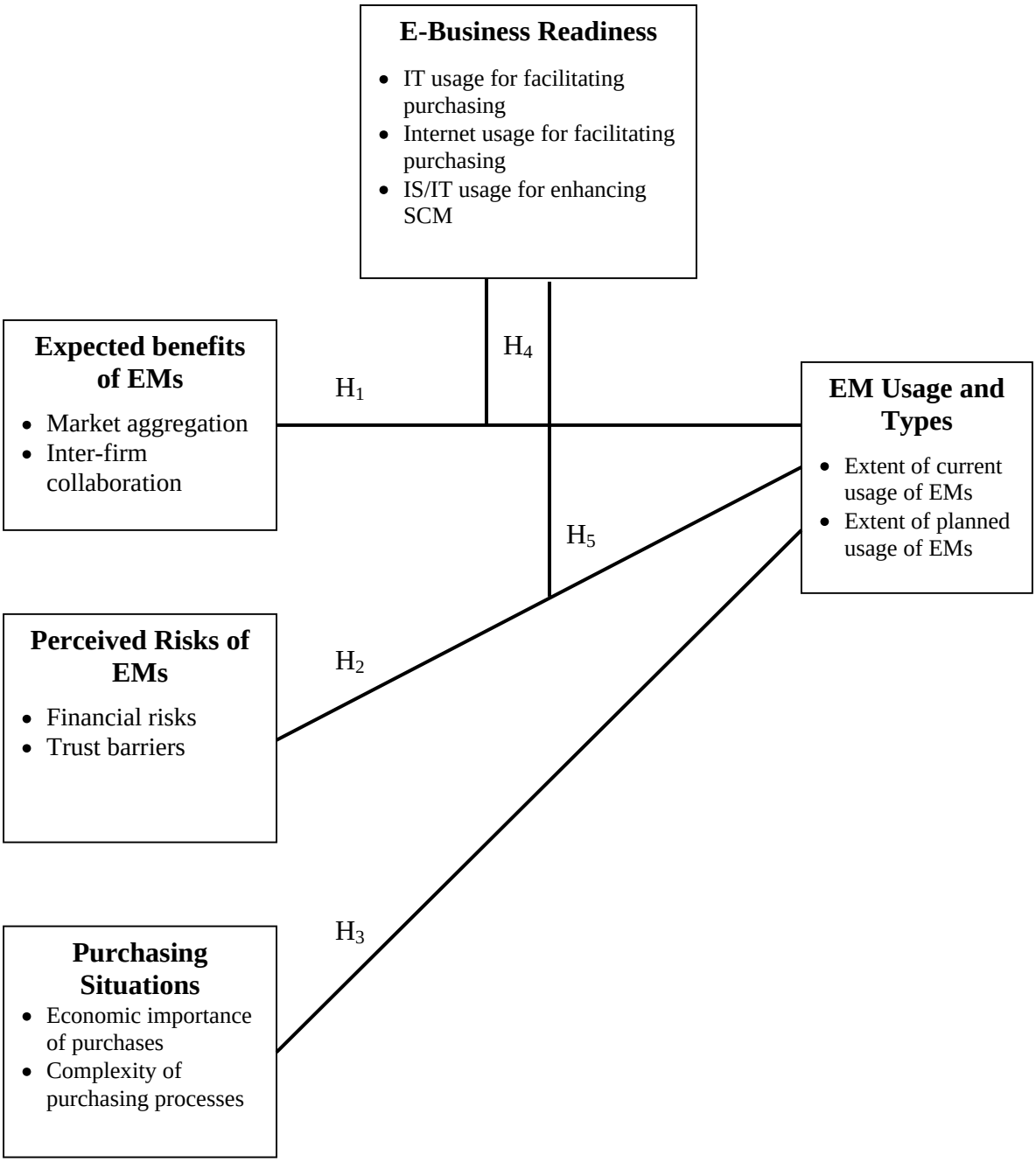


Figure 3.1.1: EM Usage Research Framework

aggregation and inter-firm collaboration. The model hypothesizes that expected benefits have a positive correlation with the extent of EM usage. Perceived risks are proposed to have negative correlation with the extent of EM usage. Perceived risks consist of two factors: financial risks, and trust barriers. The correlation between expected benefits or perceived risks of EMs with the extent of EM usage is also hypothesized to be moderated by e-business readiness. E-business refers to the extent to which firms use relevant information technologies, the Internet, and IS/IT to facilitate the purchasing process. Finally, the model hypothesizes the positive correlation between purchasing situations and the extent of EM usage. Purchasing situations can be categorized into economic importance of purchases and complexity of purchasing processes. The following section will provide the theoretical support for each hypothesis.

3.2 Research Hypotheses

3.2.1 Research Hypothesis 1

Many studies found expected benefits as having profound impacts on the usage of technology. Lee *et al.* (1999) and Kuan and Chau (2001) link EDI usage to both direct and indirect benefits. Poon and Swatman (1998) and Walczuch *et al.* (2000) identify the various benefits (including lower cost, high search efficiency, and time saving) that determine usage of the Internet by small businesses. Mehrtens *et al.* (2001) draw similar conclusion from several case studies. Kheng and Al-Hawamdeh (2002) find reduced purchasing costs as the key motivator behind the companies' interest in e-procurement. Likewise, Davila *et al.* (2003) attribute the rate of procurement usage to both quantifiable savings and qualitative benefits. Gottshalk and Abrahamsen (2002) conclude operational importance and strategic importance are the two major factors influencing the planned

usage of EMs. These works in the literature show a correlation between expected benefits and the extent of usage of EMs.

As discussed in chapter 2, expected benefits of EMs can be categorized as market aggregation and inter-firm collaboration (Bloch and Catfolis, 2001; Brunn *et al.*, 2002; Le, 2002). Market aggregation refers to usefulness of EM that overcomes market fragmentation, affording buyer with more choices, information about product availability, price transparency, and lower transaction costs. From the buyer perspective, market aggregation enables firms to reduce their search effort, find new suppliers, seek good price, check product availability and compare various products (Bakos, 1991, 1997, 1998; Bloch and Catfolis, 2001; Brunn *et al.*, 2002; Kauffman and Walden, 2001; Le, 2002; Mahadevan, 2000; Malone *et al.*, 1987). Moreover, through using EMs buyers can buy products/materials at the true market price (Le, 2002). Those benefits help purchasing companies reduce significantly transactional costs. Thus, when the buyers seek the market aggregation, they will be more likely to utilize EMs for purchasing.

The other dimension of expected benefits for EMs is inter-firm collaboration. Its role has not been substantiated by empirical studies on EMs but its importance is not in doubt considering its strategic importance in real-world business practices. Inter-firm collaboration refers to usefulness of EM that enables market participants to build and deepen their business relationships for the purposes of improving individual business processes and overall supply chain performance (Le, 2002). Firms are no longer operating alone as a single entity, but in a supply chain with relationships with different business partners. Lower transaction cost is one of the benefit of EMs (Bloch and Catfolis, 2001; Brunn et al, 2002). EMs operate as a market platform that enables firms to

integrate all functional processes in procurement, and integrate themselves with their suppliers and other business partners (Bloch and Catfolis, 2001; Brunn et al, 2002; Le, 2002). Thus, it can be expected that the companies seeking inter-firm collaboration benefits are more likely to use EMs for purchasing. These arguments lead to the hypothesis below.

Hypothesis 1*: Expected benefits of EMs and the extent of EM usage are positively correlated*

3.2.2 Research Hypothesis 2

While EM usage offers certain benefits, it also poses some potential risks. Buyers' perception of risks may act as considerable barriers. Walczuch *et al.* (2000) point out the main barriers to Internet usage include its high cost and the feeling that the Internet is not suitable for a particular business. Security is also considered an inhibiting factor (Abell and Lim, 1996). Kheng and Al-Hawamdeh (2002) attribute buyers' reluctance to use e-procurement to four major challenges: security problem, high investment, incomplete laws and regulations governing e-procurement, and inefficiency in locating information. Davila *et al.* (2003) also associate perceived risks with the extent of e-procurement usage. From the EM usage context, Lee and Clark (1997) postulate that the success of EM usage is as dependent on management of barriers as it is on the benefits enabled by IT.

Perceived risks of EMs can be classified as financial risks and trust barriers. According to Le (2002), one of the main reasons why a firm, especially a small firm, is reluctant to participate in an EM is the high cost of implementation, including initial development investments and recurring operating expenses. Moving B2B activities to EMs may require the buyer to commit certain resources to deploy IT applications and

infrastructures that link its internal business process and enterprise systems to EM's trading platform. Thus, in order to successfully utilize an EM, buyers may have to invest significantly in information system integration and, for certain EM types, in developing the EM platform itself (Brunn *et al.*, 2002; Davila *et al.*, 2003; Kheng and Al-Hawamdeh, 2002). The high upfront investment brings difficulties for firms that have financial limitation, specifically small businesses (Walczuch *et al.*, 2000). Thus, high financial risks will inhibit or constrain buyers from procuring materials/products through EM.

EM participation may mean having to deal with unknown suppliers with whom the buyer has not previously contacted and interacted. Uncertainties related to dealing with unknown partners, known as trust barriers, can be a significant constraint on EM usage. They necessitate safeguarding sensitive business information and in dealing with unknown suppliers (Pires and Asbett, 2003; Goldsby and Eckert, 2003). Moreover, EMs increase information transparency that can inhibit EM usage (Zhu, 2002). Buyers are afraid that their information may not be kept confidential and some sensitive business information may be leaked to competitors. This risk makes them hesitate to utilize EM for their purchases. Working with unknown suppliers also create uncertainties related to the identity of the suppliers, verification of the terms and conditions of the contract, supplier's fulfillment capability, and financial settlement. Moreover, the participation of suppliers in purchasing process will also be limited since suppliers and buyers haven't had a relationship before. Thus, the higher perceived risks will reduce the extent of EMs usage for purchasing. These argument leads to the hypothesis below.

Hypothesis 2*: Perceived risks of EMs and the extent of EM usage are negatively correlated*

3.2.3 Research Hypothesis 3

This hypothesis is dealing with the relationship between purchasing situations and the extent of EM usage. The purchasing function has a substantial impact on the potential profit. The variety in purchasing needs, and thus the need to purchase in different ways, is also increasing, which confronts firms with new challenges (Dubois and Pedersen, 2002). Firms cannot effectively manage all purchases in the same way but must instead develop and implement a set of differentiated purchasing strategies. The diversification in purchasing situations of firms indicates that buyers may decide to adopt different types of EMs depending on purchasing situations. Rosenthal *et al.* (1993) conduct an empirical study on the usage of EMs in chemical industry. The results indicate the critical impact of purchasing policy on the decision of a firm to utilize an EM. Focusing on specific types of purchased items, Skjøtt-Larsen *et al.* (2003) postulate that firms should choose different types of EMs depending on their own purchased items. Using a purchasing portfolio proposed by Olsen and Ellram (1998), these authors developed a framework indicating an appropriate type of EMs for each category of purchased items.

In this study, purchasing situations are identified by two factors: the economic importance of purchases and the complexity of purchasing processes. The economic importance of purchases refers to the impacts of purchased items on the cost and quality of the final products. An item with high economic importance accounts for large purchase volume, is critical for final product performance, and shows strong demand growth. Since EMs enable buyers to access to a large supplier database and information about product availability and price comparison, buyers will be able to purchase items with high volume and good quality at lower costs and efforts. The complexity of purchasing processes

refers to supply risks (scarcity and substitution possibilities), logistic requirements, and business relationship. Higher complexity requires a stronger relationship between suppliers and buyers (Kraljic, 1983; Olsen and Ellram, 1997). By using EM, buyers can benefit from inter-firm collaboration which enables them build and deepen business relationships and overall supply chain performance; therefore smoothing the purchasing process and achieving purchased items as required. Accordingly, it can be said that the higher economic importance of purchases and complexity of purchasing processes the more likely the buyer uses EMs for purchasing. Based upon above discussions we hypothesize following hypotheses.

Hypothesis 3*: Purchasing situations and the extent of EM usage are positively correlated*

3.2.4 Research Hypothesis 4

When buyers perceive that EMs can create great benefits for them in purchasing process, they will be more likely to use EMs at the greater extent. Nevertheless, the success of EM usage depends on setting up EMs with the right technology platform which can be integrated with participants' existing systems (Brunn *et al.*, 2002). This may require the buyer to commit certain resources to deploy IT applications and infrastructures that link its internal business processes and enterprise systems to an EM's trading platform. If a buyer already has experiences and capability in using information technologies, information systems and the Internet to facilitate the purchasing process, the extent of EMs usage will be increased.

Firms that have utilized the Internet will more likely adopt the Internet for business transactions (Walczuch *et al.*, 2001). In contrast, firms that have never used the

Internet and have no Internet access will have negative image of the Internet. From the logistics point of view, an empirical study by Rutner *et al.* (2003) indicates that companies that have successfully implemented integrated logistics are significantly more likely to have also implemented some form of e-commerce than those who have not, although the type of e-commerce applications varies considerably. More advanced companies are beginning to extend their logistics operations to e-commerce environment through the implementation of Internet-based purchasing and Extranet-based SCM applications. When a firm is uncertain about whether it has appropriate resources and experiences to use EMs successfully, the benefits of EMs will not be fully exploited. Likewise, companies that are more ready for e-business implementation, through using information technologies and the Internet for enhancing purchasing process and using IS/IT for enhancing supply chain management, will feel that they are more capable of succeeding in utilizing EMs; thereby, using more EMs at the greater extent (Davila *et al.*, 2003).

The impacts of e-business readiness may not be identical among different types of EMs. While all types of EMs require participants to have some certain knowledge, experiences, and capabilities in using information technologies and the Internet for purchasing, ISMs and PTNs may requires e-business readiness at higher level than do 3PXs. The reason is that ISMs and PTNs enable participants to integrate and collaborate closely with their partners, indicating more complex EM platform and integrated systems. In order to succeed participants must have sufficient capabilities to adapt their business processes to EM platform and systems (Le, 2003).

E-business readiness will strengthen market aggregation created by EMs. As discussed in Chapter Two, EMs enable buyers to reduce searching efforts with the capability to access the supplier base, and obtain necessary information about supplier, products, and price. This benefit will be strengthened if the buyers already have some capabilities of using information systems and the Internet for purchases. Their e-business readiness will help them work more successfully and effectively with EMs. The inter-firm collaboration will also be strengthened if the buyers have good information system infrastructure and capability. Inter-firm collaboration enables participants to build and deepen their business relationships with partners. This usefulness can be achieved extensively only if buyers have strong information systems and large experiences in using IT and the Internet for purchasing. This capability will allow them to integrate and collaborate successfully with suppliers, thereby enhancing the business relationships. Those arguments provide the rationale for the following hypothesis

Hypothesis 4*: E-business readiness moderates the relationship between expected benefits and the extent of EM usage*

3.2.5 Research Hypothesis 5

E-business readiness also has an impact on the relationship between perceived risks and the extent of usage of each type of EM. The higher the perceived risks, the less likely the buyers will use EMs for purchasing. Thus, when the buyers perceive some risks that can be created in using EMs, they will be reluctant to use them. E-business readiness will be an important factor that helps them make the decision. If the buyers have high extent of e-business readiness, their appropriate resources and experiences in using information technologies and the Internet for purchasing will help them avoid many

mistakes, and reduce working time. In addition, using IT/IS for enhancing supply chain management at a great extent also allows the firm to be capable of interacting and collaborating with suppliers successfully through network communication. Thus, as firms perceive high risks of EMs (financial risks or trust barriers) and meanwhile they are ready for using e-business for purchasing, EM usage is not necessarily the best choice. They may want to select another online procurement option that they have used before and may be more secured such as e-procurement, Internet-based EDI, or decide to build their own solution to avoid those risks; hence they will be less likely to use EMs. Those arguments lead to following hypotheses.

Hypothesis 5*: E-business readiness moderates the relationship between perceived risks and the extent of EM usage*

In sum, this chapter provides a theoretical framework for understanding the factors influencing the extent of usage and types of EM and develops five hypotheses based on the literature review. The following chapter will discuss research methodology for generating items for measurement instruments.

CHAPTER FOUR: INSTRUMENT DEVELOPMENT - ITEM GENERATION AND PILOT TEST

In this chapter, the instruments for this research are developed and tested. As mentioned in Chapters One and Three, instruments need to be developed to measure expected benefits of EMs, perceived risks of EMs, e-business readiness, purchasing situations, and extent of EM usage.

The development of the instruments for those constructs was implemented through stages of pre-pilot study, pilot study using Q-sort method, and large-scale survey. In the pre-pilot stage, potential items were generated through a literature review and from construct definitions. Then the initial pool of items was pre-tested with four academicians and four practitioners. The respondents were asked to provide feedback about the clarity of the questions, instructions, and the length of the questionnaire. Based on the feedback, items were modified or discarded to strengthen the constructs and content validity. The second stage was scale development and testing through a pilot study using Q-sort method. Items placed in a common pool were subjected to three sorting rounds by the judges to establish which items should be in the various categories. The objective was to pre-assess the convergent and discriminant validity of the scales by examining how the items were sorted into various construct categories. Analysis of inter-judge agreement

about the items placement identified both bad items as well as weaknesses in the original definitions of the constructs. The instruments were then further refined based on pilot study results. The third stage is later described in Chapter 5, including all the validity and reliability tests using the data from a large-scale sample. Research hypotheses were then tested based on the large-scale data analysis.

4.1 Item Generation

This is a very first and very important stage. Proper generation of measurement items of a construct determines the validity and reliability of an empirical research. Items must be generated such that the high content validity is ensured; which means the measurement items contained in an instrument should cover the major content of a construct (Churchill, 1979). Content validity is usually achieved through a comprehensive literature review and interviews with practitioners and academicians. A list of initial items for each construct was generated based on a comprehensive review of relevant literature. The general literature bases for items in each construct are briefly discussed below.

Items for Expected Benefits of EMs (Market Aggregation and Inter-Firm Collaboration) were generated based upon a comprehensive review of EM literature (Bakos 1991, 1997, 1998; Barratt and Rosdahl, 2002; Bloch and Catfolis, 2001; Brunn *et al.*, 2002; Chircu and Kauffman, 1999; Evan and Wurster, 1999; Kauffman and Walden, 2001; Le, 2002; Mahadevan, 2000; Malone *et al.*, 1987; Narasimhan and Jayaram, 1998; Narasimhan and Kim, 2001). Items for Perceived Risks of EMs (Financial Risks, and Trust Barriers) were generated based upon previous studies on e-procurement and EMs (Abell and Lim, 1996; Brunn *et al.*, 2002; Davila *et al.*, 2003; Golsby and Eckert, 2003;

Kheng and Al-Hawamdeh; 2002; Purao and Capbell, 1998; Walczuch *et al.*, 2000; Zhu, 2002). Items for E-Business Readiness (Information Technology Usage For Facilitating Purchasing, Internet Usage For Facilitating Purchasing, IS/IT Usage For Enhancing SCM) were generated through the literature on IS/IT usage, Internet usage, IS/IT usage for enhancing SCM (Akkermans *et al.*, 2003; Bardi *et al.*, 1994; Bowersox and Daugherty, 1995; Grover and Malhotra, 1997; Lancioni *et al.*, 2000; Lee *et al.*, 1999; Narasimhan and Kim, 2001; Olson and Boyer, 2003; Prekumar and Ramamurthy, 1995; Sriram *et al.*, 1997; Sanders and Premus, 2002; Vadapali and Ramamurthy, 1998; Walczuch *et al.*, 2000). Items for Purchasing Situations (Economic Importance of Purchases and Complexity of Purchasing Processes) were generated primarily based on a comprehensive review of purchasing portfolio literature (Aderson and Katz, 1998; Croom, 2000; Hadeler and Evans, 1994; Kraljic, 1983; Olsen and Ellram, 1997). Finally, items for Extent of EM Usage (Extent of Current Usage of EM and Extent of Usage of EM Planned for Future) were generated mainly through some recent studies on EMs (Gottshalk and Abrahamsen, 2002; Rosenthal *et al.*, 1993; Zhu, 2002; Skjøtt-Larsen *et al.*, 2003).

After item pools were created, items for the various constructs were reviewed by four academicians and re-evaluated by four practitioners. The purpose of this step was to check the relevance of each construct's definition and clarity of wordings of sample questionnaire items. Redundant and ambiguous items were either modified or eliminated based on the feedback from the academicians and practitioners. New items were added whenever deemed necessary. The result was the following number of items in each pool entering Q-sort analysis (see Appendix A). There were a total of 11 pools and 62 items.

Expected Benefits of EMs	
Market aggregation	10
Inter-firm collaboration	8
Perceived Risks of EMs	
Financial risks	3
Trust barriers	8
E-business Readiness	
Information technology usage for facilitating purchasing	4
Internet usage for facilitating purchasing	6
IS/IT usage for enhancing SCM	7
Purchasing Situations	
Economic importance of purchases	3
Complexity of purchasing process	6
Extent of EM usage	
Extent of current usage of EM	3
Extent of usage of EM planned for future	2
Total	61

4.2 Scale Development: The Pilot Study Using Q-Sort Method

The pilot study was implemented using Q-sort method. The Q-sort method is an iterative process in which the degree of agreement between judges forms the basis of assessing construct validity and improving the reliability of the constructs. The method consists of two stages. In the first stage, two judges are requested to sort the questionnaire items according to different constructs, based on which the inter-judge agreement is measured. In the second stage, questionnaire items that were identified as being too ambiguous, as a result of the first stage, are reworded or deleted in an effort to improve the agreement between the judges. The process is carried out repeatedly until a satisfactory level of agreement is reached.

In this research, items placed in a common pool were subjected to three Q-sort rounds with two independent judges per round. Since purchasing managers will be the potential respondents, in this procedure purchasing managers acted as judges. Six

purchasing managers who have good understanding of the subject matter were contacted and agreed to be a judge. They were asked to sort the items into different groups corresponding to a factor or dimension, based on similarities and differences among items. An indicator of construct validity was the convergence and divergence of items within the categories. If an item was consistently placed within a particular category, then it was considered to demonstrate convergent validity with the related construct, and discriminant validity with the others. Analysis of inter-judge disagreements about item placement identified both bad items, as well as weaknesses in the original definitions of constructs. Based on the misplacements made by the judges the items could be examined and inappropriately worded or ambiguous items could be either modified or eliminated.

4.2.1 Sorting Procedures

Each item was printed on a 3" by 5" card and the set of cards for each construct were shuffled and given to the judges. The judges were also given the definition of the constructs. They were then asked to put each card under one of constructs according to the best of their knowledge. A "Not Applicable" category was also included to ensure that the judges did not force any item into a particular category. Prior to sorting the cards, the judges were provided a brief introduction about the research and a standardized instruction about the Q-sort procedure. Judges were allowed to ask as many as questions as necessary to ensure they understood the procedure.

4.2.2 Inter-Rater Reliabilities

Three different measures were used to assess the inter-rater reliability. First, for each pair of judges in each sorting step, the inter-judge raw agreement scores were calculated. This was done by counting the number of items both judges agreed to place in

a certain category. An item was considered as an agreed item, though the category in which the item was sorted together by both judges may not be the originally intended category. Second, the level of agreement between the two judges in categorizing the items was measured using Cohen's Kappa (Cohen, 1960). This index is a method of eliminating chance agreements, thus evaluating the true agreement score between two judges. A description of the Cohen's Kappa concept and methodology is included in Appendix B. Third, item placement ratios were calculated by counting all the items that were correctly sorted into the target category by each of the judges and dividing them by twice the total number of items.

4.2.3 Results of First Sorting Round

In the first round, the inter-judge raw agreement scores averaged 90% (Table 4.2.3.1), the initial overall placement ratio of items within the target constructs was 92% (Table 4.2.3.2), and the Cohen's Kappa score averaged 0.89.

Cohen's Kappa coefficient can be calculated as follows.

$$k = \frac{N_i X_{ii} - \sum_i (X_{i+} X_{+i})}{N_i^2 - \sum_i (X_{i+} X_{+i})} = \frac{(61)(55) - 395}{(61^2) - 395} = .89$$

The information in Table 4.2.3.1 was used to calculate the k coefficient; where N_i is the number of total items (61), X_{ii} is the total number of items on the diagonal (that is, the number of items agreed on by two judges), X_{i+} is the total number of the items on the i^{th} row of the table, and X_{+i} is the total number of items on the i^{th} column of the table (see Appendix B for the description of this methodology).

Table 4.2.3.1: Inter-Judge Raw Agreement Scores: First Sorting Round

		Judge 1											
		1	2	3	4	5	6	7	8	9	10	11	NA
Judge 2	1	3											
	2		2										
	3			3	1								
	4			1	6								
	5					7							
	6						10						
	7						1	7					
	8								3	1			
	9									7			
	10										3	1	
	11										1	4	
	NA												0
Total Items Placement: 61					**Number of Agreement: 55**					**Agreement Ratio: 90%**			

Legend:

1 Extent of current usage of EM
2 Extent of usage of EM planned for future
3 Information technology usage for facilitating purchasing
4 Internet usage for facilitating purchasing
5 IS/IT usage for enhancing SCM
6 Market aggregation
7 Inter-firm collaboration
8 Financial risks
9 Trust barriers
10 Economic importance of purchase
11 Complexity of purchasing process

Table 4.2.3.2: Items Placement Ratios: First Sorting Round

		Actual Categories													
Theoretical Categories		1	2	3	4	5	6	7	8	9	10	11	NA	T	%
	1	6												6	100%
	2		4											6	100%
	3			8	2									10	80%
	4				12									12	100%
	5					14								14	100%
	6						18	2						20	90%
	7						3	13						16	81%
	8								6					6	100%
	9								1	15				16	94%
	10										6			6	100%
	11										2	10		12	83%
Total Items Placement: 122						**Number of Hits: 112**					**Overall Hit Ratio: 92%**				

Table 4.2.3.3 shows a summary of inter-judge agreement indices in the first round. According to Landis and Koch (1977), Cohen's Kappa coefficient of 0.89 indicates an excellent level of agreement (beyond chance) for the judges in the first round. This value is slightly lower than the value for raw agreement which is 0.90. The level of item placement ratios averaged 0.92. Six constructs (Extent of Current Usage of EM, Extent of Usage of EM Planned for Future, Internet Usage for Facilitating Purchasing, IS/IT Usage for Enhancing SCM, Financial Risks, and Economic Importance of Purchases) obtained a 100% item placement ratio. The construct with lowest item placement ratio of 80% is Information Technology Usage for Facilitating Purchasing, indicating an acceptable degree of construct validity.

Table 4.2.3.3: Inter-Judge Agreements - Round 1

Agreement Measure	**Round 1**
Raw Agreement	90%
Cohen's Kappa	89%
Placement Ratio Summary	
Extent of current usage of EM	100%
Extent of usage of EM planned for future	100%
Information technology usage for facilitating purchasing	80%
Internet usage for facilitating purchasing	100%
IS/IT usage for enhancing SCM	100%
Market aggregation	90%
Inter-firm collaboration	81%
Financial risks	100%
Trust barriers	94%
Economic importance of purchase	100%
Complexity of purchasing process	83%
Average	**92%**

An examination on the off-diagonal entries in the placement matrix (Table 4.2.3.2) was conducted in order to improve the Cohen's Kappa measure of agreement. Results agree very well for internal consistency measurements, because the off-diagonals showed a clustering, rather than a scattering of items. The examination revealed one significant cluster involving two constructs (market aggregation and inter-firm collaboration). An analysis of this cluster was conducted to identify ambiguous items (fitting in more than one category) or indeterminate items (fitting in no category), and were reworded. No item was placed in Not Applicable (NA). Also, the feedback from

both judges was obtained on each item and incorporated into the modification of items. Overall, two items were reworded. Since the first round achieved an excellent overall placement ratio of items within the target constructs (92%), we decided to keep all the items for the second sorting round.

4.2.4 Results of Second Sorting Round

The same procedure was used again in the second round, including the reworded items after the first sorting round. Two other judges were asked to cooperate in this round. Results showed that the inter-judge raw agreement scores averaged 90% (Table 4.2.4.1), the initial overall placement ratio of items within the target constructs was 95% (Table 4.2.4.2), and the Cohen's Kappa score averaged 0.89. A summary of inter-judge agreement indices in the second round is shown in Table 4.2.4.3. The value for Kappa coefficient of .89 is the same as the value obtained in the first round. The level of item placement ratios averaged 0.95, indicating a good improvement. Six out of 11 constructs (Extent of Current Usage of EM, Extent of Usage of EM Planned for Future, Internet Usage for Facilitating Purchasing, Financial Risks, Trust Barriers, and Economic Importance of Purchases) obtained a 100% item placement ratio, indicating a high degree of construct validity. The lowest item placement ratio value was 0.81 for Inter-Firm Collaboration, indicating an acceptable degree of construct validity.

Table 4.2.4.1: Inter-Judge Raw Agreement Scores: Second Sorting Round

		Judge 1											
		1	2	3	4	5	6	7	8	9	10	11	NA
Judge 2	1	3											
	2		2										
	3			4									
	4			1	6								
	5			1		6							
	6						9						
	7						2	7					
	8								3				
	9									8			
	10										3		
	11										2	4	
	NA												0
Total Items Placement: 61					**Number of Agreement: 55**					**Agreement Ratio: 90%**			

Table 4.2.4.2: Items Placement Ratios: Second Sorting Round

		Actual Categories													
		1	2	3	4	5	6	7	8	9	10	11	NA	T	%
Theoretical Categories	1	6												6	100%
	2		4											6	100%
	3			9	1									10	90%
	4				12									12	100%
	5			1		13								14	93%
	6						19	1						20	95%
	7						1	15						16	94%
	8								6					6	100%
	9									16				16	100%
	10										6			6	100%
	11										2	10		12	83%
Total Items Placement: 122						**Number of Hits: 116**					**Overall Hit Ratio: 95%**				

Table 4.2.4.3: Inter-Judge Agreements - Round 2

Agreement Measure	**Round 2**
Raw Agreement	90%
Cohen's Kappa	89%
Placement Ratio Summary	
Extent of current usage of EM	100%
Extent of usage of EM planned for future	100%
Information technology usage for facilitating purchasing	90%
Internet usage for facilitating purchasing	100%
IS/IT usage for enhancing SCM	93%
Market aggregation	95%
Inter-firm collaboration	94%
Financial risks	100%
Trust barriers	100%
Economic importance of purchase	100%
Complexity of purchasing process	83%
Average	**95%**

In order to improve the Cohen's Kappa measure of agreement, an examination on the off-diagonal entries in the placement matrix (Table 4.2.4.2) was conducted. The analysis showed a slight cluster between the constructs Market Aggregation and Inter-Firm Collaboration. The same problem had appeared in the first sorting round, but the situation had improved. In the first round, the two judges misplaced two items for Market Aggregation and three items for Inter-Firm Collaboration; while in second round, the two judges just misplaced one item for each of these two constructs respectively. Since these

two constructs are highly correlated, the slight overlap between these two constructs can be considered acceptable.

Similarly to the first round, the second round results agree very well for internal consistency measurements, because the off-diagonals showed a clustering, rather than scattering. Since the misplacement of the fourth item of construct Information Technology Usage for Facilitating Purchasing appeared again, we decided to delete this item. The second round achieved an excellent overall placement ratio of items within the target constructs (95%), we kept the rest of items for the third sorting round. Thus, there were 60 items in the third sorting round.

4.2.5 Results of Third Sorting Round

Again, in this round another two judges were involved in the sorting round with some modifications after the second sorting round. In the third round, the inter-judge raw agreement scores averaged 92% (Table 4.2.5.1), the initial overall placement ratio of items within the target constructs was 94% (Table 4.2.5.2), and the Cohen's Kappa score averaged 0.91. Thus, the result indicated a great improvement in the third round.

A summary of inter-judge agreement indices in the third round is shown in the third column of Table 4.2.5.3. The value for the Kappa coefficient of .91 showed a significant improvement (the Kappa coefficient in the first and second sorting round is 0.89), indicating an excellent level of agreement for judges in the third round. The level of item placement ratios averaged 0.94 which is very close to the second round. Six constructs (Extent of Current Usage of EM, Extent of Usage of EM Planned for Future, Internet Usage for Facilitating Purchasing, IS/IT Usage for Enhancing SCM, Market

Aggregation, Financial Risks) obtained a 100% item placement ratio, indicating a high degree of construct validity.

Table 4.2.5.1: Inter-Judge Raw Agreement Scores: Third Sorting Round

		Judge 1											
		1	2	3	4	5	6	7	8	9	10	11	NA
Judge 2	1	3											
	2		2										
	3			3	1								
	4				6								
	5					7							
	6						10						
	7						1	7					
	8								3				
	9								1	7			
	10										3	1	
	11										1	4	
	NA												0
Total Items Placement: 60					**Number of Agreement: 55**					**Agreement Ratio: 92%**			

Table 4.2.5.2: Items Placement Ratios: Third Sorting Round

		Actual Categories													
		1	2	3	4	5	6	7	8	9	10	11	NA	T	%
Theoretical Categories	1	6												6	100%
	2		4											6	100%
	3			7	1									8	88%
	4				12									12	100%
	5					14								14	100%
	6						20							20	100%
	7						3	13						16	81%
	8								6					6	100%
	9								1	15				16	94%
	10										6	1		7	86%
	11										1	10		11	91%
Total Items Placement: 120						**Number of Hits: 113**					**Overall Hit Ratio: 94%**				

Table 4.2.5.3: Inter-Judge Agreements - Round 3

Agreement Measure	**Round 3**
Raw Agreement	92%
Cohen's Kappa	91%
Placement Ratio Summary	
Extent of current usage of EM	100%
Extent of usage of EM planned for future	100%
Information technology usage for facilitating purchasing	88%
Internet usage for facilitating purchasing	100%
IS/IT usage for enhancing SCM	100%
Market aggregation	100%
Inter-firm collaboration	81%
Financial risks	100%
Trust barriers	94%
Economic importance of purchase	86%
Complexity of purchasing process	91%
Average	**94%**

From Table 4.2.5.3, the Inter-Firm Collaboration construct has lowest degree of construct validity (0.81), indicating necessary modification. Examining Table 4.2.5.2 showed that inter-firm collaboration construct reveals a light scattering of items raising concern for the level of its internal consistency. Two items of this construct were reworded in accordance with feedbacks from judges. The other constructs achieved a high degree of construct validity (the lowest item placement ratio is 86%). Thus, the number of items remaining for each construct after the third round of Q-sort was as follows:

Expected Benefits of EMs	
Market aggregation	10
Inter-firm collaboration	8
Perceived Risks of EMs	
Financial risks	3
Trust barriers	8
E-business Readiness	
Information technology usage for facilitating purchasing	3
Internet usage for facilitating purchasing	6
IS/IT usage for enhancing SCM	7
Purchasing Situations	
Economic importance of purchases	3
Complexity of purchasing process	6
Extent of EM usage	
Extent of current usage of EM	3
Extent of usage of EM planned for future	2
Total	**60**

At this point, we stopped the Q-sort method at the round three. The raw agreement score of .92, Cohen's Kappa of .92, and the average placement ratio of .94 were considered an excellent level of inter-judge agreement, indicating a high level of reliability and construct validity. The resulting measurement scales for all constructs are reported in Appendix C and will be used in the large-scale survey (Appendix D). In the next chapter the tests for the quantitative assessment of construct validity and reliability using the large-scale sample are presented.

CHAPTER FIVE: LARGE SCALE SURVEY AND INSTRUMENT VALIDATION

5.1 Large-Scale Data Collection Methodology

A large-scale survey was conducted to collect data for this dissertation. The quality of respondents and the response rate are two important factors influencing the quality of an empirical study. Since this research focuses on the usage of EMs from the buyer perspective, it was decided to choose purchasing professionals as respondents for the current study. A mailing list was provided by the Institute for Supply Management (ISM), a national association about purchasing management with a very large number of members over the world. From the ISM member database, 8000 names were randomly selected. Eight SIC codes are covered in the study indicating eight different industries: 20 "Food and Kindred Products", 26 "Papers & Allied Products", 27 "Printing and Publishing", 30 "Rubber and Miscellaneous Plastic Products", 34 "Fabricated Metal Products", 36 "Electronic and Other Equipment", 37 "Transportation Equipment", and 48 "Communication".

This mailing list was then further refined through the following steps: 1) this survey was conducted in US only; therefore, members from other countries were removed from the list; 2) some names did not have an email address. Since this was a Web-based survey and an email was sent to all respondents with the link of Web-based survey, only names with an email address were picked; 3) a similar survey was conducted prior to this survey and the researchers used a mailing list from ISM as well.

In order to increase the response rate, it was decided to remove duplicated names. Those duplicated names showed up in three SIC codes: 34, 36, and 37; 4) if there were multiple names from the same organization, the person with the most relevant job title was picked and the others were removed; 5) some same names appeared in more than one SIC code, therefore only one was kept; 6) some obvious errors in names and mailing addresses were also corrected. The refinement resulted in a list of 4095 names.

Since the surveys were sent by email, the email address had to be filtered by a server program to guarantee that the email addresses were valid according to certain standard. Moreover, since the member database provided by ISM was not up-to-date, many of them had moved, left employment, or retired and were no longer ISM's members. This number did not count in the final sample size since the respondents never received the survey. This resulted in the removal of 1069 names from the list. Accordingly, the final mailing contained 3026 names.

The survey was conducted using the Web-based method. To ensure a reasonable response rate, the survey was sent in two waves. The questionnaire with a cover letter indicating the purpose and significance of the study was emailed to target respondents. In the cover letter, the respondents were given three options to send the response: 1) online completion and submission: a web link was given so that they could complete the questionnaire online and send it immediately; 2) download the hard copy online: a link to the questionnaire in .pdf file was given and respondents could send it by fax or ask for a self-addressed stamped envelop; 3) request the hard copy by sending an email: they received in their regular mail a copy of the questionnaire along with a self-addressed stamped envelope.

There were a total of 370 responses from the mailings. Of these responses, 11 questionnaires were returned with many unanswered questions with notes indicating that they were unable to answer all questions because they never used EMs and had no clue to answer most of the questions. Therefore, the final number of complete and usable responses was 359. This represents a response rate of 11.86% (calculated as **359/3026**), indicating a reasonable and acceptable response rate. Out of 359 responses, the first wave produced 196 responses, and the second wave generated 163 responses. In addition, out of those responses, 330 were received via email and 29 were received via mail or fax.

5.2 Sample Characteristics of the Respondents and Organizations

This section will discuss sample characteristics in terms of the respondents (job title and years stayed at the organization), and the organizations (industry, business time, employment size, annual sales, purchasing budget).

5.2.1 Sample Characteristics of the Respondents

The result is shown in Table 5.2.1.1.

Job Title: Most of the respondents (74%) are purchasing managers, while 12.69% state they are director of procurement and 5.88% are titled as vice president of materials. The rest of respondents (7.43%) belong to the "other" category. Overall, the respondents of this survey are persons responsible for procurement and they are qualified to answer all questions revealing the buyer perspective.

Years worked at the organization**:** 33.44 % of respondents indicate that they have been with the organization over 10 years, 26.11% indicate having been at the organization between 6-10 years, and 35.99% state their years stayed at the organization

as between 2-5 years. Respondents with years stayed at the organization less than 2 years account for only 4.46% of the sample.

Figure 5.2.1.1 and 5.2.1.2 display respondents by job titles and years worked at the organization, respectively.

Table 5.2.1.1: Characteristics of the Respondents

1.	**Job Titles** (323)		
	Vice president of materials	19	5.88%
	Director of procurement	41	12.69%
	Purchasing manager	239	73.99%
	Other	24	7.43%
2.	**Years worked at the organization** (314)		
	Under 2 years	14	4.46%
	2-5 years	113	35.99%
	6-10 years	82	26.11%
	Over 10 years	105	33.44%

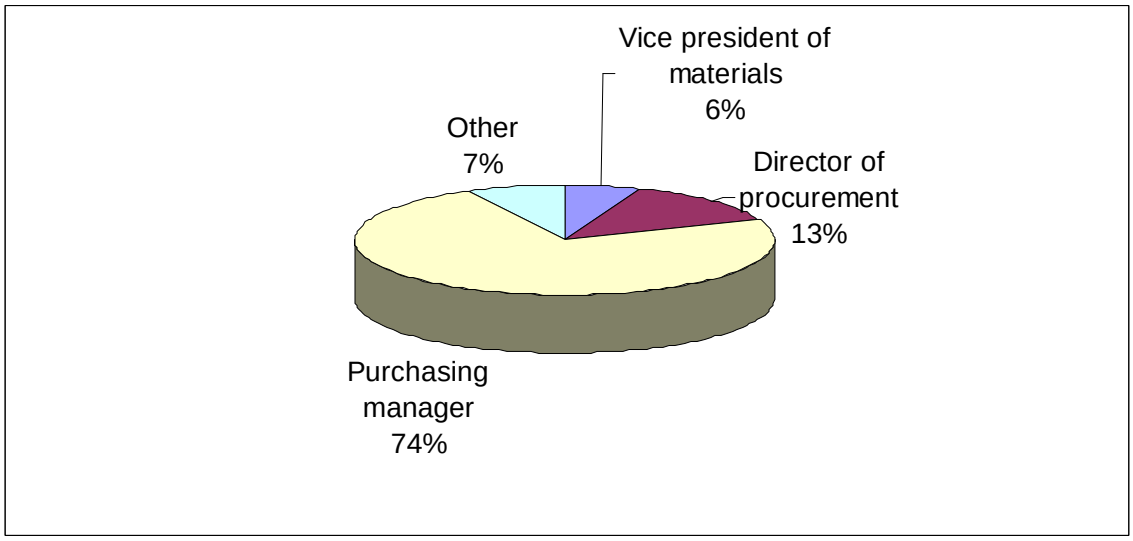


Figure 5.2.1.1: Respondents by Job Title

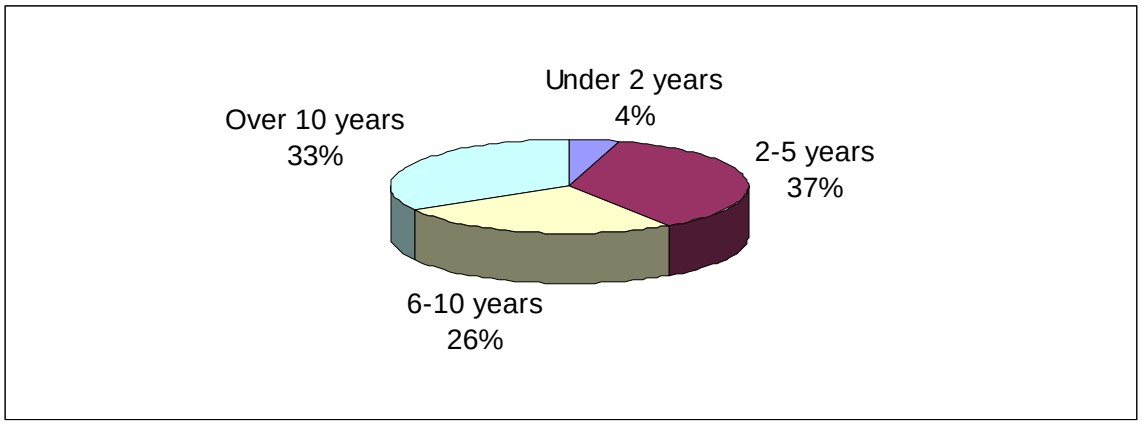


Figure 5.2.1.2: Respondents by Years Worked at Organization

5.2.2 Sample Characteristics of Surveyed Organizations

The result is shown in Table 5.2.2.1.

Industry (based upon SIC code): Many respondents (29.25%) indicate their organization is in the Electronic and Other Equipment industry; 14.48% of respondents are in the Food and Kindred Products industry; the same number of them (12.26%) is in the Fabricated Metal Products industry and the Communication industry; while 9.19% of them are in the Paper and Allied Products industry. Finally, 7.52% and 6.69% of respondents are in the Printing and Publishing industry and the Rubber and Miscellaneous Plastic Products industry, respectively.

Number of employees: The number of employees indicates the diversification of the organization ranging from the small size to the large size. More than half of organizations are large size (20.35% of organizations have more than 10000 employees, 28.42 % of organizations have between 1001 and 10000 employees, and another 12.63% have between 501 to 1000 employees). Organizations with between 251-500 employees account for 15.79% of the sample, the ones with between 100-250 employees account for 12.28% of the sample, and the rest (10.53%) have less than 100 employees.

Business time: More than half of organizations (58.25%) have been in business for between 11 and 50 years. 26.86% of them indicate that they have been in business for between 51 and 100 years, while only 9.71% have been in business for more than 100 years. The rest of them (5.18%) are very new organizations, since they have been in business for less than 10 years.

Annual sales: More than half of organizations have very high annual sales (36.99% earn more than 1 billion USD, and 31.05% earn between 100 millions to 1 billion USD). 20.55% of them have the revenue between 10 and 25 millions USD per year, while a low percentage of them have earned less than 10 millions USD per year (5.02% have revenue between 10 and 25 millions USD per year, and only 1.83% earn between 5 and 10 millions USD per year). The rest of them (only 4.57%) have annual sales less than 5 millions USD.

Purchasing budget: Almost half of organizations (43.11%) spend more than 100 millions USD per year for purchasing, while 22.75% spend between 25 and 100 millions for purchasing. The number of organizations that have a purchasing budget between 10 and 25 millions USD account for 17.37% of the sample and those spending between 1 and 10 millions USD account for 11.98% of the sample. The rest of them (only 4.79%) have the purchasing budget less than 1 million USD.

Figure 5.2.2.1, 5.2.2.2, 5.2.2.3, 5.2.2.4 and 5.2.2.5 display organizations by industry, number of employees, business time, annual sales, and purchasing budget, respectively. Overall, the diversification in industry type, company size and experiences in operations indicates that this survey has covered a wide range of organizations in different industries with different sizes and experiences, of which more than half of

organizations are large organizations with reasonable operations time in business and high annual sales.

Table 5.2.2.1: Characteristics of the Surveyed Organizations

1.	**Industry - SIC** (359)		
	Food and Kindred Products (20)	52	14.48%
	Paper and Allied Products (26)	33	9.19%
	Printing and Publishing (27)	27	7.52%
	Rubber and Miscellaneous Plastic Products (30)	24	6.69%
	Fabricated Metal Products (34)	44	12.26%
	Electronic and Other Equipment (36)	105	29.25%
	Transportation Equipment (37)	30	8.36%
	Communication (48)	44	12.26%
2.	**Number of employees** (285)		
	<= 100	30	10.53%
	101 - 250	35	12.28%
	251 - 500	45	15.79%
	501 - 1000	36	12.63%
	1001 - 10000	81	28.42%
	> 10000	58	20.35%
3.	**Business time (in years)** (308)		
	Under 10 years	16	5.18%
	11 - 50 years	180	58.25%
	51 - 100 years	83	26.86%
	More than 100 years	30	9.71%
4.	**Annual Sales (in USD)** (219)		
	Less than 5 millions	10	4.57%
	5 millions to < 10 millions	4	1.83%
	10 millions to < 25 millions	11	5.02%
	25 millions to <100 millions	45	20.55%
	100 millions to < 1 billion	68	31.05%
	More than 1 billion	81	36.99%
5.	**Purchasing budget (in USD)** (167)		
	Less than 1 million	8	4.79%
	1 million to < 10 millions	20	11.98%
	10 million to < 25 millions	29	17.37%
	25 millions to < 100 millions	38	22.75%
	More than 100 millions	72	43.11%

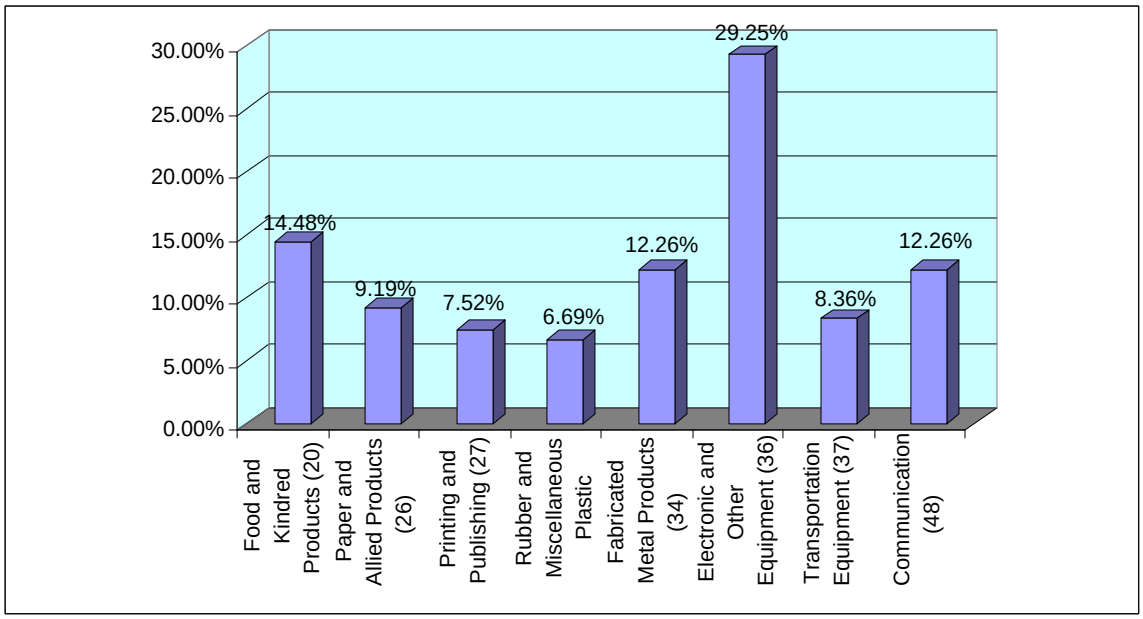


Figure 5.2.2.1: Organizations by Industry (SIC Codes)

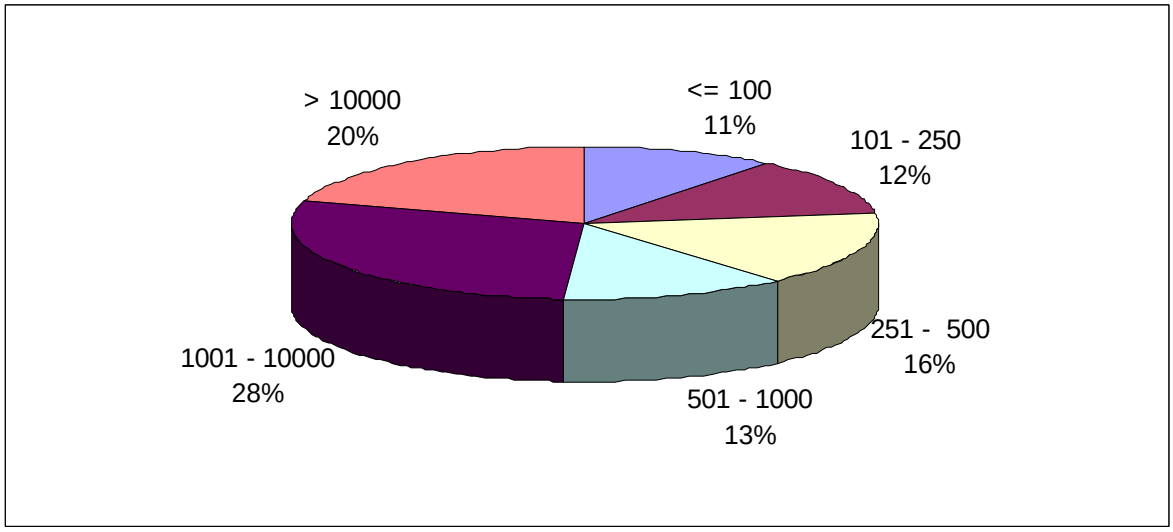


Figure 5.2.2.2: Organizations by Number of Employees

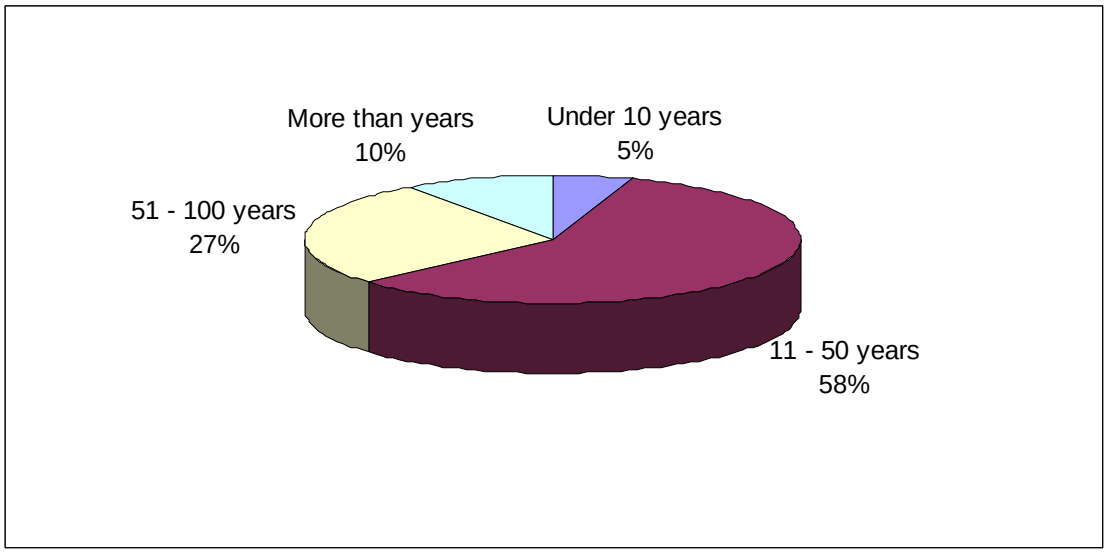


Figure 5.2.2.3: Organizations by Business Time

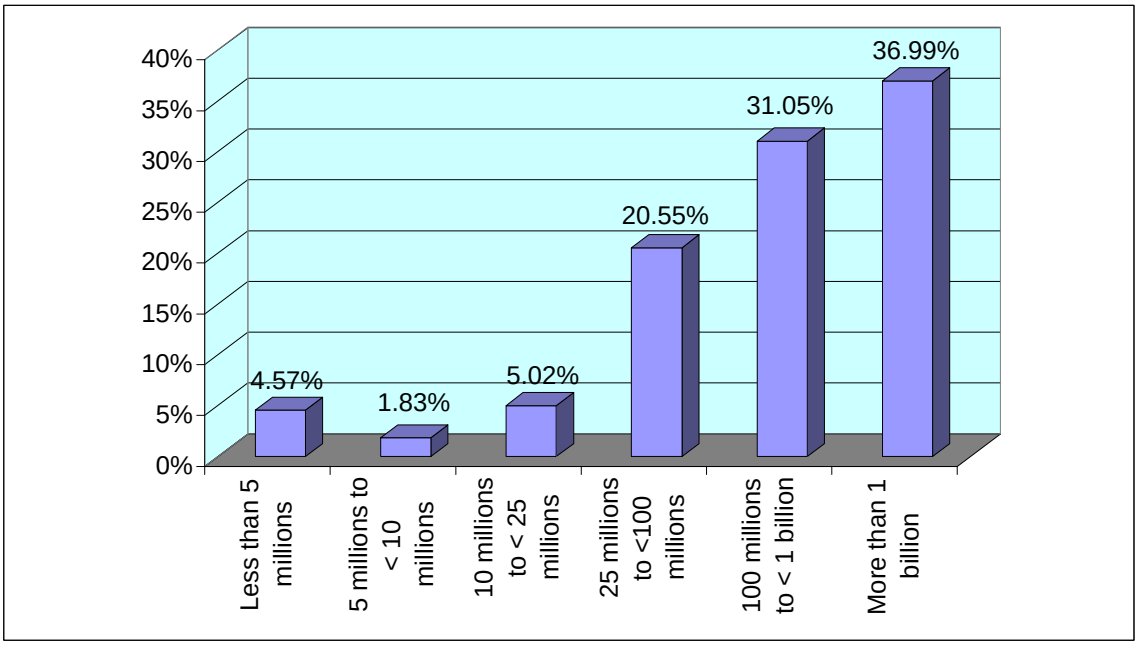


Figure 5.2.2.4: Organizations by Annual Sales

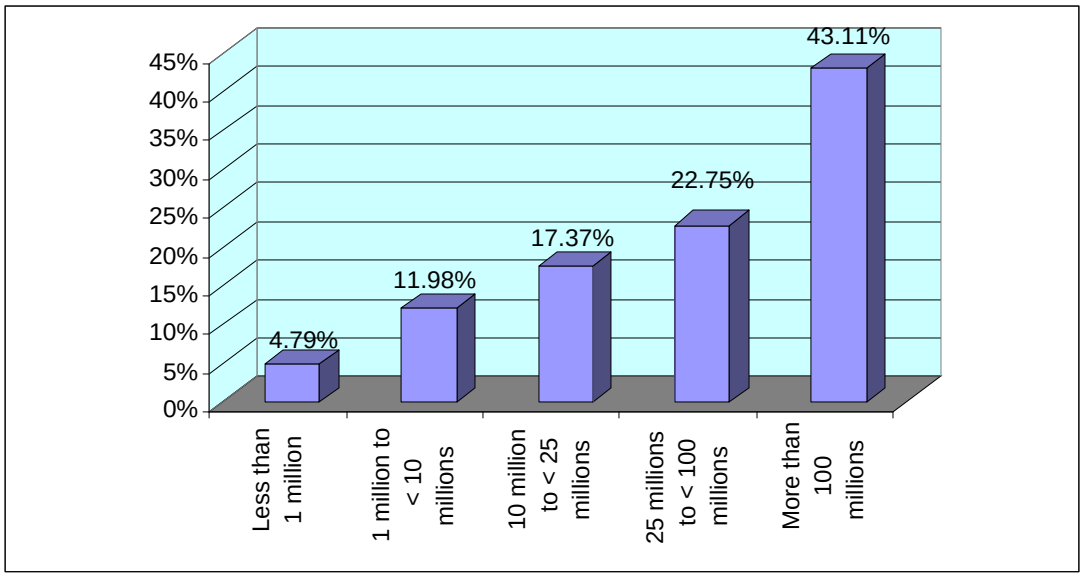


Figure 5.2.2.5: Organizations by Purchasing Budget

5.3. Extent of EM Usage

This section provides a summary of the extent of EM usage (not at all - 1, small extent - 2, moderate extent - 3, considerable extent - 4, and great extent - 5). Extent of current usage by EM type is shown in Table 5.3.1 and extent of planned usage by EM type is shown in Table 5.3.2.

Overall, nearly 54 percent of the survey respondents indicate their organizations currently use one or more EMs. Regarding individual EM types, the figures are around 30 percent for 3PXs and ISMs, and slightly higher (40%) for PTNs. Among the current users, only a small minority utilizes EMs of any type to a “considerable” or “great extent”. It can be seen that the extent of current EM usage is rather low, and this extent is not very different among three EM types.

Table 5.3.1: Extent of Current Usage by EM Type

	3PXs	ISMs	PTNs
Not applicable	5.3%	5.1%	6.5%
Not at all	64.6%	65.7%	60.1%
Small extent	15.4%	15.7%	17.7%
Moderate extent	7.0%	7.0%	5.9%
Considerable extent	2.5%	3.7%	4.8%
Great extent	5.1%	2.8%	5.1%

Regarding the extent of planned EM usage, it can be seen that many more companies have some definite plans to use EMs in the future. Specifically, around 56% of respondents indicate plan to use 3PXs or ISMs and around 54% has a plan to use PTNs. Although the extent of planned EM usage is higher than current usage, percentage of companies which plan to utilize EMs of any type to a "considerable" or "great extent" is still very low (about 11%). It also can be seen that there is no significant difference between three EM types as for extent of planned usage.

Table 5.3.2: Extent of Planned Usage by EM Type

	3PXs	ISMs	PTNs
Not applicable	4.5%	4.2%	5.1%
Not at all	44.4%	42.9%	46.0%
Small extent	28.1%	24.9%	25.4%
Moderate extent	11.8%	18.8%	15.5%
Considerable extent	5.3%	5.9%	5.6%
Great extent	5.9%	3.1%	7.3%

5.4 Between-Response Comparison

Between-response comparison is an important issue in conducting a large-scale survey since a bias may affect the validation of responses. The bias occurs when the observed value deviates from the population parameter due to differences between respondents from different sources. Researchers must ensure that the survey has no such difference.

In this research, two comparisons were made. The first comparison was made between those subjects who responded after the initial mailing and those who responded to the second wave, and between those who responded via email and those who responded via mail or fax. Chi-square tests were used to make the comparisons. Results of the comparison between the first wave and the second wave are shown in Table 5.4.1. It can be seen there is no significant difference in respondent's job title, years worked at the organization, industry, number of employees, business time, annual sales, purchasing budget, extent of current EM usage, and extent of planned EM usage between these two groups. The second comparison was made between email responses and mail or fax responses. Results of this comparison are shown in Table 5.4.2. Likewise, there is no difference between those two groups. Thus, it can be concluded that the bias is not a cause for concern.

Table 5.4.1: Comparisons between The First Wave and The Second Wave

Variables	First Wave	Second Wave	Chi-square Test
1. Job Title			
Vice president of materials	13	6	χ^2=3.64
Director of procurement	25	16	df=3
Purchasing manager	132	107	p>.10
Other	10	14	
Total	***180***	***143***	
2. Years Worked at The Organization			
Under 2 years	10	4	χ^2=2.068
2-5 years	63	50	df=3
6-10 years	42	40	p>.10
Over 10 years	59	46	
Total	***174***	***140***	
3. Industry – SIC			
Food and Kindred Products (20)	34	18	χ^2=5.67
Paper and Allied Products (26)	18	15	df=7
Printing and Publishing (27)	13	14	p>.10
Rubber and Miscellaneous Plastic Products (30)	14	10	
Fabricated Metal Products (34)	21	23	
Electronic and Other Equipment (36)	52	53	
Transportation Equipment (37)	18	12	
Communication (48)	26	18	
Total	***196***	***163***	
4. Number of Employees			
<= 100	18	12	χ^2=1.67
101 – 250	19	16	df=5
251 - 500	26	19	p>.10
501 – 1000	18	18	
1001 – 10000	47	34	
> 10000	29	29	
Total	***157***	***128***	
5. Business Time (In Years)			
Under 10 years	8	8	χ^2=0.89
11 - 50 years	101	79	df=3
51 - 100 years	46	37	p>.10
More than 100 years	19	11	
Total	***174***	***135***	
6. Annual Sales (in USD)			
Less than 5 millions	5	5	χ^2=3.18
5 millions to < 10 millions	2	2	df=5
10 millions to < 25 millions	8	3	p>.10
25 millions to <100 millions	27	18	
100 millions to < 1 billion	41	27	
More than 1 billion	41	40	
Total	***124***	***95***	
7. Purchasing Budget (In USD)			
Less than 1 million	4	4	χ^2=6.29
1 million to < 10 millions	16	4	df=4
10 million to < 25 millions	19	10	p>.10
25 millions to < 100 millions	19	19	
More than 100 millions	39	33	
Total	***97***	***70***	

Table 5.4.1: Comparisons between The First Wave and The Second Wave (cont.)

Variables	First Wave	Second Wave	Chi-square Test
8a. Extent of Current 3PX Usage			
Not applicable	14	6	χ^2=4.8
Not at all	121	110	df=5
Small extent	29	27	p>.10
Moderate extent	15	10	
Considerable extent	7	2	
Great extent	10	8	
Total	***196***	***163***	
8b. Extent of Planned 3PX Usage			
Not applicable	12	5	χ^2=6.78
Not at all	89	70	df=5
Small extent	45	55	p>.10
Moderate extent	26	16	
Considerable extent	12	8	
Great extent	12	9	
Total	***196***	***163***	
9a. Extent of Current ISM Usage			
Not applicable	10	9	χ^2=2.4
Not at all	126	110	df=5
Small extent	31	25	p>.10
Moderate extent	16	9	
Considerable extent	6	7	
Great extent	7	3	
Total	***196***	***163***	
9b. Extent of Planned ISM Usage			
Not applicable	10	6	χ^2=2.24
Not at all	79	75	df=5
Small extent	51	38	p>.10
Moderate extent	40	28	
Considerable extent	10	11	
Great extent	6	5	
Total	***196***	***163***	
10a. Extent of Current PTN Usage			
Not applicable	16	9	χ^2=4.57
Not at all	121	93	df=5
Small extent	35	29	p>.10
Moderate extent	9	12	
Considerable extent	8	9	
Great extent	7	11	
Total	***196***	***163***	
10b. Extent of Planned PTN Usage			
Not applicable	12	10	χ^2=1.53
Not at all	78	67	df=5
Small extent	51	39	p>.10
Moderate extent	31	24	
Considerable extent	9	12	
Great extent	15	11	
Total	***196***	***163***	

Table 5.4.2: Comparisons between The Email Responses and Mail/Fax Responses

Variables	Email Responses	Mail/Fax Responses	Chi-square Test
1. Job Title			
Vice president of materials	19	0	χ^2=2.04
Director of procurement	37	4	df=3
Purchasing manager	216	23	p>.10
Other	22	2	
Total	***294***	***29***	
2. Years Worked at The Organization			
Under 2 years	13	1	χ^2=1.18
2-5 years	100	13	df=3
6-10 years	76	6	p>.10
Over 10 years	96	9	
Total	***285***	***29***	
3. Industry - SIC			
Food and Kindred Products (20)	46	6	χ^2=4.32
Paper and Allied Products (26)	31	2	df=7
Printing and Publishing (27)	26	1	p>.10
Rubber and Miscellaneous Plastic Products (30)	24	0	
Fabricated Metal Products (34)	40	4	
Electronic and Other Equipment (36)	95	10	
Transportation Equipment (37)	28	2	
Communication (48)	40	4	
Total	***330***	***29***	
4. Number of Employees			
<= 100	27	3	χ^2=0.74
101 – 250	32	3	df=5
251 - 500	41	4	p>.10
501 – 1000	33	3	
1001 – 10000	71	10	
> 10000	52	6	
Total	***256***	***29***	
5. Business Time (In Years)			
Under 10 years	16	0	χ^2=2.75
11 - 50 years	160	20	df=3
51 - 100 years	77	6	p>.10
More than 100 years	27	3	
Total	***280***	***29***	
6. Annual Sales (In USD)			
Less than 5 millions	9	1	χ^2=2.84
5 millions to < 10 millions	4	0	df=5
10 millions to < 25 millions	10	1	p>.10
25 millions to <100 millions	36	9	
100 millions to < 1 billion	60	8	
More than 1 billion	71	10	
Total	***190***	***29***	
7. Purchasing Budget (In USD)			
Less than 1 million	8	0	χ^2=3.66
1 million to < 10 millions	18	2	df=4
10 million to < 25 millions	25	4	p>.10
25 millions to < 100 millions	30	8	
More than 100 millions	57	15	
Total	***138***	***29***	

Table 5.4.2: Comparisons between The Email Responses and Mail/Fax Responses (cont.)

Variables	Email Responses	Mail/ Fax Responses	Chi-square Test
8a. Extent of Current 3PX Usage			
Not applicable	17	3	χ^2=3.69
Not at all	215	16	df=5
Small extent	50	6	p>.10
Moderate extent	22	3	
Considerable extent	9	0	
Great extent	17	1	
Total	***330***	***29***	
8b. Extent of Planned 3PX Usage			
Not applicable	17	0	χ^2=2.95
Not at all	143	16	df=5
Small extent	92	8	p>.10
Moderate extent	39	3	
Considerable extent	19	1	
Great extent	20	1	
Total	***330***	***29***	
9a. Extent of Current ISM Usage			
Not applicable	17	2	χ^2=3.56
Not at all	221	15	df=5
Small extent	49	7	p>.10
Moderate extent	23	2	
Considerable extent	11	2	
Great extent	9	1	
Total	***330***	***29***	
9b. Extent of Planned ISM Usage			
Not applicable	14	2	χ^2=1.78
Not at all	143	11	df=5
Small extent	81	8	p>.10
Moderate extent	62	6	
Considerable extent	19	2	
Great extent	11	0	
Total	***330***	***29***	
10a. Extent of Current PTN Usage			
Not applicable	23	2	χ^2=2.01
Not at all	198	16	df=5
Small extent	59	5	p>.10
Moderate extent	19	2	
Considerable extent	16	1	
Great extent	15	3	
Total	***330***	***29***	
10b. Extent of Planned PTN Usage			
Not applicable	21	1	χ^2=1.62
Not at all	132	13	df=5
Small extent	82	8	p>.10
Moderate extent	50	5	
Considerable extent	20	1	
Great extent	25	1	
Total	***330***	***29***	

5.5 Large-scale Instrument Assessment Methodology

Instrument assessment is an important step in testing the research model. In order to validate the measurement instrument, the collected data needs to be analyzed according to the following objectives: first-order CFA (confirmatory factor analysis) model, second-order CFA model, and reliability. Methods that were used for each analysis are structural equation modeling (for first-order CFA and second-order CFA models), and Cronbach's alpha (for reliability).

Factor analysis is a statistical procedure for investigating relations between sets of observed and latent variables. In using this approach to data analyses, the covariation among a set of observed variables is examined to gather information on underlying latent constructs (i.e., factors). Confirmatory factor analysis (CFA) is appropriately used when the researcher has knowledge of the underlying latent variable structure. Based on knowledge of the theory, empirical research, or both, the researcher postulates relations between the observed measures and the underlying factors, and then tests this hypothesized structure statistically. The model would then be evaluated by statistical means to determine the adequacy of its goodness of fit to the sample data. Because the CFA model focuses solely on the link between factors and their measured variables it represents what has been termed a measurement model (Byrne, 1998). More recently, the structural equation modeling (SEM) has gained an increasing popularity due to its robustness and flexibility in establishing CFA. This research will thus use SEM to test the measurement model. CFA models include a first-order CFA model and a second-order CFA model. First-order CFA models are those in which correlations among the observed variables can be described by a smaller number of latent variables, each of

which may be considered to be one level, or one unidimensional arrow away from the observed variable; these factors are termed primary or first-order factors. Second-order CFA models are those in which correlations among the first-order factors, in turn, can be represented by a single factor, or at least a smaller set of factors. Relatedly, one can think of these higher order factors as being two levels, or two unidimensional arrows away from the observed variables; hence the term second-order factor (Byrne, 1998).

One of the most widely used SEM software is Joreskog and Sorbom's (1989) LISREL. Using LISREL, it is possible to specify, test, and modify the measurement model. Model-data fit was evaluated based on multiple fit indexes. The Chi-square is perhaps the most popular index to evaluate the goodness of fit of the model. It measures the difference between the sample covariance and the fitted covariance. However, the Chi-square index is sensitive to sample size and departures from multivariate normality. Therefore, it has been suggested that it must be interpreted with caution in most applications (Joreskog and Sorbom, 1989). For that reason, Chi-square/degree of freedom (df) is used with values less than 3 indicate good fit. Some of other measures of overall model fit are goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), normed-fit index (NFI), and root mean square residual (RMR). GFI indicates the relative amount of variance and covariance jointly explained by the model. The AGFI differs from GFI in that it adjusts for the number of degree of freedom in the model. NFI is a relative comparison of proposed model to the null model. CFI avoids the underestimation of fit often noted in small samples for NFI. Many researchers interpret these index scores (GFI, AGFI, CFI, NFI) in the range of .80-.89 as representing reasonable fit; scores of .90 or higher are considered as evidence of good fit

(Joreskog and Sorbom, 1989). The RMR indicates the average discrepancy between the elements in the sample covariance matrix and the model-generated covariance matrix. RMR values range from 0 to 1, with smaller values indicating better model; values less than .05 indicate good fit (Byrne, 1998).

Following Sethi and King (1994), iterative modifications were made for first-order and second-order CFA models by observing modification indices and coefficients to improve key model fit statistics. Further, as recommended by Joreskog and Sorbom (1989), only one item was altered at a time to avoid over-modification of the model. This iterative process continued until all model parameters and key fit indices met recommended criteria.

Finally, the reliability (internal consistency) of the items comprising each dimension was examined using Cronbach's alpha. Following the guideline established by Nunnally (1978), an alpha score of higher than .70 is generally considered to be acceptable.

The measurement model testing was done with two sub-data sets. The data was divided randomly into two sub-data sets: the first sub-data set with 180 responses and the second sub-data set with 179 responses. The measurement model was tested with the first sub-data set with necessary modification as discussed above, and then this modified measurement model was tested again with the second sub-data set to confirm the validation of the constructs.

5.6 Large-scale Measurement Results

The following section will present large-scale instrument validation results on each construct. For each construct, the instrument assessment methodology described in

the previous section was applied. There is an exception with two constructs: Extent of current usage of EM and Extent of usage of EM planned for future. In order to measure the extent of usage, we used a ratio scale for length of time, percentage of spending, and number of EMs. However, those items don't have consistent scales with the items of other constructs using ordinal scale (see the questionnaire in Appendix D), therefore, they cannot be used to test the research model. In order to solve this problem, we used another question asking respondents to rate the overall extent of EM usage using the ordinal scale. Then the correlation between this overall item and other specific items would be tested. The high correlation would indicate that this overall item could represent the extent of EM usage measured by length of time, percentage of spending and number of EMs.

In presenting the results of the large-scale study, the following acronyms were used to indicate the questionnaire items in each sub-construct. These acronyms are also listed in Appendix E.

Expected Benefits (EB)

MA	Market Aggregation
IC	Inter-Firm Collaboration

Perceived Risks (PR)

FR	Financial Risks
TB	Trust Barriers

Purchasing Situations (PS)

EI	Economic Importance of Purchases
CP	Complexity of Purchasing Process

E-Business Readiness (ER)

ITUSE	Information Technology Usage for Facilitating Purchasing
INTUSE	Internet Usage for Facilitating Purchasing
ISSCM	IS/IT Usage for Enhancing SCM

Extent of EM usage

CU	Extent of Current Usage of EM (for each EM type: CU/3PX, CU/ISM, and CU/PTN)
PU	Extent of Usage of EM Planned for Future (for each EM type: PU/3PX, PU/ISM, and PU/PTN)

5.6.1 Expected Benefits of EMs

Expected benefits (EB) construct was initially represented by two dimensions and 18 items, including Market Aggregation – MA (10 items) and Inter-Firm Collaboration – IC (8 items). First, the first-order CFA model for Expected Benefits was tested with the first sub-data set with the sample size of 180, and then the modified model was retested with the second sub-data set with the sample size of 179. Second, the second-order CFA model was tested to see if two sub-constructs (MA and IC) underlie a single higher-order construct – Expected Benefits (EB). Again, this second-order model was also retested with the second sub-data set for validation.

The detailed model fit statistics of iterative processes in the first-order CFA for EB is shown in Table 5.6.1.1. The initial model of EB was tested indicating good λ coefficients being greater than 0.6 but the model fit was very poor with χ^2/df = 3.5, RMR = 0.06, GFI = 0.77 and AGFI = 0.71 indicating a possibility of error correlation (Table 5.6.1.1). Modification indices indicated a high error correlation between MA9 and MA8 (37.82). It was decided to drop item MA9 since it also had a high error correlation with MA5 (19.64).

The model after removing MA9 showed a satisfactory λ being greater than 0.6. Model fit indices were improved with RMR = 0.05 and χ^2/df = 3. However, other fit indices were still very poor - GFI = 0.81 and AGFI = 0.75 – indicating a need of further modifications. Modification indices showed a high error correlation between MA5 and

MA6 (27.43). It was decided to remove item MA5 since it also had a moderate error correlation with MA10 (16.27). In addition, this item (price comparison) was already included in another item (price transparency).

After removing MA5 the model showed some improvements in model fit indices: χ^2/df = 2.83 and CFI = 0.91. However, since GFI, AGFI and NFI were still below 0.9, therefore, a further modification was needed. The examination on modification indices showed a high error correlation between IC8 and IC6 (23.22). Since item IC8 also had a moderate error correlation with MA7 (16.87), it was deleted. That makes sense because this item was already included in other items.

Table 5.6.1.1: Model Fit Statistics for EB – The First-Order CFA Models with the First Sub-Data Set

Fit indices	χ^2	χ^2/**df**	**RMR**	**GFI**	**AGFI**	**NFI**	**CFI**
Initial model	472	3.5	0.06	0.77	0.71	0.82	0.87
After removing item MA9	354.9	3.0	0.05	0.81	0.75	0.84	0.89
After removing items MA9 and MA5	291.6	2.83	0.05	0.83	0.78	0.86	0.91
After removing items MA9, MA5, and IC8	230	2.58	0.05	0.85	0.80	0.88	0.92
After removing items MA9, MA5, IC8, and MA8	180	2.37	0.05	0.87	0.83	0.89	0.94
After removing items MA9, MA5, IC8, MA8, and MA1	132	2.06	0.04	0.90	0.85	0.91	0.95
After removing items MA9, MA5, IC8, MA8, MA1, and IC4	97.6	1.84	0.04	0.92	0.88	0.96	0.97
After removing items MA9, MA5, IC8, MA8, MA1, IC4 and IC2	67.5	1.57	0.04	0.94	0.90	0.94	0.98

In the next iteration, with the removal of IC8 model still did not show a good fit. Despite a little improvement (χ^2/df = 2.83 and CFI = 0.92), most of fit indices were still poor (GFI = 0.85, AGFI = 0.80, and NFI = 0.88). Thus, the modification process needed to be continued. Modification indices stated a moderate correlation between MA8 and IC4 (16.26) and between MA8 and MA1 (11.98). In addition, the examination of the item MA8 showed that this item (eliminating 'maverick' purchases) does not fit well to other items in the same construct. For those reasons, it was removed.

The removal of MA8 indicated some improvements in model fit indices: χ^2/df = 2.37, CFI = 0.94. However, GFI, AGFI and NFI were still below 0.9, indicating a need of further modifications. It was shown that MA1 had a high error correlation with MA2 (19.56). The examination on those items indicated that MA1 (finding new suppliers) was already included in other items. In addition, MA1 had a moderator error correlation with MA10 (9.97). Accordingly, it was decided to remove MA1.

After removing MA1, model fit indices had some substantial improvements: χ^2/df = 2.06, RMR = 0.04, GFI = 0.90, NFI = 0.91, and CFI = 0.95. However, a further modification was still necessary since AGFI was still low (0.85). The examination of modification indices showed a moderate error correlation between IC4 and MA10 (14.58). It was decided to drop IC4 since the modification index for factor loading of IC4 was also high (12.97).

Model fit indices after removing IC4 were improved: χ^2/df = 1.84, GFI = 0.92, NFI = 0.96, and CFI = 0.97. Since AGFI was still below 0.9, the model was not in a good fit and there was a need of a further modification. Modification indices indicated a moderate error correlation between IC2 and MA10 (12.35). In addition, IC2 also had a

moderate error correlation with IC3 (10.85). For that reason, it was decided to remove IC2. The model with the removal of IC2 showed very good model fit indices: χ^2/df = 1.57, RMR = 0.04, GFI = 0.94, AGFI = 0.90, NFI = 0.94, and NFI = 0.98. Since the final model was in very good fit, there was no need of any further modifications. The final first-order CFA model for Expected Benefits (EB) is shown in Figure 5.6.1.1. The factor loading (λ) was acceptable with the lowest λ being 0.68.

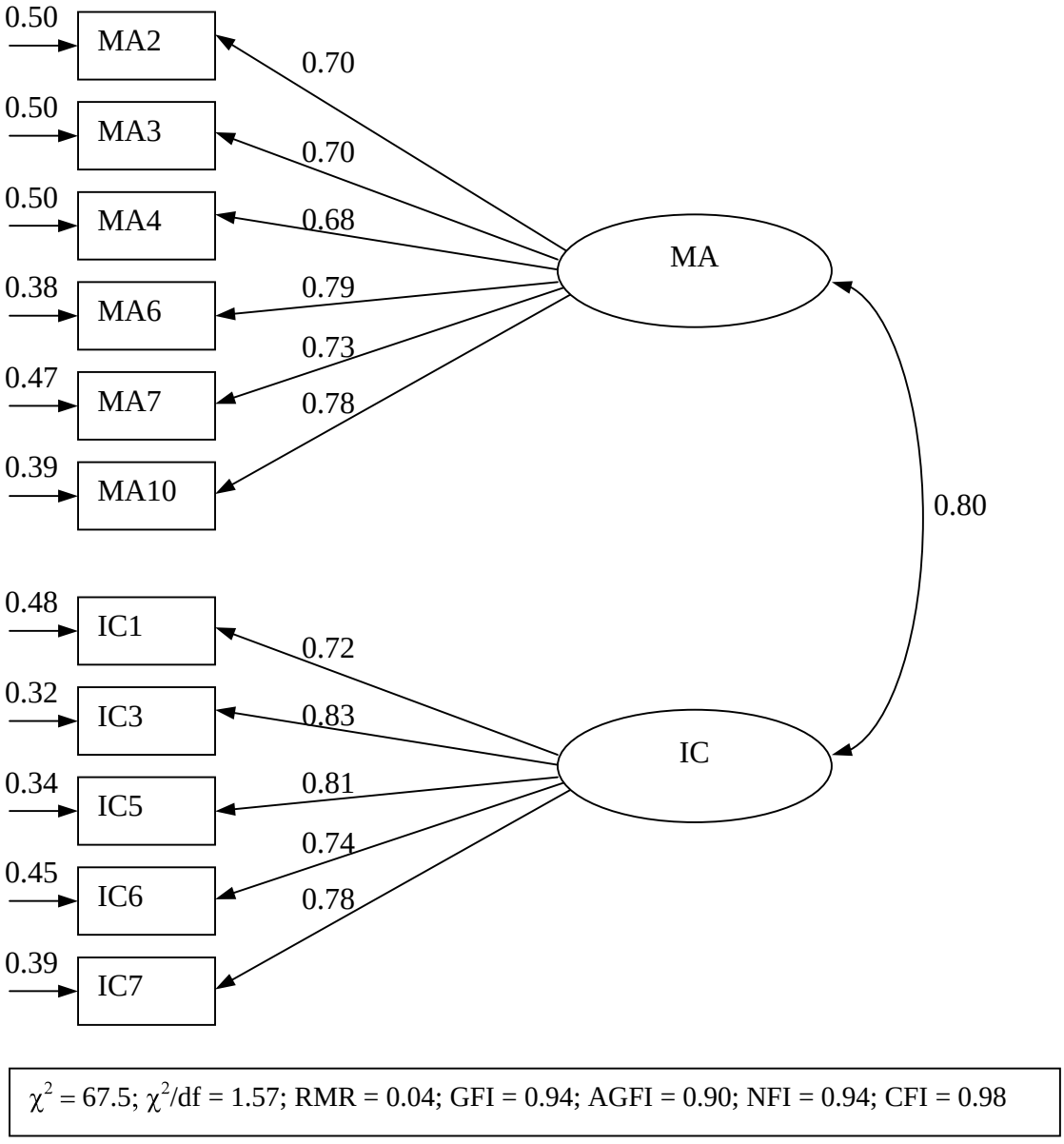


Figure 5.6.1.1: The Final First-Order CFA Model for EB - The First Sub-Data Set

As mentioned before, in order to confirm that this modified measurement model was in good fit for not only one set of data but also for other similar data set, this model was retested with the second sub-data set with sample size of 179. The first-order CFA model for EB with the second sub-data set is shown in Figure 5.6.1.2.

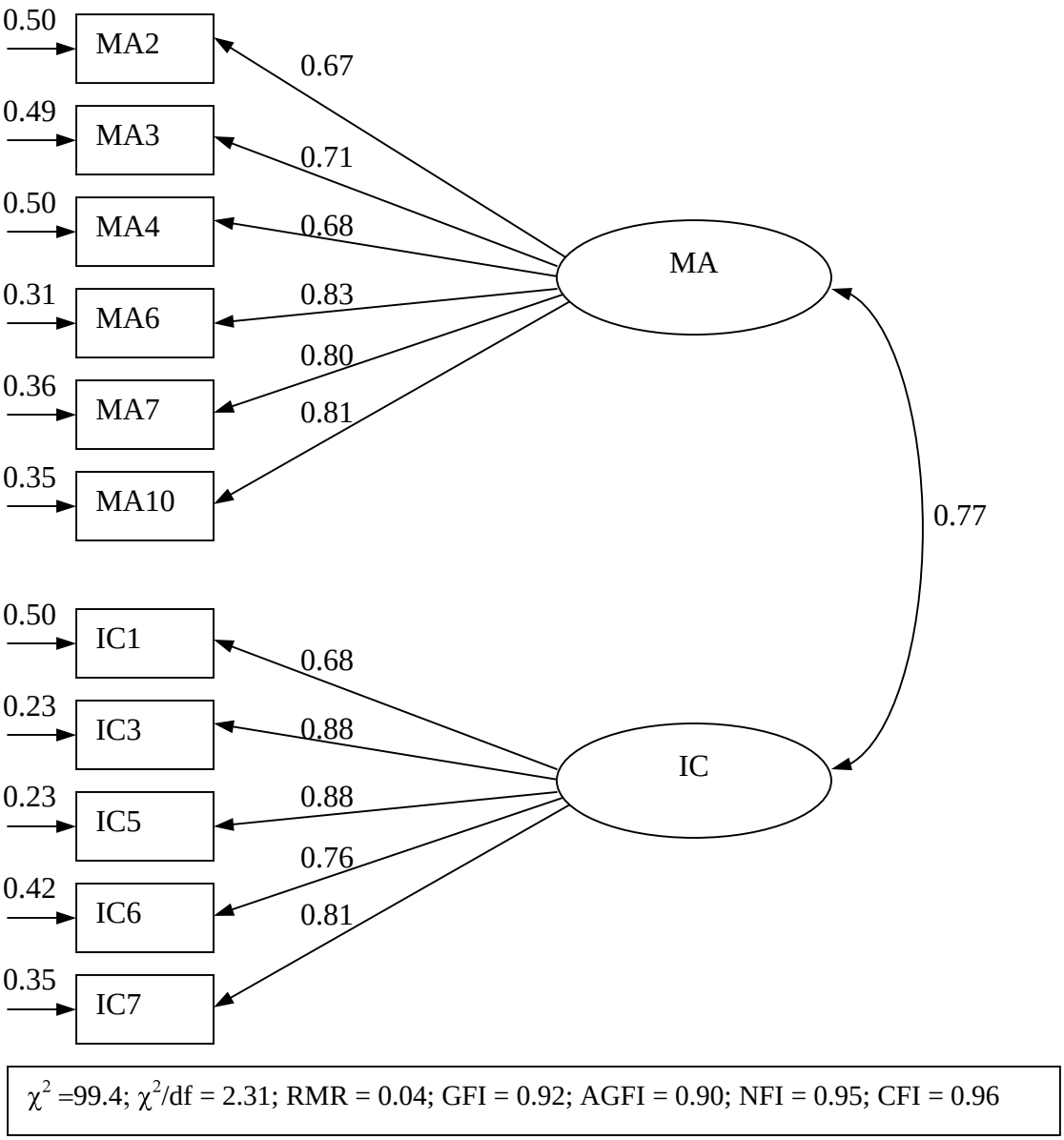


Figure 5.6.1.2: The Final First-Order CFA Model for EB - The Second Sub-Data Set

The results for the second sub-data set showed good model fit indices (χ^2/df = 2.31, RMR = 0.04, CFI = 0.92, AGFI = 0.90, NFI = 0.95, and CFI = 0.96) indicating the validation of the modified first-order CFA model for EB.

The next step was to test if these two sub-constructs (MA and IC) underlie a single higher-order construct – Expected Benefits (EB). First, the second-order CFA model was tested with the first sub-data set and then retested with the second sub-data set to validate the model. The second-order CFA model with the first sub-data set is shown in Figure 5.6.1.3. The model showed very good model fit indices: χ^2/df = 2.9, RMR = 0.03, CFI = 0.94, AGFI = 0.90, NFI = 0.94, and CFI = 0.96. The standardized coefficients (γ) are .93 for MA, and 0.85 for IC and all are statistically significant.

The second-order CFA model with the second sub-data set is shown in Figure 5.6.1.4. It can be seen from that figure GFI (0.92), AGFI (0.90), NFI (0.92), and CFI (0.93) were all above 0.9, indicating a good model fit. In addition, the standardized coefficients (γ) were .87 for MA, and 0.89 for IC and all were statistically significant.

The final set of measurement items for Expected Benefits (EB) and resulting reliabilities as measured by Cronbach's alpha (calculated from the entire sample) are listed in Table 5.6.1.2. The lowest Cronbach's alpha is 0.83, indicating the reasonable reliability of constructs.

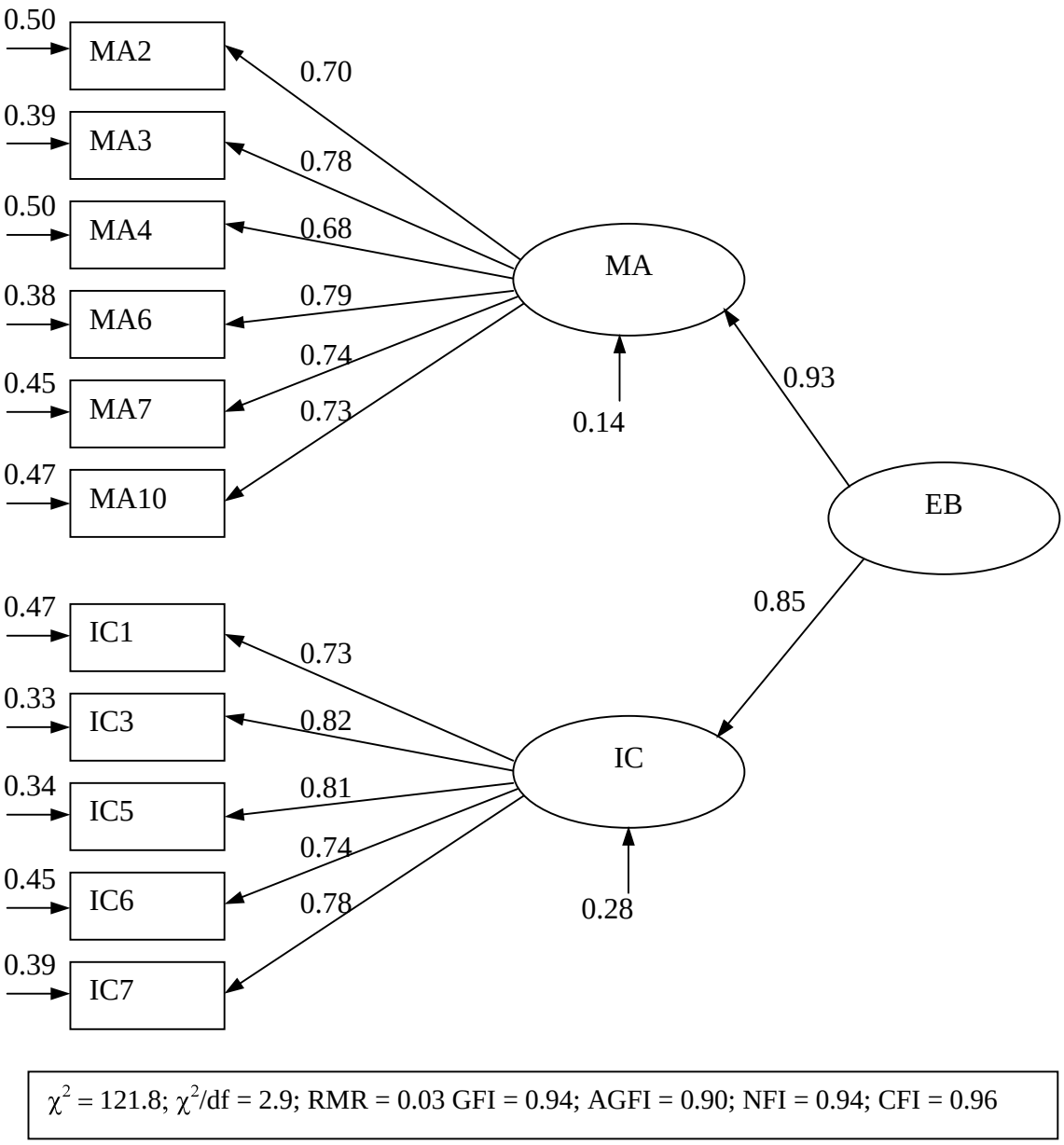
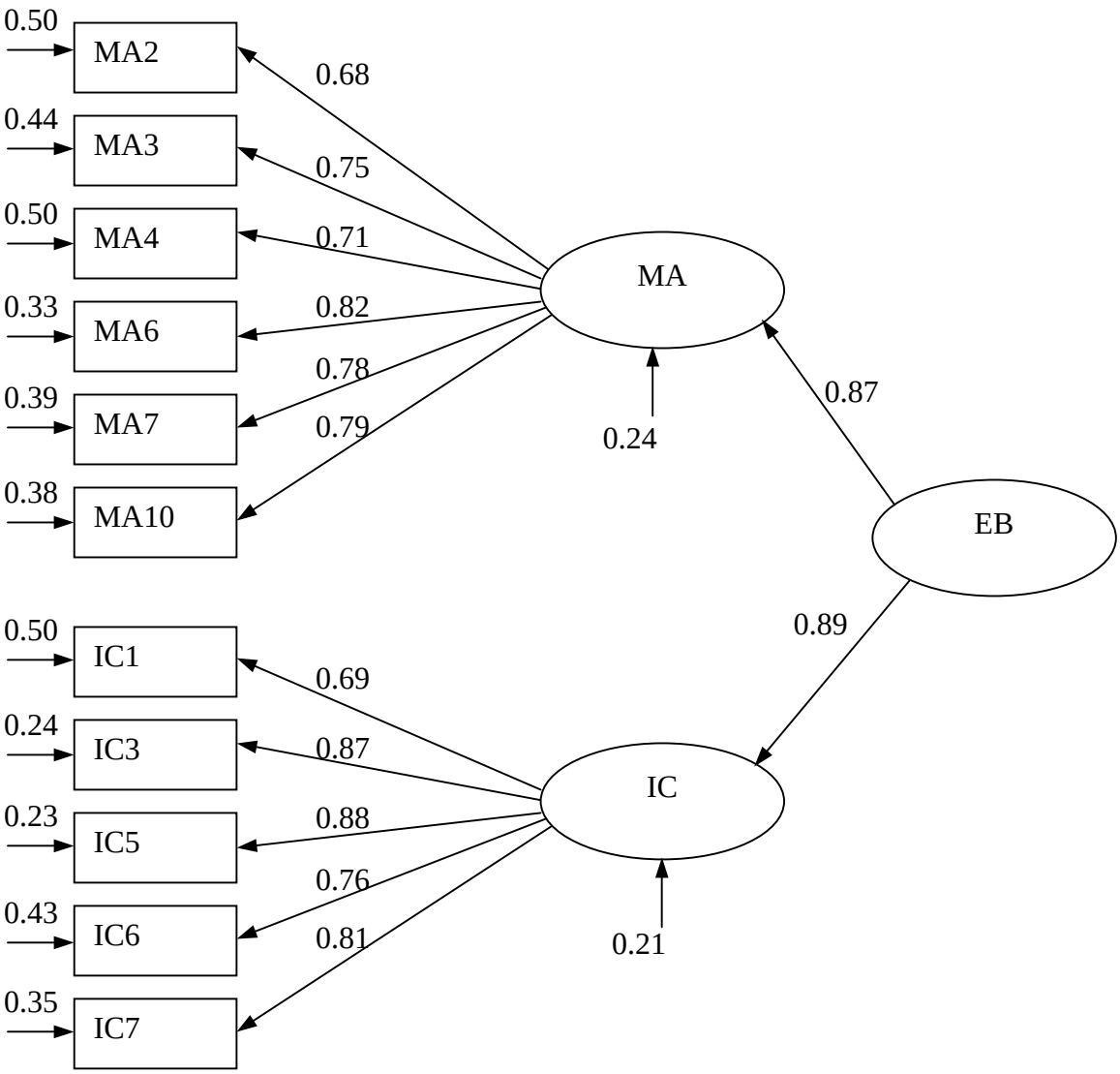


Figure 5.6.1.3: The Second-Order CFA Model for EB - The First Sub-Data Set



χ^2 = 130; χ^2/df = 3; RMR = 0.03 GFI = 0.92; AGFI = 0.90; NFI = 0.92; CFI = 0.93

Figure 5.6.1.4: The Second-Order CFA Model for EB - The Second Sub-Data Set

Table 5.6.1.2: Expected Benefits - Final Construct Measurement Items

Coding	Items	α
	MA- Market aggregation	
MA2	The EM is useful for reaching a larger number of suppliers	**0.83**
MA3	The EM is useful for increasing price transparency	
MA4	The EM is useful for seeking information about product availability	
MA6	The EM is useful for seeking lower materials/products cost	
MA7	The EM is useful for seeking lower transactional commission and related fees	
MA10	The EM is useful for paying at true market price	
	IC - Inter-Firm Collaboration	
IC1	The EM is useful for increasing supply chain-wide inventory visibility	**0.91**
IC3	The EM is useful for shortening order-to-delivery lead time	
IC5	The EM is useful for improving logistics management	
IC6	The EM is useful for collaborating with suppliers on product design and development	
IC7	The EM is useful for collaborating with suppliers on the process of procurement	

5.6.2 Perceived Risks of EMs

Perceived Risks (PR) construct was initially represented by two sub-constructs, Financial Risks – FR (3 items) and Trust Barriers – TB (8 items), with total of 11 items. The process of conducting CFA for PR is similar to testing the measurement model for EB. First, the first-order CFA model for PR was tested with the first sub-data set with sample size of 180. The detailed model fit statistics of iterative process is shown in Table 5.6.2.1.

The initial model of PR was tested indicating good λ coefficients being greater than 0.6. Although GFI (0.92), NFI (0.93), and CFI (0.95) were well above 0.9, other model fit indices were not good enough: χ^2/df = 4.01 and AGFI=0.87. Thus, a further modification was needed. The examination on modification indices indicated a high error

correlation between TB3 and TB1 (36.75) and between TB3 and TB8 (31.43). It could be seen that TB3 had a high error correlation with two other items, and from the questionnaire this item (limited participation of suppliers) did not seem to match well to other items. For that reason, it was decided to delete TB3.

Table 5.6.2.1: Model Fit Statistics for PR – The First-Order CFA Models with the First Sub-Data Set

Fit indices	χ^2	χ^2/**df**	**RMR**	**GFI**	**AGFI**	**NFI**	**CFI**
Initial model	176.4	4.1	0.05	0.92	0.87	0.93	0.95
After removing item TB3	126	3.7	0.05	0.92	0.88	0.94	0.95
After removing items TB3 and TB8	95	3.6	0.04	0.94	0.89	0.95	0.96
After removing items TB3, TB8 and TB1	40.15	2.1	0.03	0.97	0.94	0.98	0.99

The model after removing TB3 showed a satisfactory λ being greater than 0.6. Model fit indices were improved with χ^2/df = 3.7. However, AGFI was still below 0.9 (0.8), indicating a need of further modifications. Modification indices showed a high error correlation between TB8 and TB7 (33.27). It was decided to remove item TB5 since it also had a moderate error correlation with FR3 (10.20).

After removing TB8, although some improvements in the model fit were shown - RMR=0.04, and GFI=0.94 - χ^2/df was still above 3.0 and AGFI was still below 0.9. Accordingly, there was a need for further modification. The examination on modification indices showed a moderate error correlation between TB1 and TB6 (17.87). Since item TB1 also had a moderate modification index for the factor loading (15.20), it was deleted.

That makes sense because most of EMs now can handle the problem of leaking business information.

The model with the removal of TB1 showed very good model fit indices: χ^2/df = 2.1, RMR = 0.03, GFI = 0.97, AGFI = 0.94, NFI = 0.98, and NFI = 0.99. Since the final model was in very good fit, there was no need of any further modifications. The final first-order CFA model for Perceived Risks (PR) is shown in Figure 5.6.2.1. The factor loading (λ) was acceptable with the lowest λ being 0.72.

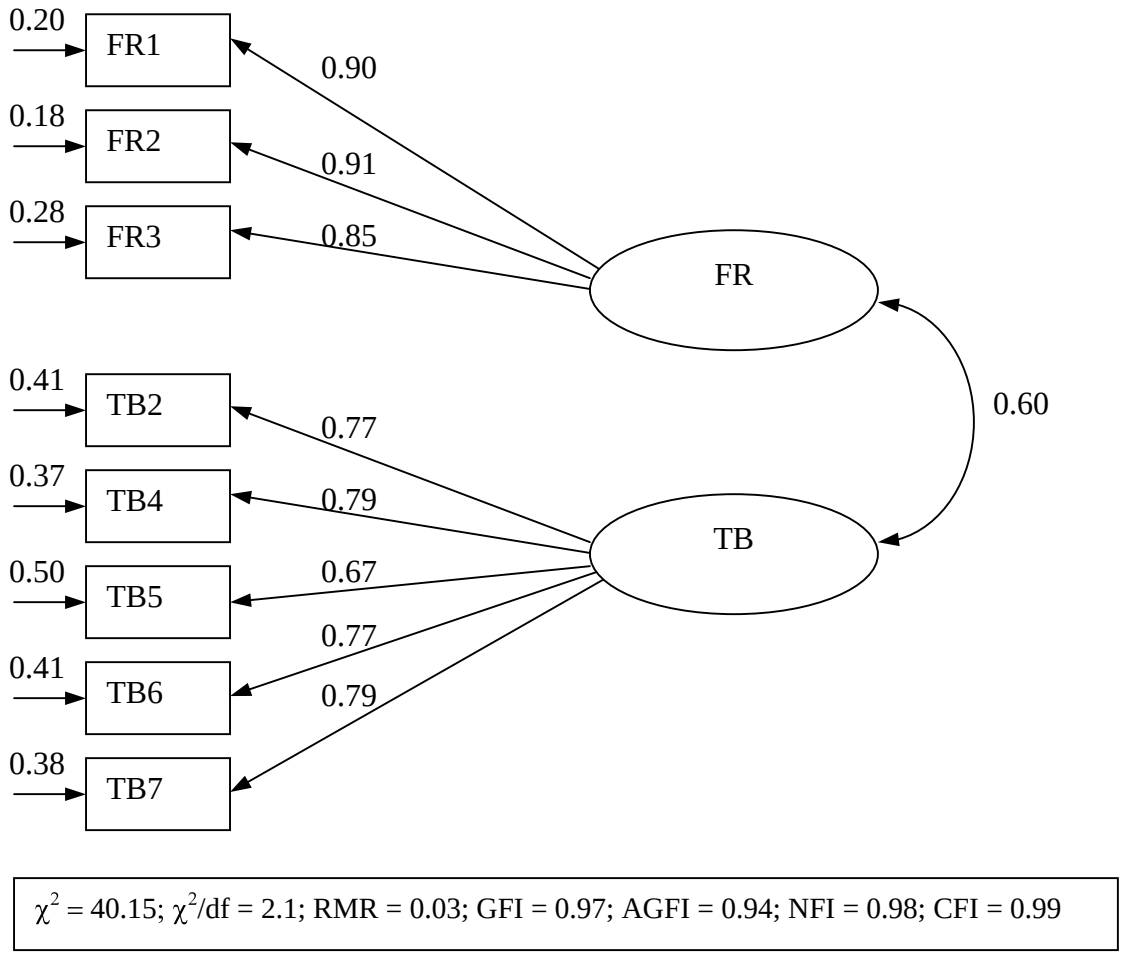


Figure 5.6.2.1: The Final First-Order CFA Model for PR - The First Sub-Data Set

Next, this model was retested with the second sub-data set with sample size of 179 in order to confirm the validation of the model. The first-order CFA model for PR with the second sub-data set is shown in Figure 5.6.2.2.

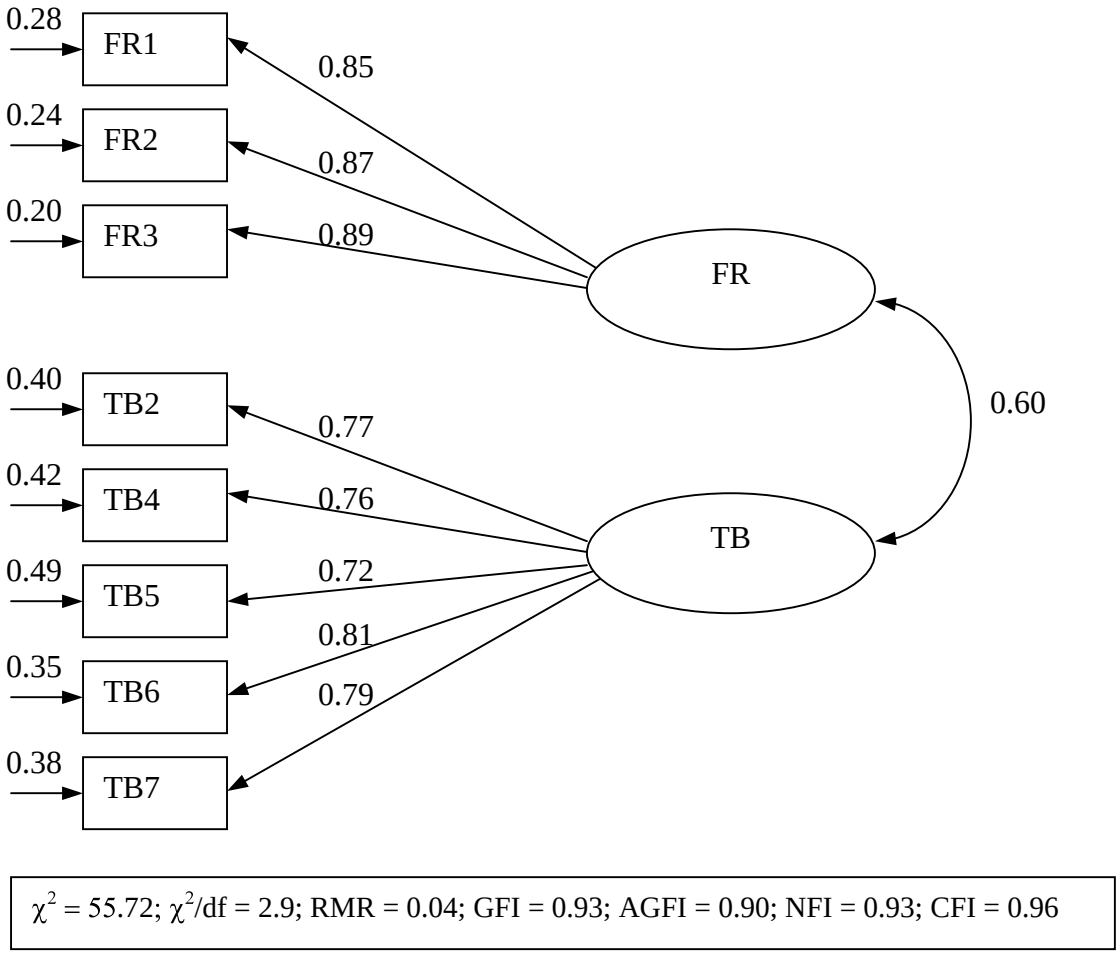


Figure 5.6.2.2: The Final First-Order CFA Model for PR - The Second Sub-Data Set

It can be seen that the first-order CFA model for PR retested with the second sub-data set also showed good model fit indices indicating the validation of the modified first-order CFA model for PR.

After testing the first-order CFA model, the second-order CFA model was tested to see if these two sub-constructs (FR and TB) underlie a single higher-order construct – Perceived Risks (PR). First, the second-order CFA model was tested with the first sub-data set and then retested with the second sub-data set to validate the model. The second-order CFA model with the first sub-data set is shown in Figure 5.6.2.3. The model showed very good model fit indices: χ^2/df = 2.2, RMR = 0.04, CFI = 0.97, AGFI = 0.94, NFI = 0.94, and CFI = 0.97. The standardized coefficients (γ) are .75 for FR, and 0.76 for TB and all are statistically significant.

Then, this second-order CFA model for PR was retested with the second sub-data set (see Figure 5.6.2.4). It can be seen that GFI (0.93), AGFI (0.90), NFI (0.93), and CFI (0.96) were all above 0.9, indicating good fit. In addition, the standardized coefficients (γ) were .90 for FR, and 0.65 for TB and all were statistically significant.

The final set of measurement items for Perceived Risks (PR) and resulting reliabilities measured by Cronbach's alpha (calculated from the entire sample) are listed in Table 5.6.2.2. The lowest Cronbach's alpha is 0.91, indicating the reasonable reliability of constructs.

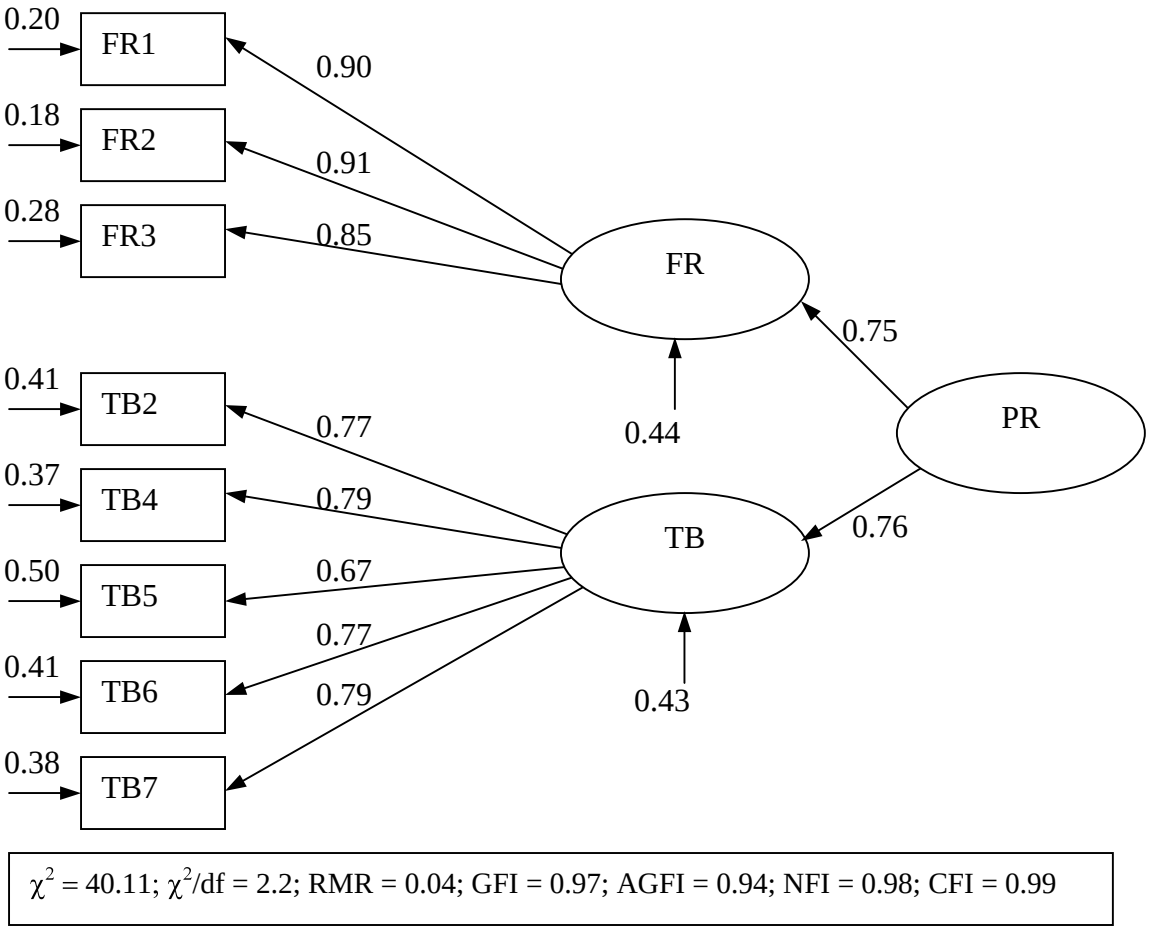


Figure 5.6.2.3: The Second-Order CFA Model for PR - The First Sub-Data Set

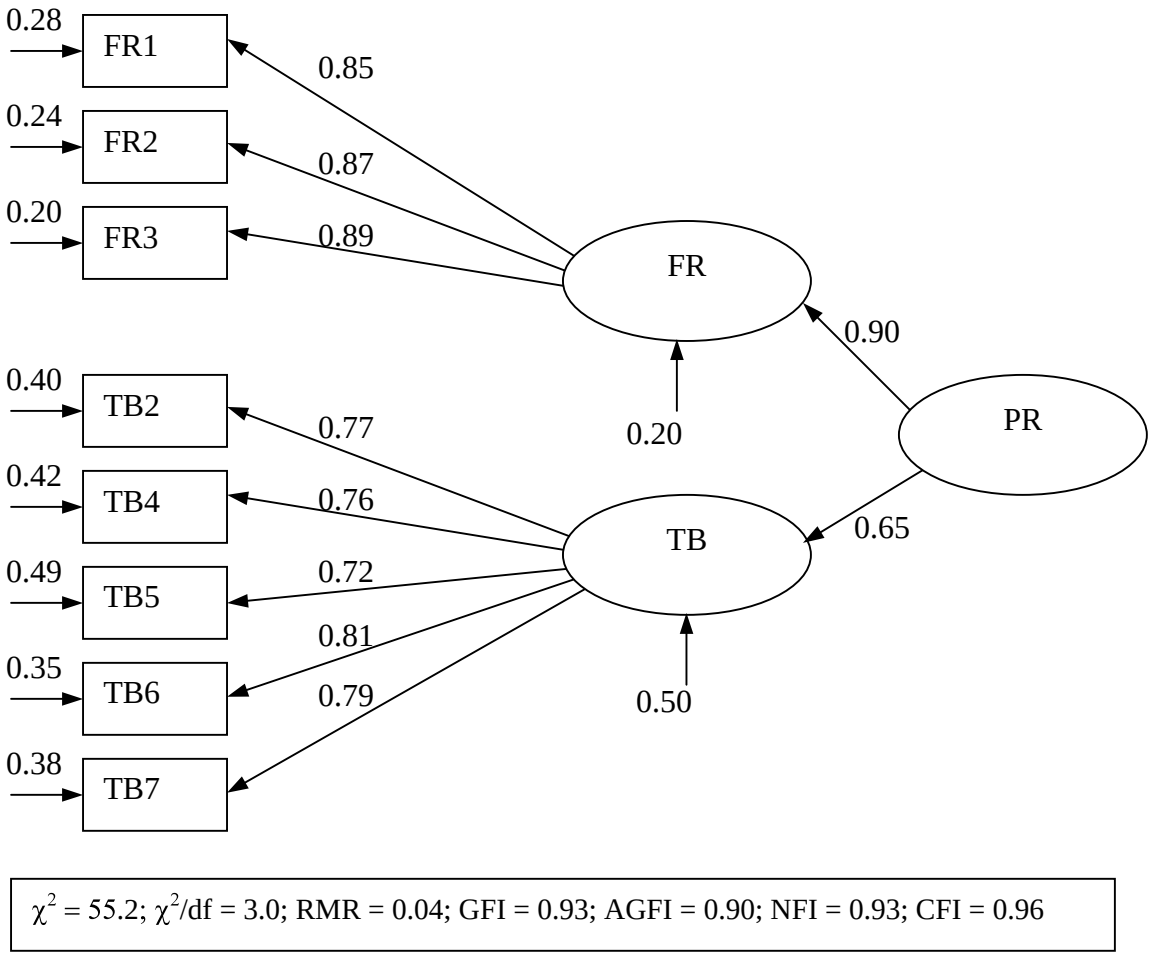


Figure 5.6.2.4: The Second-Order CFA Model for PR - The Second Sub-Data Set

Table 5.6.2.2: Perceived Risks - Final Construct Measurement Items

Coding	Items	α
	FR – Financial Risks	
FR1	High cost of EM platform development inhibits our organization from procuring materials/products through EM	**0.91**
FR2	High business process coordination cost inhibits our organization from procuring materials/products through EM	
FR3	High cost for IS integration inhibits our organization from procuring materials/products through EM	
	TB - Trust barriers	
TB2	Uncertainties related to the settlement of disputes inhibit our organization from procuring materials/products through EM	**0.93**
TB4	Uncertainties related to the identity of the suppliers inhibit our organization from procuring materials/products through EM	
TB5	Incompatible inter-firm business processes inhibit our organization from procuring materials/products through EM	
TB6	Uncertainties related to verification of the terms and conditions of the contract inhibit our organization from procuring materials/products through EM	
TB7	Uncertainties related to supplier's fulfillment capability inhibit our organization from procuring materials/products through EM	

5.6.3 Purchasing Situations

Purchasing Situations (PS) construct was initially measured by two sub-constructs and 9 items, including Economic Importance of Purchases – EI (3 items) and Complexity of Purchasing Processes – CP (6 items). In the first step the first-order CFA model for PS was tested with the first sub-data set with sample size of 180 and then the modified model was retested with the second sub-data set (179 responses). The model fit statistics for each iteration with the first sub-data set is shown in Table 5.6.3.1.

The initial model of PS was tested indicating good λ coefficients being greater than 0.6, except the λ for CP1 was low (0.41). However, the model fit indices were very poor: χ^2/df = 4.7, RMR=0.1, GFI=0.87, AGFI=0.77, NFI=0.3, and CFI=0.84.

Accordingly, there was a need of necessary modifications. As mentioned, the factor loading of CP1 was rather low (0.41). In addition, the examination on modification indices indicated a high modification index for λ for CP1. For that reason, it was decided to delete CP1.

Table 5.6.3.1: Model Fit Statistics for PS – The First-Order CFA Models with the First Sub-Data Set

Fit indices	χ^2	χ^2/**df**	**RMR**	**GFI**	**AGFI**	**NFI**	**CFI**
Initial model	122.5	4.7	0.1	0.87	0.77	0.83	0.84
After removing item CP1	72	3.7	0.06	0.92	0.85	0.90	0.92
After removing items CP1 and CP6	36.8	2.8	0.04	0.96	0.91	0.94	0.95

After removing CP1, although some improvements in fit indices were shown - GFI=0.92, NFI=0.90, and CFI=0.92 - χ^2/df was still above 3.0 and AGFI was still below 0.9, indicating a possibility of error correlations. Therefore, a further modification was needed. The examination on modification indices showed a high error correlation between CP6 and CP3 (36.0). Since item CP6 also had a high error correlation with CP4 (23.4), it was removed.

The model with the removal of CP6 showed very good model fit indices: χ^2/df = 2.8, RMR = 0.04, GFI = 0.96, AGFI = 0.91, NFI = 0.94, and NFI = 0.95. Since the final model was in very good fit, there was no need of any further modifications. The final first-order CFA model for PS is shown in Figure 5.6.3.1. The factor loading (λ) was acceptable with the lowest λ being 0.64.

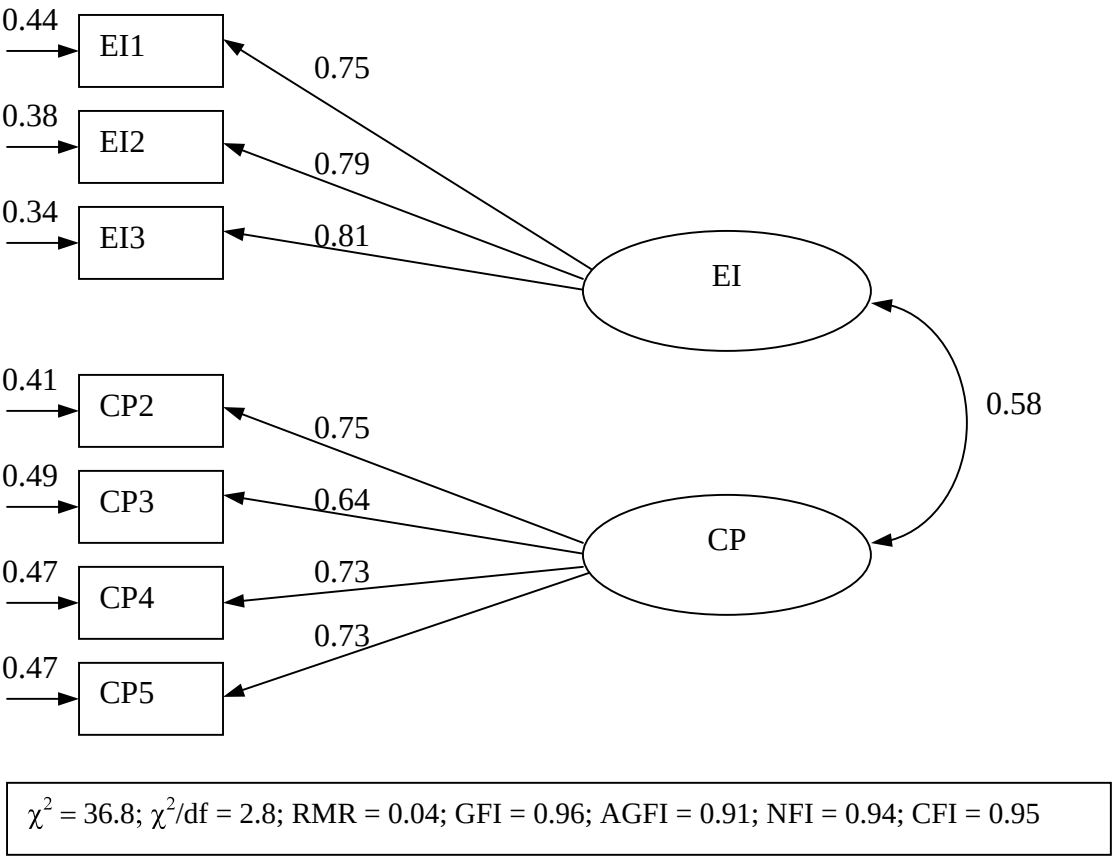


Figure 5.6.3.1: The Final First-Order CFA Model for PS - The First Sub-Data Set

Then, this model was retested with the second sub-data set (179 responses) in order to confirm that this modified measurement model was in good fit for not only one set of data. The first-order CFA model for PS with the second sub-data set is shown in Figure 5.6.3.2.

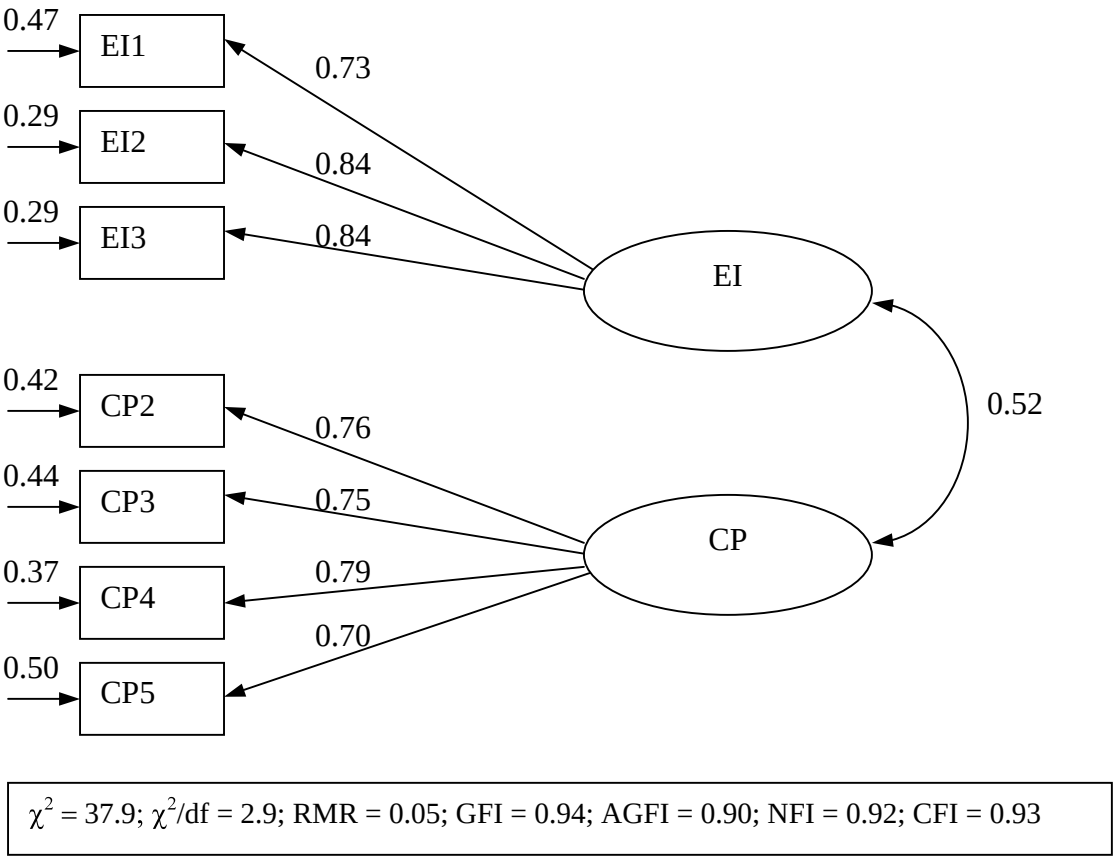


Figure 5.6.3.2: The Final First-Order CFA Model for PS – The Second Sub-Data Set

This figure indicated that the first-order CFA model for PS retested with the second sub-data set also showed good model fit indices (χ^2/df = 2.9; RMR = 0.05; GFI = 0.94; AGFI = 0.90; NFI = 0.92; CFI = 0.93) indicating the validation of the modified first-order CFA model for PS.

In the next step, the second-order CFA model was tested to see if these two sub-constructs (EI and CP) underlie a single higher-order construct – Purchasing Situations (PS). The second-order CFA model was firstly tested with the first sub-data set and then retested with the second sub-data set to validate the model. The second-order CFA model with the first sub-data set is shown in Figure 5.6.3.3. The model showed very good model

fit indices: χ^2/df = 2.9, RMR = 0.04, CFI = 0.96, AGFI = 0.90, NFI = 0.94, and CFI = 0.95. The standardized coefficients (γ) were .70 for EI, and 0.69 for CP and all were statistically significant.

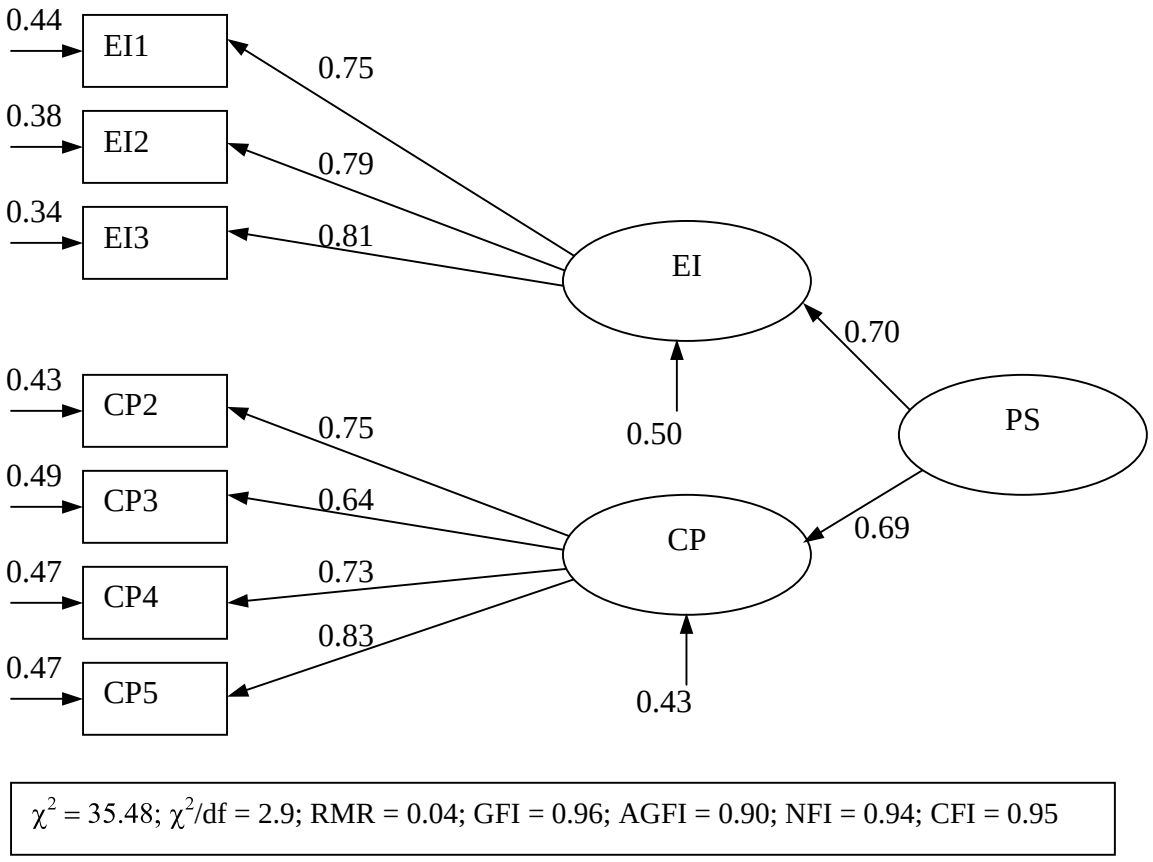


Figure 5.6.3.3: The Second-Order CFA Model for PS – The First Sub-Data Set

Then, this second-order CFA model for PS was retested with the second sub-data set (see Figure 5.6.3.4). It can be seen that GFI (0.94), AGFI (0.90), NFI (0.92), and CFI (0.93) are all above 0.9, indicating good fit indices. In addition, the standardized coefficients (γ) are .53 for EI, and 0.53 for CP and all are statistically significant.

The final set of measurement items for Purchasing Situations (PS) and resulting reliabilities measured by Cronbach's alpha (calculated from the entire sample) are listed in Table 5.6.3.2. The lowest Cronbach's alpha is 0.77, indicating the acceptable reliability of constructs.

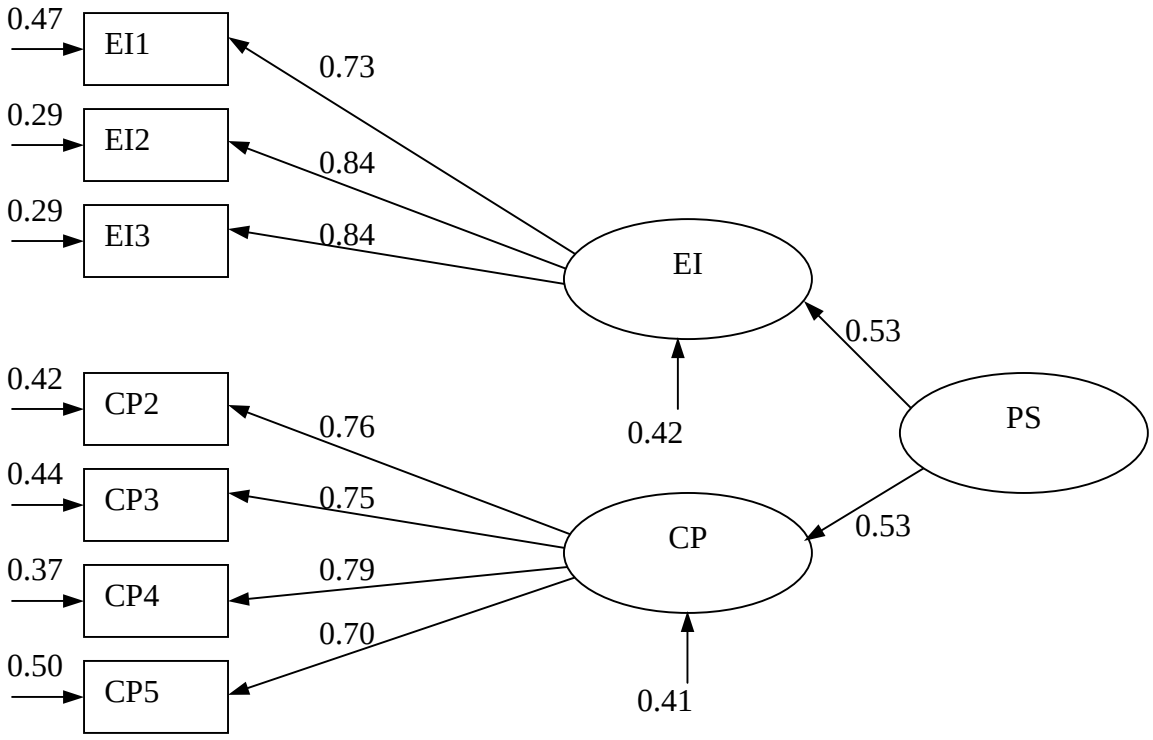


Figure 5.6.3.4: The Second-Order CFA Model for PS – The Second Sub-Data Set

Table 5.6.3.2: Purchasing Situations - Final Construct Measurement Items

Coding	Items	α
EIP - Economic Importance of Purchases		
EIP1	The EM is attractive for the procurement of materials/products that accounts for large purchase volume	**0.77**
EIP2	The EM is attractive for the procurement of materials/products that are critical to final product quality	
EIP3	The EM is attractive for the procurement of materials/products that show strong demand growth	
CP - Complexity of purchasing processes		
CP2	The EM is attractive for the procurement of materials/products that must have strict technical specifications	**0.84**
CP3	The EM is attractive for the procurement of materials/products that have relatively few capable suppliers	
CP4	The EM is attractive for the procurement of materials/products that involve difficulty in switching suppliers	
CP5	The EM is attractive for the procurement of materials/products that are supplied under long-term arrangements with preferred suppliers	

5.6.4 E-Business Readiness

E-Business Readiness (ER) construct was initially measured by three sub-constructs and 18 items, including IT Usage for Facilitating Purchasing – ITUSE (4 items), Internet Usage for Facilitating Purchasing – INTUSE (6 items), and IS/IT Usage for Enhancing SCM – ISSCM (8 items). In the first step the first-order CFA model for ER was tested with the first sub-data set with 180 responses, and then the modified model was retested with the second sub-data set with 179 responses. In the second step, the second-order CFA model was tested to see if three sub-constructs (ITUSE, INTUSE, and ISSCM) underlie a single higher-order construct – E-Business Readiness (ER). Finally, this second-order model was also retested with the second sub-data set for validation.

The detailed model fit statistics of iterative process in the first-order CFA for ER is shown in Table 5.6.4.1. The initial model was tested indicating acceptable λ

coefficients being greater than 0.5, except the λ of ISSCM7 being 0.4. The model fit was very poor with χ^2/df = 4.8, RMR = 0.14, GFI = 0.84 and AGFI = 0.79 indicating a possibility of error correlation. Modification indices indicated a high error correlation between ISSCM7 and ITUSE2 101.36 (37.82). It was decided to drop item ISSCM7 since it also had a low factor loading.

Table 5.6.4.1: Model Fit Statistics for ER – The First-Order CFA Models with the First Sub-Data Set

Fit indices	χ^2	χ^2/**df**	**RMR**	**GFI**	**AGFI**	**NFI**	**CFI**
Initial model	561	4.8	0.14	0.84	0.79	0.84	0.86
After removing item ISSCM7	409	4.0	0.09	0.87	0.83	0.86	0.89
After removing items ISSCM7 and ISSCM2	279	3.2	0.08	0.91	0.87	0.89	0.94
After removing items ISSCM7, ISSCM2, and INTUSE4	195	2.6	0.07	0.93	0.89	0.91	0.94
After removing items ISSCM7, ISSCM2, INTUSE4, and ISSCM6	154.4	2.5	0.06	0.94	0.90	0.92	0.95
After removing items ISSCM7, ISSCM2, INTUSE4, ISSCM6, and INTUSE2	112.8	1.97	0.05	0.95	0.93	0.95	0.96

The model after removing ISSCM7 showed satisfactory λ coefficients being greater than 0.5. Model fit indices were still poor with χ^2/df = 4.0, RMR = 0.09, GFI=0.87, AGFI=0.83, NFI=0.86, and CFI=0.89. Thus, a further modification was needed. The examination on modification indices showed a high error correlation between ISSCM2 and ISSCM1 (90.36). It was decided to remove item ISSCM2 since it also had a high error correlation with INTUSE2 (43.73).

After removing ISSCM2 the model showed some improvements in model fit indices: χ^2/df = 3.2, CFI = 0.91, and CFI=0.94. However, since AGFI and NFI were still below 0.9 and RMR was still above 0.05, there was a need of further modification. The examination on modification indices showed a high error correlation between INTUSE4 and INTUSE3 (34.74). Since item INTUSE4 also had a moderate modification index for factor loading (13.58), it was deleted.

In the next iteration, with the removal of INTUSE4 the model showed some improvements: χ^2/df = 2.63, GFI=0.93, NFI=0.91, and CFI=0.94. However, RMR was still above 0.05 and AGFI was still below 0.9. Thus, the modification process needed to be continued. Modification indices stated a high correlation between ISSCM6 and INTUSE2 (23.07) and a moderate correlation between ISSCM6 and ISSCM1 (14.32). In addition, the examination on the item ISSCM6 showed that this item (use IS/IT in forecasting systems) does not fit well to other items in the same construct. For those reasons, it was removed.

The removal of ISSCM6 improved AGFI (0.90). Other fit indices were well above 0.90. However, RMR was still above 0.05, indicating a possibility of error correlation. It was shown that INTUSE2 had a moderate error correlation with INTUSE3 (15.43). In addition, INTUSE2 had a moderator error correlation with ITUSE2 (10.25). Accordingly, it was decided to remove INTUSE2.

The model with the removal of INTUSE2 showed very good model fit indices: χ^2/df = 1.97, RMR = 0.05, GFI = 0.95, AGFI = 0.93, NFI = 0.95, and NFI = 0.96. Since the final model was in very good fit, there was no need of any further modifications. The

final first-order CFA model for E-Business Readiness (ER) is shown in Figure 5.6.1.1. The factor loading (λ) was acceptable with the lowest λ being 0.54.

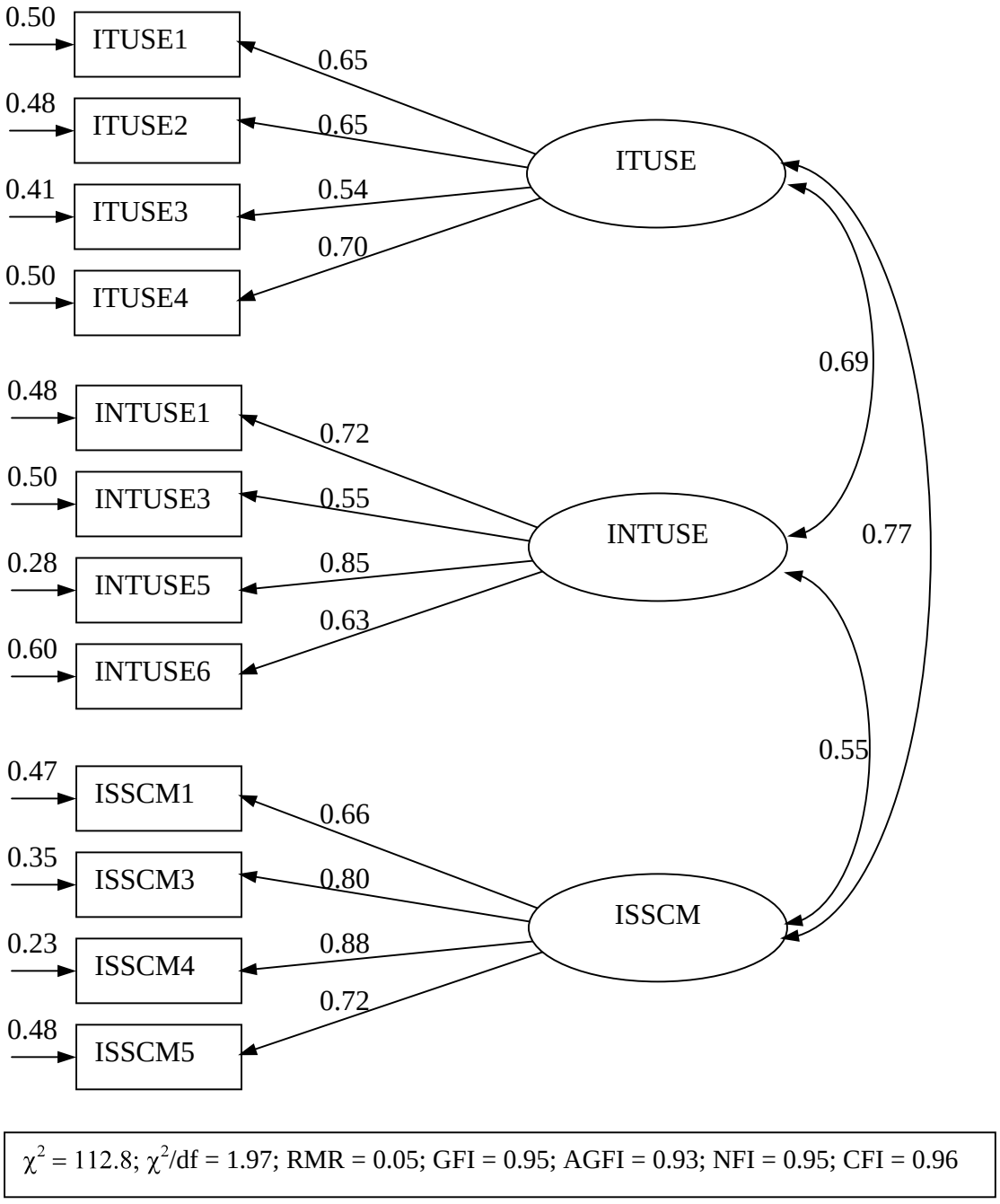


Figure 5.6.4.1: The Final First-Order CFA Model for ER - The First Sub-Data Set

Then, in order to confirm that this modified measurement model was in good fit for not only one set of data, this model was retested with the second sub-data set. The first-order CFA model for ER with the second sub-data set is shown in Figure 5.6.4.2.

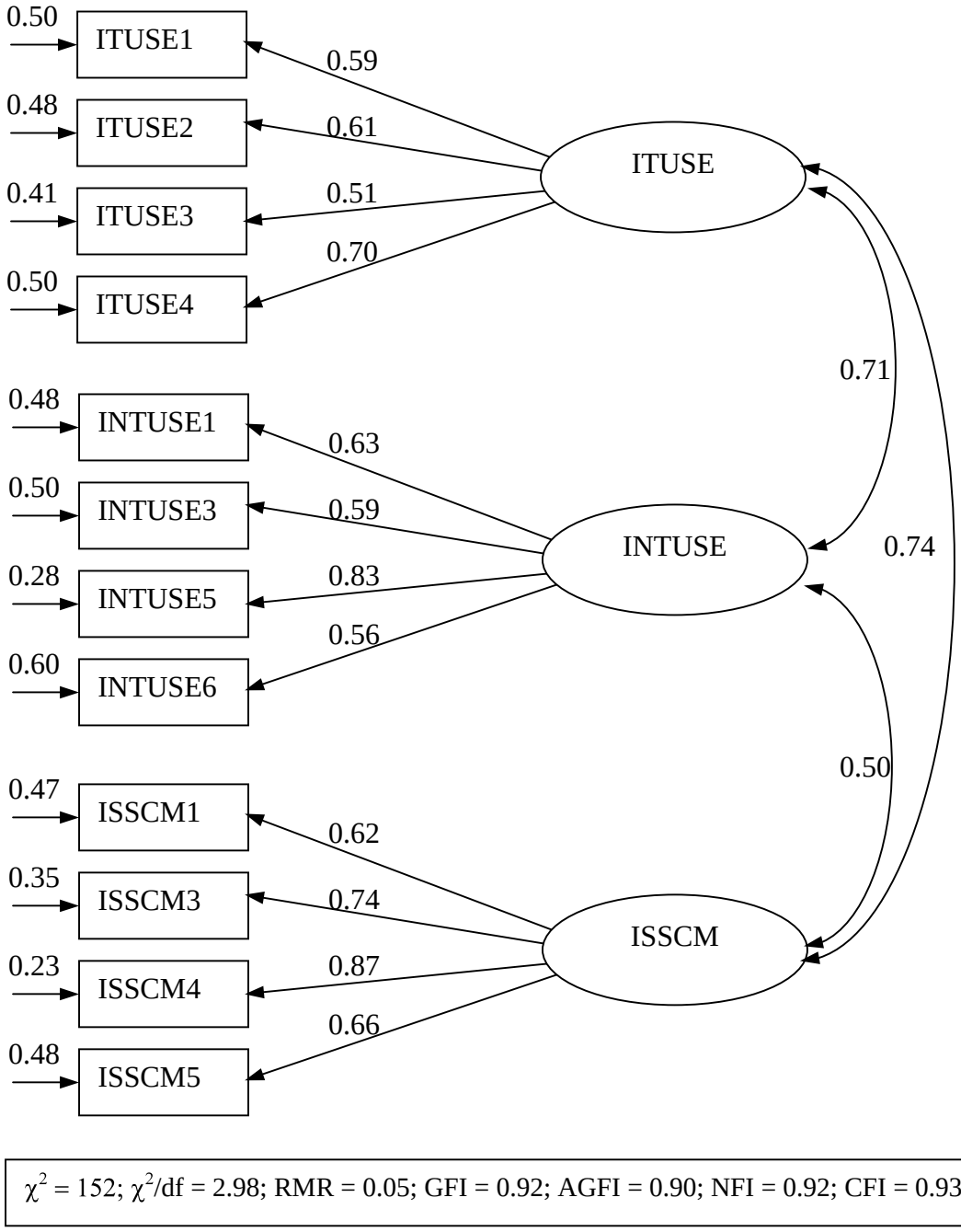


Figure 5.6.4.2: The Final First-Order CFA Model for ER - The Second Sub-Data Set

The model with the second sub-data set showed good model fit indices (χ^2/df = 2.98, RMR = 0.05, CFI = 0.92, AGFI = 0.90, NFI = 0.92, and CFI = 0.93) indicating the validation of the modified first-order CFA model for ER.

The next step was to test if these three sub-constructs (ITUSE, INTUSE, and ISSCM) underlie a single higher-order construct – E-Business Readiness (ER). The second-order CFA model was firstly tested with the first sub-data set and then retested with the second sub-data set to validate the model. The second-order CFA model with the first sub-data set is shown in Figure 5.6.4.3. The model showed very good model fit indices: χ^2/df = 2.7, RMR = 0.05, CFI = 0.93, AGFI = 0.90, NFI = 0.92, and CFI = 0.93. The standardized coefficients (γ) are 0.85 for ITUSE, 0.98 for INTUSE, and 0.98 for ISSCM and all are statistically significant.

The similar step was done with the second sub-data set. The second-order CFA model with the second sub-data set is shown in Figure 5.6.4.4. It can be seen that GFI (0.92), AGFI (0.90), NFI (0.91), and CFI (0.93) were all above 0.9, indicating a good model fit. In addition, the standardized coefficients (γ) were 0.86 for ITUSE, 0.97 for INTUSE, and 0.98 for ISSCM and all were statistically significant.

The final set of measurement items for E-Business Readiness and resulting reliabilities measured by Cronbach's alpha (calculated from the entire sample) are listed in Table 5.6.4.2. The lowest Cronbach's alpha is 0.75, indicating the reasonable reliability of constructs.

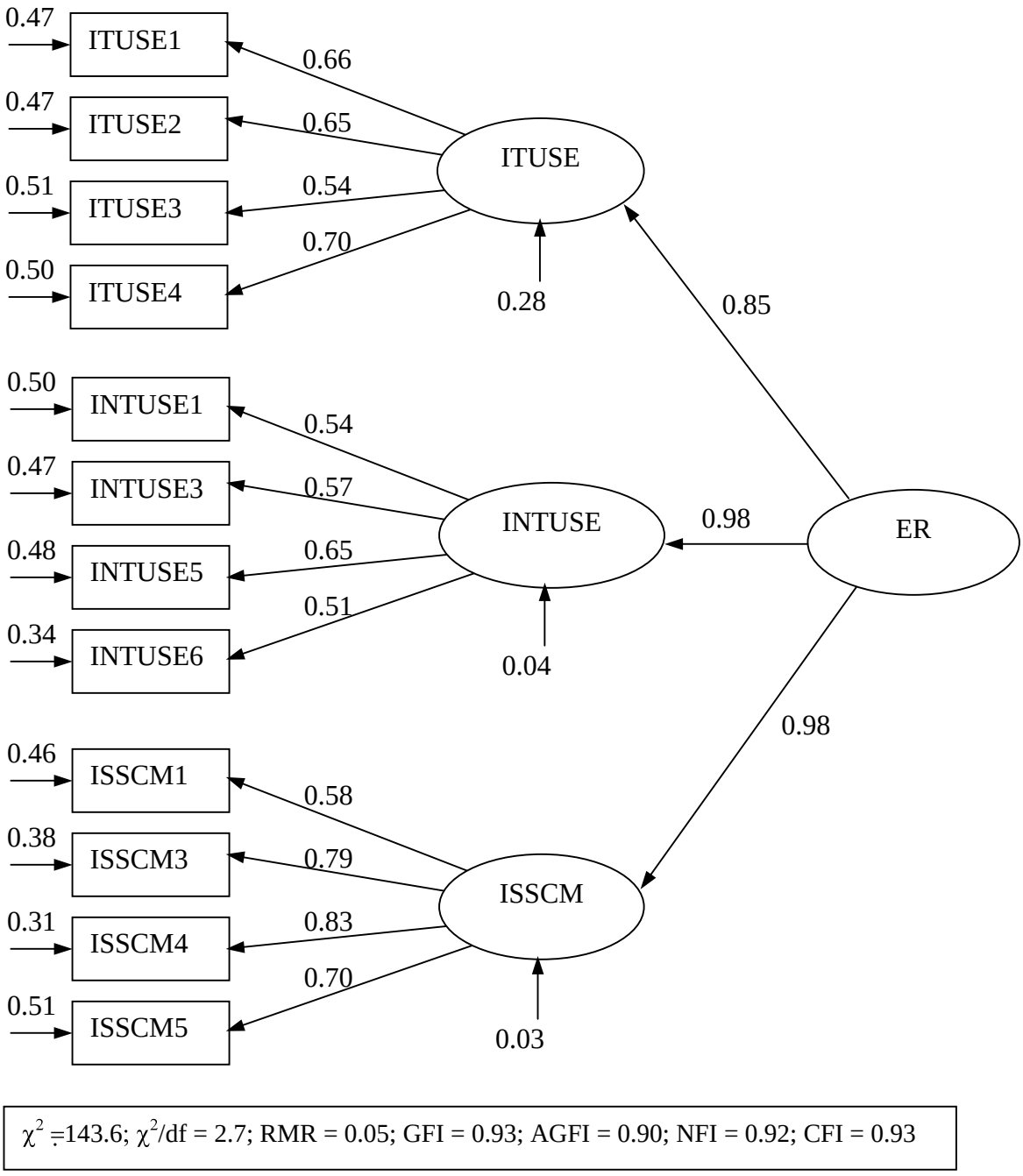


Figure 5.6.4.3: The Second-Order CFA Model for ER - The First Sub-Data Set

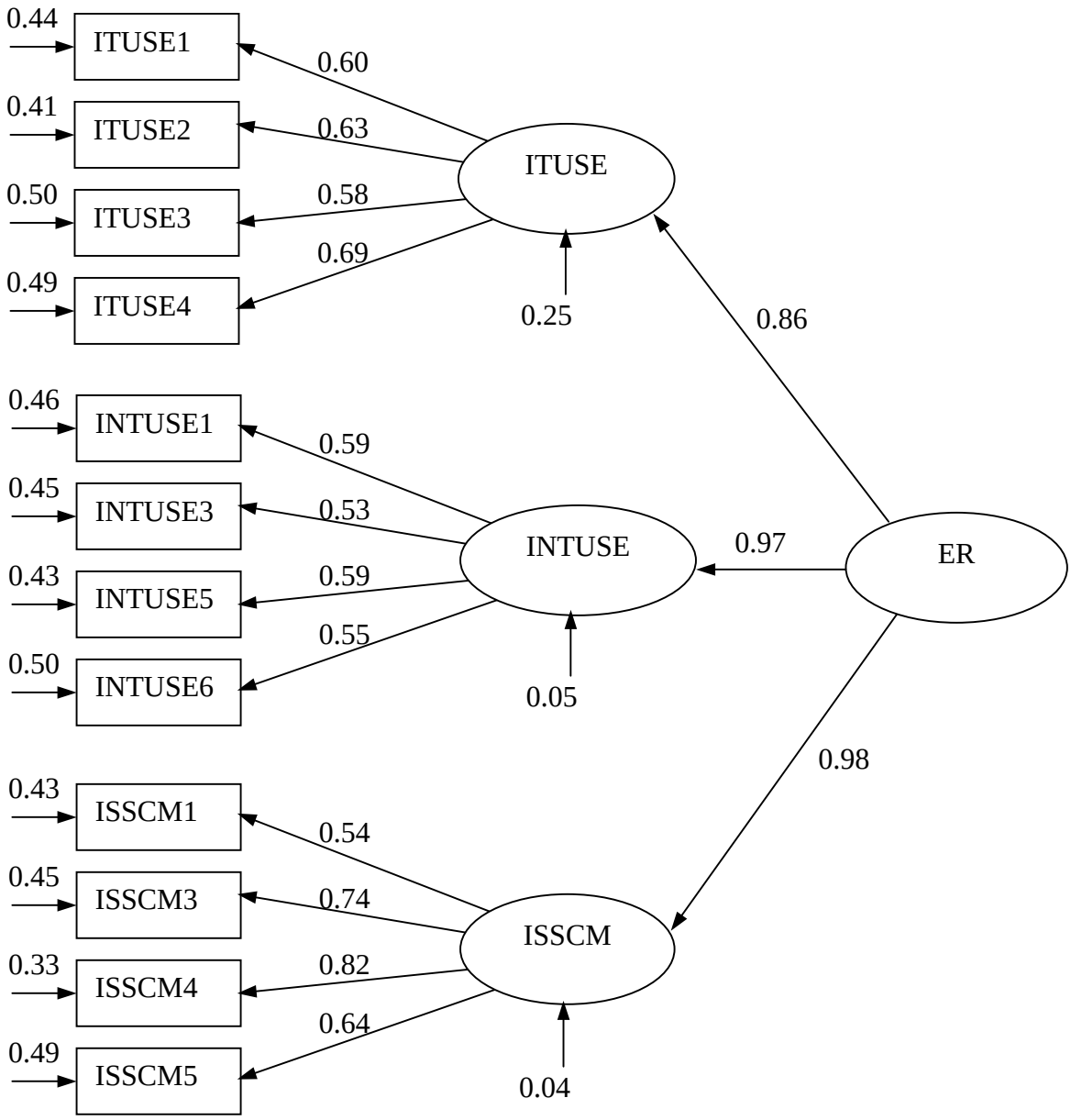


Figure 5.6.4.4: The Second-Order CFA Model for ER - The Second Sub-Data Set

Table 5.6.4.2: E-Business Readiness - Final Construct Measurement Items

Coding	Items	α
ITUSE - Information technology usage for facilitating purchasing		
ITUSE1	To facilitate the purchasing process our organization uses EDI (Electronic Data Interchange)	**0.75**
ITUSE2	To facilitate the purchasing process our organization uses ERP (Enterprise Resource Planning)	
ITUSE3	To facilitate the purchasing process our organization uses Electronic Request for Quotes (RFQ)/Request for Proposal (RFP)	
ITUSE4	To facilitate the purchasing process our organization uses Electronic Funds Transfer (EFT) and/or Electronic Payment	
INTUSE - Internet usage for facilitating purchasing		
INTUSE1	To facilitate the purchasing process our organization uses the Internet for announcing purchasing requirements	**0.82**
INTUSE3	To facilitate the purchasing process our organization uses the Internet for placing orders on supplier's website	
INTUSE5	To facilitate the purchasing process our organization uses the Internet for tracking payment information	
INTUSE6	To facilitate the purchasing process our organization uses the Internet for sharing design information with our suppliers	
ISSCM - IS/IT usage for enhancing SCM		
ISSCM1	To facilitate supply chain management our organization uses IS/IT in production control systems	**0.91**
ISSCM3	To facilitate supply chain management our organization uses IS/IT in automatic ordering systems	
ISSCM4	To facilitate supply chain management our organization uses IS/IT in resource management systems	
ISSCM5	To facilitate supply chain management our organization uses IS/IT in transportation management systems	

5.6.5 Extent of Current Usage of EM and Extent of Usage of EM Planned for Future.

As mentioned above, the Extent of Current Usage of EM was measured by three items: CU1 (the length of time an organization currently uses EM), CU2 (the percentage of procurement spending an organization currently conducted through EM), and CU3 (the number of EMs an organization currently uses for purchasing). However, those items were in a ratio scale which were not consistent with the ordinal scale that was used for items of other constructs. In order to solve that problem, we used a new item (CU) in an

ordinal scale asking respondents to rate their overall extent of current usage of EM. Then the correlation between this overall item and other specific items mentioned above was tested. The significant correlation indicates this new item could be used to measure the extent of current usage of EM. The Pearson's correlation coefficient was used to evaluate this correlation. Pearson's correlation coefficient (r), expresses the degree of linear relationship between two variables measured from the same individual. Pearson's r values can range between -1.00 to +1.00. A correlation coefficient of +1.00 signifies a perfect positive relationship, while -1.00 shows a perfect negative relationship. The smallest correlation is zero. The Pearson's correlation coefficient can be computed using the following formula.

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{\left(\sum X\right)^2}{N}\right)\left(\sum Y^2 - \frac{\left(\sum Y\right)^2}{N}\right)}}$$

Similar problem exists in the Extent of EM Usage Planned for Future construct. This construct was measured by two items: PU1 (the percentage of procurement spending an organization plans to conduct through EM in the future), and PU2 (the number of EMs an organization plans to use for purchasing in the future). Again, we used another item (PU) in ordinal scale and the correlation between this new item and above items was evaluated using Pearson's correlation coefficient.

Results of those tests are illustrated in Tables 5.6.5.1 to 5.6.5.6, indicating that in all cases the overall item has strong correlation (Pearson’s correlation coefficient is greater than 0.7) with other specific items at the significant level of 0.01.

Table 5.6.5.1: Pearson's Correlation Coefficient for Current Usage of 3PXs

	CU/3PX	CU1/3PX	CU2/3PX	CU3/3PX
CU/3PX				
CU1/3PX	0.754**			
CU2/3PX	0.846**	0.833**		
CU3/3PX	0.661**	0.817**	0.712**	

(**: correlation is significant at the 0.01 level; missing values: 20)

Table 5.6.5.2: Pearson's Correlation Coefficient for Planned Usage of 3PXs

	PU/3PX	PU1/3PX	PU2/3PX
PU/3PX			
PU1/3PX	0.898**		
PU2/3PX	0.712**	0.752**	

(**: correlation is significant at the 0.01 level; missing values: 17)

Table 5.6.5.3: Pearson's Correlation Coefficient for Current Usage of ISMs

	CU/ISM	CU1/ISM	CU2/ISM	CU3/ISM
CU/ISM				
CU1/ISM	0.762**			
CU2/ISM	0.768**	0.814**		
CU3/ISM	0.781**	0.830**	0.817**	

(**: correlation is significant at the 0.01 level; missing values: 19)

Table 5.6.5.4: Pearson's Correlation Coefficient for Planned Usage of ISMs

	PU/ISM	PU1/ISM	PU2/ISM
PU/ISM			
PU1/ISM	0.842**		
PU2/ISM	0.769**	0.820**	

(**: correlation is significant at the 0.01 level; missing values: 16)

Table 5.6.5.5: Pearson's Correlation Coefficient for Current Usage of PTNs

	CU/PTN	CU1/PTN	CU2/PTN	CU3/PTN
CU/PTN				
CU1/PTN	0.726**			
CU2/PTN	0.804**	0.791**		
CU3/PTN	0.697**	0.782**	0.705**	

(**: correlation is significant at the 0.01 level; missing values: 25)

Table 5.6.5.6: Pearson's Correlation Coefficient for Planned Usage of PTNs

	PU/PTN	PU1/PTN	PU2/PTN
PU/PTN			
PU1/PTN	0.875**		
PU2/PTN	0.729**	0.767**	

(**: correlation is significant at the 0.01 level; missing values: 22)

In addition to the Pearson's correlation, in order to make sure that the overall item can be well predicted by other items, the linear regression was conducted. The linear regression analysis was done with six different relationships and results were shown in Table 5.6.5.7. The results show that the lowest R^2 is 0.675, indicating a high predictive

ability of independent variables. Thus, in most of regression models more than 70 percent of the variation in the dependent variable is explained by independent variables. In addition, all of regression models are significant at the 0.01 level (F test was given in ANOVA table). Finally, all of the relationships are significant at the 0.01 level. Thus, it can be concluded that the overall items (CU and PU) can be predicted well by other specific items.

Table 5.6.5.7: Regression Analysis for the Extent of Current EM Usage Extent of Planned EM Usage

Dependent variables	Independent variables	R^2	Significance of regression (F test)
CU/3PX	CU1/3PX, CU2/3PX, CU3/3PX	**0.725**	**p< 0.01**
PU/3PX	PU1/3PX, PU2/3PX	**0.810**	**p< 0.01**
CU/ISM	CU1/ISM, CU2/ISM, CU3/ISM	**0.675**	**p< 0.01**
PU/ISM	PU1/ISM, PU2/ISM	**0.728**	**p< 0.01**
CU/PTN	CU1/PTN, CU2/PTN, CU3/PTN	**0.684**	**p< 0.01**
PU/PTN	PU1/PTN, PU2/PTN	**0.773**	**p< 0.01**

The significant results of bivariate correlation and regression analysis indicated that CU and PU can be used to represent the Extent of Current EM Usage and Extent of Planned EM Usage, respectively. In next chapter, hypotheses testing will be discussed with detailed analysis on relationship between three factors (EB, PR, and PS) and CU/PU. In addition, the moderating effect of ER will be also discussed.

CHAPTER SIX: HYPOTHESES TESTING

As mentioned before, the data analysis has two main parts: assessment of measurement instruments and hypotheses testing. Measurement instruments have been carefully assessed in the previous chapter with necessary adjustments. This chapter focuses on testing hypotheses of the research model.

Since the extent of EM usage is measured from both current and planned usage perspective, all hypotheses were tested in both cases: the dependent variable is Extent of Current EM Usage (CU), and the dependent variable is Extent of Planned EM Usage (PU). Hypothesis 1 is represented by the relationship (EB— CU/PU); this one hypothesizes that Expected Benefits (EB) are positively correlated with the Extent of EM Usage. Hypothesis 2 is represented by the relationship (FR — CU/PU); this one hypothesizes that Financial Risks (FR) are negatively correlated with the Extent of EM Usage. Hypothesis 3 is represented by the relationship (PS — CU/PU); this one hypothesizes that Purchasing Situations (PS) are positively correlated with the Extent of EM Usage. Hypothesis 4 refers to the moderating effect of E-Business Readiness (ER) on the correlation between Expected Benefits (EB) and Extent of EM Usage. In other words, it is represented by the relationship (ERxEB — CU/PU); this one hypothesizes that the interaction between Expected Benefits (EB) and E-Business Readiness (ER) is correlated with the Extent of EM Usage. Likewise, Hypothesis 5 is represented by the relationship

(ERxPR – CU/PU); this one hypothesizes that the interaction between Perceived Risks (PR) and E-Business Readiness (ER) is correlated with the Extent of EM Usage. The method used to test those hypotheses was multiple regression that will be discussed in the following section.

6.1 Multiple Regression Model

6.1.1 Multiple Regression Method

In order to test hypotheses, multiple regression analysis was used. Multiple regression is an extension of simple linear regression involving more than one independent variable (IV). This technique is used to test the relationship between a single dependent variable (DV) and a set of independent variables (IV) (Harris, 1998). The multiple regression equation takes the form:

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots + b_kX_k$$

where

- Y is the dependent variable
- X_i is an independent variable (i = 1 to k)
- b_0 is the intercept, where the regression line intercepts the Y-axis, representing the amount the dependent Y will be when all the independent variables are 0
- b_i (i= 1 to k) is the regression coefficients or beta coefficient, representing the amount the dependent variable Y changes when the independent variable changes 1 unit

Cross-product terms can be added as independent variables to explore interaction effects, as known as moderating regression. Moderating regression involves regression that first tests the relationship of the predictors of interest on the criterion variable, and

secondly tests the relationship of a term that carries information about both predictors (the interaction term). The interaction term can then be computed for each subject by multiplying the two predictors such that the resulting regression equation is in the form:

$$Y = b_0 + b_1X + b_2Z + b_3X \bullet Z$$

where b_0 is the intercept, b_1 is the regression coefficient for X, b_2 is the regression coefficient for Z, and b_3 is the regression coefficient about the interaction between X and Z.

The regression analysis was done using stepwise method. Stepwise method is perhaps the most popular sequential approach to variable selection. This approach allows the researcher to examine the contribution of each independent variable to the regression model. Each variable is considered for inclusion prior to developing the equation. The independent variable with greatest contribution is added first. Independent variables are then selected for inclusion based upon their incremental contribution over the variable(s) already in the equation.

Interpretation of multiple regression analysis focuses on determining the adequacy of the regression model that has been developed. Conducting multiple regression typically generates outputs that can be divided into three parts: R^2, the significance of regression (F-ratio), and significance of regression coefficient. R^2 is the coefficient of determination and tells us how much of the variance of the dependent variable can be explained by the independent variable. The R^2 can vary between 0 and 1. If the regression is properly applied and estimated, the researcher can assume that the higher the value of R^2, the greater the explanatory power of the regression equation, and

therefore the better the prediction of the dependent variable. The R^2 value can be computed as follows

$$R^2 = \frac{\text{Explained variation}}{\text{Total variation}} = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2}$$

To examine the significance of the overall model, the F-ratio is used. If the F-test is significant then the relationship between DV and IVs is linear and therefore the model significantly predicts the DV. The test statistics F is calculated as

$$F\ ratio = \frac{SSE_{regression} / df_{regression}}{SSE_{total} / df_{residual}}$$

where

$df_{regression}$ = number of estimated coefficients – 1

$df_{residual}$ = sample size – number of estimated coefficients

The final part of the output is the coefficients table that reports the following: unstandardized regression coefficient (b), the standardized regression coefficient (beta or β), and p values. The unstandardized regression coefficient represents the slope weight for each variable in the model and is used to create the regression equation. b weights also indicates how much the value of DV changes when the IV increases by 1 and the other IV's remain the same. A positive b specifies a positive change in the DV when the IV increases, whereas a negative b indicates a negative change in the DV when the IV increases. The standardized regression coefficient is used to create a regression equation for the standardized variables. It is based upon z-scores with a mean of 0 and standard deviation of 1. The coefficients table also presents p values, which indicates the significance of the b weight and β weight.

6.1.2 Regression Equations

In this research, two regression equations were formed representing five hypotheses for two different dependent variables - Extent of Current EM Usage (CU) (equation 1) and Extent of Planned EM Usage (PU) (equation 2) – as shown below.

$$CU = b_0 + b_1EB + b_2PR + b_3PS + b_4ER + b_5ERxEB + b_6ERxPR \quad (1)$$

$$PU = b_0 + b_1EB + b_2PR + b_3PS + b_4ER + b_5ERxEB + b_6ERxPR \quad (2)$$

where

- CU and PU: dependent variables
- EB, PR, PS, ER: independent variables
- ERxEB: the interaction term representing the moderating effect of ER on EB
- ERxPR: the interaction term representing the moderating effect of ER on PR
- b_0: the intercept
- b_1: the regression coefficient indicating how much the value of CU or PU changes when the EB increases that can be used to discuss the hypothesis 1
- b_2: the regression coefficient indicating how much the value of CU or PU changes when the PR increases that can be used to discuss the hypothesis 2
- b_3: the regression coefficient indicating how much the value of CU or PU changes when the PS increases that can be used to discuss the hypothesis 3
- b_4: the regression coefficient indicating how much the value of CU or PU changes when the ER increases
- b_5: the regression coefficient indicating how much the value of CU or PU changes when the interaction ERxEB increases that can be used to discuss the hypothesis 4.

Rejecting the null hypothesis that $b_5 = 0$, indicates the presence of an interaction or moderating effect.

– b_6: the regression coefficient indicating how much the value of CU or PU changes when the interaction ERxPR increases that can be used to discuss the hypothesis 5. Rejecting the null hypothesis that $b_6 = 0$, indicates the presence of an interaction or moderating effect.

6.2 Multiple Regression Results

The multiple regression model has been tested with two regression equations as mentioned in the previous section. As tested in Chapter Five, there were nine first-order constructs: MA, IC, FR, TB, EI, CP, ITUSE, ITNUSE, and ISSCM; and four constructs – EB, PR, PS, and ER – were considered second-order constructs. In addition, CU and PU were single items. Four second-order constructs were determined by aggregating first-order construct using average values.

First, the regression results for Extent of Current EM Usage (CU) are shown in Table 6.2.1 and Table 6.2.2. Table 6.2.1 shows the step-wise analysis in the multiple regression test. The interaction term ERxEB was the first variable entered indicating its importance in the regression model. R^2 in this first step was 0.225, F statistic was 81.79. In the second step, EB was entered; R^2 was 0.322, indicating the R^2 change being 0.97, and F statistic was 66.63. PR was entered in the third step showing R^2 of 0.383; R^2 change was 0.61 and F statistic was 58.05. The step-wise was stopped here and PS, ER, and ERxPR were excluded.

Table 6.2.2 shows the final results of the multiple regression analysis. The coefficient of determination was 0.383 indicating that 38.3 percent of the variance of the

dependent variable can be explained by independent variables. This low R^2 indicated that the predictive ability of independent variables was low. The F-value and significance in ANOVA table (F = 58.05 and p<0.01) indicated that the regression model was significant at 0.01 level.

Table 6.2.1: Step-Wise Analysis for Extent of Current EM Usage

Steps	Variables entered	R-square	R-square change (ΔR^2)	F Statistic	p-value
1	ERxEB	0.225	-	81.79	<0.01
2	EB	0.322	0.97	66.63	<0.01
3	PR	0.383	0.61	58.05	<0.01

Table 6.2.2: Multiple Regression Results for Extent of Current EM Usage

Dependent Variable: Extent of Current EM Usage (CU)			
F-test F statistic = 58.05 p <0.01		**R-square** R^2 = 0.383	
Regression coefficients			
	Unstandardized Coefficients	Standardized Coefficients	p-value
Constant	**1.224**	**-**	**< 0.01**
EB	**0.274**	**0.316**	**< 0.01**
PR	**-0.300**	**-0.251**	**< 0.01**
PS*	0.022	0.027	0.894
ER*	0.178	0.111	0.239
ERxEB	**0.065**	**0.447**	**< 0.01**
ERxPR*	-0.113	-0.048	0.111

(*: excluded variables)

The examination on regression coefficients indicated that only two independent variables, expected benefits (EB) b_1=0.274, p<0.01; and perceived risks (PR) b_2=-0.300, p<0.01; and an interaction term (ERxEB) b_5=0.065, p<0.01, significantly contributed to the model. The regression equation obtained was

$$CU = 1.224 + 0.274EB - 0.300PR + 0.065ERxEB$$

Thus, it can be concluded that there is a significantly positive relationship between Expected Benefits (EB) and Extent of Current EM Usage (CU); a significantly negative relationship between Perceived Risks (PR) and Extent of Current EM Usage (CU); and a significantly positive moderating effect of E-Business Readiness (ER) on Expected Benefits (EB).

Second, the multiple regression for Extent of Planned EM Usage (PU) was tested. The regression results are shown in Table 6.2.3 and Table 6.2.4. The step-wise analysis in the multiple regression test was shown in Table 6.2.3. The first entered variable was the interaction term ERxEB; R^2 in this first step was 0.225, F statistic was 81.95. In the second step, EB was entered; R^2 was 0.322, indicating the R^2 change of 0.113, and F statistic was 71.67. ERxPR was entered in the third step showing R^2 of 0.383; R^2 change was 0.49 and F statistic was 59.04. In the fourth step, PS was entered; R^2 was 409, R^2 change was 0.22, and F statistic was 4.24. The step-wise was stopped here and PR and ER were excluded.

The final results of the multiple regression analysis was shown in Table 6.2.4. R^2, the coefficient of determination, was slightly higher (0.409) indicating that 40.9 percent of the variance of the dependent variable can be explained by independent variables. However, this R^2 was still low indicating the low predictive ability of independent variables. The F-test showed $F = 48.24$ and $p<0.01$ indicating that the regression model was significant at 0.01 level.

Table 6.2.3: Step-Wise Analysis for Extent of Planned EM Usage

Steps	Variables entered	R-square	R-square change (∆R2)	F Statistic	p-value
1	ERxEB	0.225	-	81.95	<0.01
2	EB	0.338	0.113	71.67	<0.01
3	ERxPR	0.387	0.49	59.04	<0.01
4	PS	0.409	0.22	48.24	<0.01

Table 6.2.4: Multiple Regression Results for Extent of Planned EM Usage

Dependent Variable: Extent of Planned EM Usage (PU)			
F-test F statistic = 48.24 p <0.01		**R-square** R^2 = 0.409	
Regression coefficients			
	Unstandardized Coefficients	Standardized Coefficients	p-value
Constant	0.336	-	0.114
EB	**0.322**	**0.362**	**< 0.01**
PR*	-0.059	-0.039	0.254
PS	**0.200**	**0.156**	**< 0.01**
ER*	0.107	0.061	0.188
ERxEB	**0.103**	**0.690**	**< 0.01**
ERxPR	**-0.083**	**-0.323**	**< 0.01**

(*: excluded variables)

Review of regression coefficients showed that only two independent variables, expected benefits (EB) b_1=0.322, p<0.01; and purchasing situations (PS) b_3=0.200, p<0.01; and two interaction terms, ERxEB b_5=0.103, p<0.01; and ERxPR b_6=-0.083, p<0.01, significantly contributed to the model. The regression equation obtained was

PU = 0.322EB + 0.200PS + 0.103ERxEB - 0.113ERxPR

Thus, it can be concluded that there is a significantly positive relationship between Expected Benefits (EB) and Extent of Planned EM Usage (PU); a significantly

positive relationship between Purchasing Situations (PS) and Extent of Planned EM Usage (PU); a significantly positive moderating effect of E-Business Readiness (ER) on Expected Benefits (EB); and a significantly negative moderating effect of E-Business Readiness (ER) on Perceived Risks (PR). Again, the low regression coefficient showed the small extent of the change in the dependent variable when the independent variables increase.

In summary, although the low R^2 showed the low predictive ability of independent variables in some extents, and the low regression coefficients showed the low change in the dependent variables when independent variables increases, the regression models were significant and seven out of ten coefficients were significant. Thus, it can be concluded that the hypotheses H1 and H4 were fully supported, whereas H2, H3, and H5 were partially supported (Table 6.2.5).

Table 6.2.5: Summary of Results for the Hypotheses Testing

Hypothesis	Relationship	Effect	Status
H1	EB — CU/PU	Positive	**Supported**
H2	PR – CU/PU	Negative	***Partially Supported***
H3	PS – CU/PU	Positive	***Partially Supported***
H4	ERxEB – CU/PU	Positive	**Supported**
H5	ERxPR – CU/PU	Negative	***Partially Supported***

6.3 Differences among Three Different Types of EMs - 3PXs vs. ISMs vs. PTNs

The previous section tested all proposed hypotheses, in which 6 of them were supported, indicating the correlation between Expected Benefits, Perceived Risks, and Purchasing Situations with the Extent of Current EM Usage and Extent of Planned EM

Usage. However, although those hypotheses indicate the significance of the relationship in each type of EMs, they did not allow us to figure out differences among three types of EMs: 3PXs, ISMs, and PTNs. These differences are important since they enable buyers to decide which type of EMs would be appropriate for them when they examine the EMs from different aspects: expected benefits, perceived risks, and purchasing situations. Thus, this analysis will be very helpful for us in discussing the implications of research model and hypotheses testing.

Given the importance of examining those differences, this section conducts ANOVA (Analysis Of Variance) which is a hypothesis testing procedure that simultaneously evaluates the significance of mean differences on a dependent variable between two or more treatment conditions of groups. The treatment conditions or groups are defined by various levels of the independent variable.

In this section, the effect of type of EMs on Extent of EM Usage, Expected Benefits, Perceived Risks, and Purchasing Situations were tested using ANOVA. Results were interpreted in the following procedure: (1) Levene's test will be conducted to test the assumption of homogeneity of variance which is the most important assumption in ANOVA test. Non-significance of this test indicates homogeneity of variance; (2) main effect of type of EMs will be tested using F ratio and significance of F will indicate the significance of group differences; (3) in order to compare three types of EMs for each characteristic the planned comparison, or contrast test, was used. Planned comparison enables us to test the contrasts among EM types as planned and the value and sign of contrasts indicate the extent of differences and which EM type is preferred to another for each characteristic.

6.3.1 Differences among EM Types with Respect to Extent of Current Usage

First, Levene's test of equality of variances was conducted within ANOVA and the non-significance indicates homogeneity of variance within groups (Levene Statistic=2.687, p=0.69) (see Figure 6.3.1.1). Then, the main effect of factor (EM type) was determined. F ratio (F=1.471) and levels of significance (p=0.230) showed that Extent of Current EM Usage was not significantly affected by EM types. Figure 6.3.1.1 also displays the results of the contrast test. Although the contrast values indicated extent of current 3PX usage was slightly higher then extent of ISM usage and slightly lower than extent of PTN usage which in its turn was slightly higher than extent of ISM usage, those differences were not significant. Thus, it can be concluded that there is no significant pair-wise differences in Extent of Current EM Usage among three different types of EMs.

Table 6.3.1.1: Differences among EM Types with Respect to Extent of Current Usage

1. Test of Homogeneity of Variance		
Levene Statistic = 2.687		**p = 0.69**
2. Test of Main Effect		
F Statistic = 1.471		p =0.230
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	0.0606	0.462
3PXs vs. PTNs	-0.0809	0.329
ISMs vs. PTNs	-0.1415	0.088

6.3.2 Differences among EM Types with Respect to Extent of Planned Usage

Test of equality of variances using Levene's test was conducted within ANOVA and the non-significance of this test indicated homogeneity of variance within groups (Levene Statistic=2.436, p=0.088) (see Figure 6.3.2.1). The F test showed F=1.310 and p=0.270. It can be concluded that there is no significant effect of EM types on Extent of Planned EM Usage. Again, the contrast values showed a slight smaller extent of 3PX usage compared with ISM and PTN. However, p-values of contrast tests were all above 0.05 indicating no significant pair-wise differences in Extent of Planned EM Usage among three different types of EMs.

Table 6.3.2.1: Differences among EM Types with Respect to Extent of Planned Usage

1. Test of Homogeneity of Variance		
Levene Statistic = 2.436		p = 0.088
2. Test of Main Effect		
F Statistic = 1.310		p =0.270
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	-0.0089	0.921
3PXs vs. PTNs	-0.1300	0.147
ISMs vs. PTNs	-0.1211	0.177

6.3.3 Differences among EM Types with Respect to Market Aggregation

This section considers the effect of EM types on Market Aggregation. The non-significance of Levene's test indicates homogeneity of variance within groups (Levene Statistic=0.028, p=0.973). Then, the main effect of factor (EM type) was determined with F=11.349 ($p<0.01$), indicating that Market Aggregation was significantly affected by EM types. Contrast tests were conducted resulting in significance for the second and third

contrast tests, and non-significance for the first one. The contrast values showed that 3PXs were significantly preferred to PTNs for Market Aggregation; and so were ISMs. It was also shown that 3PXs were not significantly different from ISMs with respect to Market Aggregation. It can be concluded that public EMs (3PXs and ISMs) are superior to private EMs (PTNs) in term of providing participants the Market Aggregation.

Table 6.3.3.1: Differences among EM Types with Respect to Market Aggregation

1. Test of Homogeneity of Variance		
Levene Statistic = 0.028		p = 0.973
2. Test of Main Effect		
F Statistic = 11.439		p < 0.01
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	-0.0400	0.568
3PXs vs. PTNs	**0.2696**	**<0.01**
ISMs vs. PTNs	**0.3096**	**<0.01**

6.3.4 Differences among EM Types with Respect to Inter-Firm Collaboration

In order to test the difference among EM types for Inter-Firm Collaboration, in the first step the Levene's test was conducted indicating homogeneity of variance within groups (Levene Statistic=0.623, p=0.536) (see Figure 6.3.4.1). Then, the F test indicated the main effect of factor (type of EMs) with F=4.262 (p=0.01). Thus, Inter-Firm Collaboration was significantly affected by EM types and that effect was shown in the contrast tests. The second contrast test was the only one which was significant. The negative value of the first contrast showed that ISMs were significantly preferred to 3PXs for Inter-Firm Collaboration; and so were PTNs. It was also seen that extent of Inter-Firm Collaboration provided by ISMs was slightly lower than by PTNs, but since the p-value

was above 0.05 it can be concluded that this difference was not significant. Thus, it can be concluded that the bias EMs (ISMs and PTNs) are significantly superior to the neutral EMs (3PXs) with respect to Inter-Firm Collaboration.

Table 6.3.4.1: Differences among EM Types with Respect to Inter-Firm Collaboration

1. Test of Homogeneity of Variance		
Levene Statistic = 0.623		p = 0.536
2. Test of Main Effect		
F Statistic = 4.262		p = 0.01
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	**-0.1627**	**0.028**
3PXs vs. PTNs	**-0.2039**	**<0.01**
ISMs vs. PTNs	-0.0412	0.583

6.3.5 Differences among EM Types with Respect to Financial Risks

The testing process was repeated here, but with the Perceived Risks. First, the Financial Risks were considered. The non-significance of Levene's test indicated homogeneity of variance within groups (Levene Statistic=0.342, p=0.710) (see Figure 6.3.5.1). Then, the main effect of factor (EM type) was examined indicating F=0.013 (p=0.987). Thus, there was no effect of EM types on Financial Risks. Very high p-values of contrast tests also pointed out the extent of Financial Risks was not significantly different among three EM types: 3PXs, ISMs, and PTNs.

Table 6.3.5.1: Differences among EM Types with Respect to Financial Risks

1. Test of Homogeneity of Variance		
Levene Statistic = 0.342		p = 0.710
2. Test of Main Effect		
F Statistic = 0.013		p = 0.987
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	-0.0093	0.908
3PXs vs. PTNs	0.0037	0.964
ISMs vs. PTNs	0.0130	0.874

6.3.6 Differences among EM Types with Respect to Trust Barriers

The process of comparing Perceived Risks among EM types was continued with Trust Barriers. The Levene's test showed homogeneity of variance within groups (Levene Statistic=2.163, p=0.116) (see Figure 6.3.6.1). The F test resulted in F=16.124 (p<0.01), indicating the significant effect of EM types on Trust Barriers. Pair-wise comparison tests were conducted by contrast tests resulting in the significance for the second and third tests while the first test was shown non-significant. The positive contrast values of the second contrast indicated that the extent of Trust Barriers created by 3PXs was significantly higher than PTNs. Likewise, ISMs were shown to have to encounter the Trust Barriers in significantly greater extent than PTNs. Thus, PTN is the EM which has lowest possibility of creating trust barriers compared with other. Finally, the high p-value (0.264) of the first contrast indicated no significant difference between 3PXs and ISMs for trust barriers, although the value of contrast showed a slightly greater extent of Trust Barriers in 3PXs.

Table 6.3.6.1: Differences among EM Types with Respect to Trust Barriers

1. Test of Homogeneity of Variance		
Levene Statistic = 2.163		p = 0.116
2. Test of Main Effect		
F Statistic = 16.124		p < 0.01
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	0.0381	0.264
3PXs vs. PTNs	**0.4061**	**<0.01**
ISMs vs. PTNs	**0.3229**	**< 0.01**

6.3.7 Differences among EM Types with Respect to Economic Importance of Purchases

From this section, the comparison was moved to Purchasing Situations, and the first situation considered was Economic Importance of Purchases. First, Levene's test of equality of variances was conducted within ANOVA and the non-significance indicated homogeneity of variance within groups (Levene Statistic=1.772, p=0.171) (see Figure 6.3.7.1). Then, the main effect of factor (EM type) was determined. Since F=0.887 (p=0.412) it can be concluded that Economic Importance of Purchases is not significantly affected by EM types. The non-significance of contrast tests also showed that there was no significant pair-wise difference among three EM types with respect to Economic Importance of Purchases.

Table 6.3.7.1: Differences among EM Types with Respect to Economic Importance of Purchases

1. Test of Homogeneity of Variance		
Levene Statistic = 1.772		p = 0.171
2. Test of Main Effect		
F Statistic = 0.887		p = 0.412
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	-0.0744	0.348
3PXs vs. PTNs	-0.1027	0.199
ISMs vs. PTNs	-0.0282	0.725

6.3.8 Differences among EM Types with Respect to Complexity of Purchasing Processes

Lastly, the comparison was done for Complexity of Purchasing Processes. The Levene's test showed homogeneity of variance within groups (Levene Statsitic=3.541, p=0.059) (see Figure 6.3.8.1). The F test resulted in F=0.3801 (p=0.02), indicating that there was a significant effect of EM types on Complexity of Purchasing Processes. It can be seen that the first two contrasts were significant while the remaining was not. The negative value of the first contrast showed that ISMs were significantly preferred to 3PXs for the procurement of materials/products that have the high complexity of purchasing processes. Likewise, the value of second contrast indicated PTNs are superior to 3PXs with respect to complexity of purchasing processes. The non-significance of the last contrast showed that ISMs were not significantly different from PTNs for this characteristic.

Table 6.3.8.1: Differences among EM Types with Respect to Complexity of Purchasing Processes

1. Test of Homogeneity of Variance		
Levene Statistic = 3.541		p = 0.059
2. Test of Main Effect		
F Statistic = 0.3801		p = 0.02
3. Contrast Tests		
Contrast	***Value of Contrast***	***p-value***
3PXs vs. ISMs	**-0.1650**	**0.03**
3PXs vs. PTNs	**-0.1988**	**0.01**
ISMs vs. PTNs	-0.0338	0.66

6.4 Discussions of Hypotheses Testing Results

The previous section reported hypotheses testing results on the proposed research model. To summarize, two out of five hypotheses were fully supported (H1: EB-CU/PU; and H4: ERxEB – CU/PU), and other three hypotheses were partially supported (H2: PR - PU; H3: PS – CU; and H5: ERxPR – PU).

However, the statistical significance is not ultimate objectives of academic research. They are just the means to achieve the end, which is better understanding of the subject under investigation and discovery of new relationships. The result from this research can be used not only by academicians in further exploring and testing relationships in the context of EM usage from the buyer perspective, but also by practitioners when they consider utilizing EMs for purchasing. This section will discuss the theoretical and practical implications of the test of each hypothesis.

Hypothesis 1*: Expected benefits of EMs and the extent of EM usage are positively correlated*

This hypothesis is fully supported with significant relationship between Expected Benefits (EB) and Extent of Current EM Usage (CU) as well as and Extent of Planned EM Usage (PU). This result confirms the important role of expected benefits in influencing buyers' decision to utilize EMs for purchasing. The higher the expected benefits of EMs, the more likely the buyers will use EMs for purchasing. Expected benefits were considered a second-order construct by market aggregation and inter-firm collaboration. It confirms the economics literature developed by Malone *et al.* (1987) and Bakos (1991) and other researches in this literature about benefits of EMs in terms of reducing transactional costs, price transparency, and market liquidity. This finding also supports the statement by Block and Catfolis (2001), Brunn *et al.* (2002), and Le (2002) postulating the important role of inter-firm collaboration.

It can be seen that the correlation between expected benefits and extent of planned usage of EM is stronger than the correlation with extent of current usage of EMs; indicating the incremental crucial role of expected benefits in expanding the extent of EM usage in the future. This implication may give EM operators an idea how to develop EMs to attract more participants to use EMs for purchasing.

The planned comparison showed the differences of expected benefits among EM types that will enable buyers to select an appropriate EM type to join. The results indicated 3PXs are preferred to PTNs for market aggregation; ISMs provide greater extent of market aggregation than PTNs; whereas there is no difference between 3PXs and ISMs for market aggregation. Thus, if the market aggregation is the major benefit

that the buyers expect, 3PXs or ISMs will be a better choice since they can provide buyers greater extent of market aggregation compared with PTNs.

As for inter-firm collaboration, 3PXs are shown to provide inter-firm collaboration at the smaller extent than ISMs. In addition, PTNs are preferred to 3PXs for inter-firm collaboration, whereas there is no difference between ISMs and PTNs for that benefit dimension. Thus, if inter-firm collaboration is a primary benefit expected by the of buyers, they may want to consider joining an ISM or PTN since they can benefit more from those EMs than from 3PXs.

In summary, it can be concluded that 3PXs are more preferred for market aggregation, PTNs are more preferred for inter-firm collaboration, whereas ISMs can provide both of those benefits at reasonable extent. That finding agrees with the real situations of those EMs' implementation.

Hypothesis 2*: Perceived risks of EMs and the extent of EM usage are negatively correlated*

The results show that this hypothesis was only partially supported. The negative relationship between Perceived Risks (PR) and Extent Of Current EM Usage (CU) was significant, whereas the negative relationship between Perceived Risks (PR) and Extent of Planned EM Usage (PU) was insignificant. The negative relationship between perceived risks and extent of current EM usage indicates that higher perceived risks would inhibit or constrain buyers to utilize EMs for purchasing. These findings also confirm the literature about potential risks in participating in EMs in term of high costs of EM platform development, business coordination and IS integration costs (Abell and Lim, 1996; Kheng and Al-Hawamdeh; 2002; Purao and Capbell, 1998; Walczuch *et al.*,

2000; Zhu, 2002). However, the impact of perceived risks was insignificant for the planned EM usage. Thus, in the future companies have a plan to use EMs at the greater extent and the benefits as well as functionalities of EMs are perceived to be improved; therefore, the risks are perceived to be reduced and their impact may not be a main concern.

Perceived Risks were also a second-order construct built by two first-order constructs – Financial Risks and Trust Barriers. However, the extent of those risks is not identical among EM types. The planned comparison showed no significant difference between EM types for financial risks. In other words, three EM types are perceived to have financial risks at the same extent. As for trust barriers, 3PXs are perceived to have more trust barriers than PTNs; so are ISMs. The results also showed no significant difference between 3PXs and ISMs for trust barriers. This finding makes sense since PTNs are perceived to be capable of providing higher trusts to participants with closer relationship between suppliers and buyers. Thus, if financial risks are the main concern of the buyers regarding potential risks of EMs then either 3PXs, ISMs, or PTNs could be a choice for the buyers since they can create the same extent of financial risks. However, if trust barriers become a primary concern PTNs could be the best choice since the buyers will have the lowest trust barriers when joining a PTN. This finding indicates the potential of PTNs in the future of EMs evolvement.

Hypothesis 3*: Purchasing situations and the extent of EM usage are positively correlated*

This hypothesis was partially supported since the relationship between Purchasing Situations (PS) and Extent of Planned EM Usage (PU) was significant, whereas the

relationship between Purchasing Situations (PS) and Extent of Current EM Usage (CU) was insignificant. Purchasing Situations (PS) are also a second-order construct built by economic importance of purchases and complexity of purchasing processes. The insignificant relationship between purchasing situations and extent of current EM usage can be explainable. Currently, the number of EM users is rather low (about 35%) and among current users, the majority has used EMs at the small or moderate extent; whereas very few of them (about 7%) have used EMs at the considerable or great extent. For that reason, there is no clear impact of purchasing situations on the extent of current EM usage. In the future, more companies have a plan to use EMs for purchasing (about 55%), and about 11% will be using EMs at the considerable or great extent. The results of regression analysis showed a significant relationship between purchasing situations and extent of planned EM usage. Thus, when the buyers use EMs at the greater extent, their purchasing situations (when they use EMs for purchasing) will be more diversified and purchasing situations will have an impact on the planned EM usage. The higher the economic importance and complexity of purchases, the more likely a firm will have a definite plan to use EMs for purchasing.

The planned comparison showed no significant difference among EM types for economic importance of purchases. Thus, if the products/materials that the buyers will purchase have a high volume of high contribution to the final quality, any EMs could be a good choice for the buyer since they enable the buyers to facilitate the purchasing process. On the other hand, the complexity of purchasing processes was shown to be different among EM types. The results indicated ISMs are preferred to 3PXs when the purchasing processes are more complex; so are PTNs. Nonetheless, there is no significant

difference between ISMs and PTNs for this characteristic. This finding makes sense since ISMs and PTNs are capable of providing the collaboration between buyers and sellers which will allow the buyers to handle the complexity of purchasing process. Thus, when the purchasing processes are more complicated, ISMs or PTNs would be an appropriate choice for the buyers.

Hypothesis 4*: E-business readiness moderates the relationship between expected benefits and the extent of EM usage*

This hypothesis was fully supported showing the significantly positive relationship between the interaction (ERxEB) and Extent of Current EM Usage (CU) as well as Extent of Planned EM Usage (PU). This finding indicated the moderating effect (with reasonable regression coefficient) of E-Business Readiness (ER) on Expected Benefits (EB). Thus, if the great extent of benefits of EMs expected by the buyers interacts with the great extent of readiness of the buyers in using IT/IS and the Internet for facilitating purchasing then the buyers will be more likely to use EMs for purchasing at a great extent. It can be noticed that the moderating effect of ER on EB is higher for planned usage than for current usage. The explanation could be that the number of companies using the Internet for purchasing is increased (ISM, 2003) and, therefore, they will be more ready for using e-business. Moreover, as indicated in Chapter Five, 55% of companies have a plan to use EMs for purchasing in the future. Thus, when they expect more benefits from EMs and they are more ready for using e-business then they will be more likely to decide to use EMs for purchasing.

Hypothesis 5*: E-business readiness moderates the relationship between perceived risks and the extent of EM usage*

This hypothesis was partially supported showing the insignificant relationship between the interaction (ERxPR) and Extent of Current EM Usage (CU), and the significant relationship between the interaction (ERxPR) and Extent of Planned EM Usage (PU). This finding indicated that for the current EM usage, although perceived risks have a significantly negative relationship with extent of EM usage the moderating effect of e-business readiness (ER) on perceived risks (PR) does not exist. In other words, since very few companies have used EMs at a great extent e-business readiness cannot change the negative impact of perceived risks.

As for the planned usage, the results showed a significantly negative moderating effect of ER on PR. However, the hypothesis 2 indicated no significant impact of perceived risks (PR) on extent of planned EM usage (PU). Thus, although in the future PR is not an important variable that influences the extent at which companies plan to use EMs, the interaction between PR and ER plays an important role in influencing the extent of planned EM usage. The negative effect showed that the interaction between PR and ER will make the buyer hesitant to use EMs for purchasing. This finding can be explained that the buyers that perceive some potential risks on using EMs for purchasing and possess some IS infrastructure and experiences in using IT and Internet for facilitating purchasing may consider using other online procurement solutions such as e-procurement and EDI or developing their own solutions to avoid the risks that may be created in using EMs.

As mentioned earlier, the moderating effect of ER has never been investigated in existing literature on EMs. Therefore, although the results showed a significant moderating effect, further studies need to be done in order to confirm this finding. Moreover, the low R^2 indicated the low predictive ability of independent variables. Accordingly, the moderating effect of ER has to be interpreted with caution.

6.5 Summary of Results

Overall, the results indicates that expected benefits of EMs have positive correlations with extent of EM usage (current and planned usage), perceived risks of EMs have negative correlations with extent of EM usage, and purchasing situations have positive relationships with extent of EM usage. In addition, e-business readiness was indicated as a moderator on the positive relationship between expected benefits and extent of EM usage and on the negative relationship between perceived risks and extent of EM usage.

The next chapter will conclude with the summary of research findings and major contributions, implications for managers, limitations of the research, and recommendations for future research.

CHAPTER SEVEN: SUMMARY AND RECOMMENDATIONS FOR FUTURE RESEARCH

This chapter provides (1) summary of research findings and major contributions, (2) implications for practitioners, (3) limitations of the research, and (4) recommendations for future research.

7.1 Summary of Findings

The current research represents one of the first large-scale empirical efforts to systemically investigate the issue of EM usage from the buyer perspective. It aims at figuring out relationships between various factors and extent of EM usage for purchasing. As we have mentioned in the introduction, although EMs have been studied in many researches, very few of them has provided empirical evidence and there is no comprehensive research model in the context of EM usage. In this research, the developed research model considers various factors that are correlated to the buyer's decision to utilize EMs for purchasing. The relationships between those factors and extent of EM usage are tested based on the data collected from 359 purchasing managers. The study contributes to our knowledge of EM usage in a number of ways.

First, this research provided a theoretical framework that identified various factors that have correlations with extent of EM usage for purchases including expected benefits, perceived risks, purchasing situations, and e-business readiness. This framework

provided a foundation for future research. In the future, a similar model can be constructed from the seller and market operator perspectives.

Second, the study provided valid and reliable measurements for the following six constructs: 1) Expected Benefits, 2) Perceived Risks, 3) Purchasing Situations, 4) E-Business Readiness, 5) Extent of Current EM Usage, and 6) Extent of Planned EM Usage. For expected benefits, this study filled the gap in the EMs' literature which has focused only on the market aggregation side of expected benefits of EMs and largely ignored the vital role of inter-firm collaboration. This research explored adequately the benefits EMs create from both sides: market aggregation and inter-firm collaboration. In addition, this research developed a construct of perceived risks of EMs that have not been sufficiently examined in the current literature. Finally, this was the first time the constructs of purchasing situations and e-business readiness had been developed in the context of EM usage. All of those scales were tested through rigorous statistical methodology including factorial validity and reliability. All the scales were shown to meet the requirements for reliability and validity and thus, can be used in future research. Such valid and reliable scales had been otherwise lacking in the literature of empirical EM research. The development of these measurements will greatly stimulate and facilitate the theory development in this field.

Third, the empirical results of this study gave researchers a clear idea about the extent at which companies use EMs at the current time. Nearly 54 percent of survey respondents indicated their organizations currently use an EM of some type. This figure is substantially higher than a corresponding quarterly survey figure of 34.7 percent reported by the Institute of Supply Management (2003). One possible explanation is that

this survey contains many questions with details that require some considerable degree of familiarity with EMs. Respondents who do not currently use or plan to use EMs are less likely to respond than those who are. This factor may also explain in part the apparent over-representation of large organizations among the survey respondents. Firms with over $100 million in annual procurement spending have purchased materials through EMs more often than those below.

Fourth, this study provided supporting evidences to the conceptual and prescriptive literature about previously untested statements regarding two dimensions of expected benefits of EMs and the relationship between expected benefits and extent of EM usage (current or planned usage). The results indicated two major factors constructing expected benefits at high loadings: market aggregation and inter-firm collaboration. They also supported empirically hypotheses regarding the positive relationship between market aggregation or inter-firm collaboration and extent of EM usage. These findings are consistent with the economics literature on EMs that provided rational for the impact of market aggregation. They confirmed the postulations in studies of Malone *et al.* (1987) and Bakos (1991, 1997, 1998), which emphasized transactional cost reduction and search cost reduction as major benefits of EMs, and were similar to outcomes of a limited number of empirical studies in the same fields (Gudmunson and Walczuck, 1999; Daniel and Klimis, 1999; and Mahadevan, 2000). In addition to cost reduction, EMs were also empirically perceived to enable buyers to access the supplier database, and build the market liquidity (as postulated by Mahadevan, 2002; Kauffman and Walden, 2001; Le, 2002). Moreover, the empirical results of this study provided substantial supports for SCM studies that was only conceptual or managerial in its

approach. This finding strengthened the proposition of Le (2002), Bloch and Catfolis (2001) and Brunn *et al.* (2002) about the second dimension of expected benefits of EMs - inter-firm collaboration. Most of respondents indicated EMs could be able to provide buyers supply chain-wide inventory visibility, shorten order-to-delivery lead-time, streamline purchasing process, improve logistics management, collaborate and share information with suppliers on procurement process. The outcomes were similar to the results found by Eng (2004) that EMs enable the majority of companies to automate transaction-based activities and procurement-related processes. The regression analysis showed the positive relationship between expected benefits and extent of EM usage, indicating the influence of expected benefits in the context of EM usage. The results also indicated the differences among three types of EMs - 3PX, ISM, and PTN – for expected benefits.

Fifth, the results highlighted the critical role of perceived risks from two aspects: financial risks and trust barriers. It was indicated that perceived risks of EMs have negative relationships with the extent of EM usage. This finding provided very important empirical evidences for existing studies on perceived risks of EMs that have not been adequately supported. The results indicated that one of most important reasons that inhibit buyers to use EMs for purchasing is the financial risk. Moving B2B activities to EMs may require the buyer to committee certain resource to deploy IT application and infrastructures that link its internal business processes and enterprise systems to an EM's trading platform (Davila *et al.*, 2003). In addition, working with unknown suppliers was shown to be another major inhibitor since buyers have to encounter many uncertainties regarding settlement of disputes, financial settlement, condition of contracts, etc. Again,

the difference between three types of EMs with respect to perceived risks was also indicated.

Sixth, although purchasing portfolio had been explored in many existing studies this was the first research revealing the important impact of purchasing situations in the EM usage context. The results of this study provided a very important evidence for purchasing situations that have not been adequately revealed in existing empirical studies. The purchasing situations suggested firstly by Kraljic (1983) and then extended by Olsen and Ellrum (1997) are shown to have two dimensions: economic importance of purchases and complexity of purchasing processes. The supported positive relationship between purchasing situations and the extent of EM usage indicated the importance of purchasing situations on the EM usage. Since EMs enable buyers to access to a large supplier database and information about product availability and price comparison, buyers are able to purchase items with high volume and good quality at lower costs and efforts. In addition, the higher complexity requires the stronger relationship between suppliers and buyers (Kraljic, 1983; Olsen and Ellrum, 1997). By using EM, buyers can benefit inter-firm collaboration which enables them build and deepen business relationships and overall supply chain performance; therefore smoothing the purchasing process and achieving purchased items as required. Accordingly, it can be said that the higher economic importance of purchases and complexity of purchasing processes the more likely the buyer uses EMs for purchasing. Those relationships were also different in each type of EMs.

Seventh, this research revealed the important role of e-business readiness in EM usage which has never been mentioned in existing studies. The results supported the

hypothesis that e-business moderates the effects of expected benefits and perceived risks on the extent of EM usage. The success of EMs depends on setting up EMs with the right technology platform which can be integrated with participants' existing systems (Brunn *et al.*, 2002). The findings indicated consistent outcomes with existing studies on e-business readiness (Walczuch *et al.*, 2001; Rutner *et al.* 2003; Davila *et al.*, 2003). The significantly positive moderating effect of e-business readiness on expected benefits showed that when the buyers expect more benefits from EMs and they are more ready for using e-business then they will be more likely to decide to use EMs for purchasing. On the other hand, the results showed the negative moderating effect of e-business readiness on perceived risks. Thus, when the buyers perceive some potential risks on using EMs for purchasing and possess some IS infrastructure and experiences in using IT and Internet for facilitating purchasing they may consider using other online procurement solutions such as e-procurement and EDI or developing their own solutions to avoid the risks that may be created in using EMs. Hence, the extent of EM usage will be reduced.

7.2 Implications for Practitioners

The results of this study have several important implications for practitioners. First, this research showed the extent of EM usage from the buyer perspective which gives organizations an overview picture about EM usage currently and in the future. The results indicated that although the percentage of current users was not really high, EMs would have brighter future with larger number of planned users. This movement will be a proof of the shifting to e-business implementation. That also will be helpful for market operators in developing a long-term strategic plan.

Second, this research provided a clear understanding about various benefits EMs can create. The positive relationship between expected benefits and the extent of EM usage points out the important role of benefits in correlation with the buyer's decision to utilize EMs for purchasing. By confirming two aspects of benefits of EMs (market aggregation and inter-firm collaboration), this research gives practitioners an empirical evidence that cost reduction is not only benefit EMs create. In the future, the benefit of EMs that will be exploited by most organizations would be inter-firm collaboration since today's competition is moving from organizations to between supply chains. This finding also would be helpful for market operators such that they will know how to develop EM platforms to attract more participants. In addition, this research also examined the differences between three types of EMs (3PX, ISM, and PTN) for benefits they create. Thus, the buyers will be able to make a right decision to choose a specific type of EMs to participate in based upon their own benefit expectations.

Third, the research identified various potential risks of EMs that may inhibit firms to join EMs (the negative relationship between perceived risks and the extent of EM usage shows that the higher the risks of EMs the lower the extent of EM usage). Empirical evidences from this research indicated two main risks of EMs: financial risks (dealing with high implementation costs) and trust barriers (dealing with uncertainties related to unknown suppliers). Thus, the buyers will be able to figure out what problems they may have when joining an EM. Since the risks are not identical over three different types of EMs, the buyers will have sufficient information to select the right type of EMs to participate in. Again, market operators also benefit this finding since they will know all potential disadvantages of their EMs and they will be able to fix those problems.

Fourth, the study confirmed the important implications of the correlation between purchasing situations and extent of EM usage. The variety of purchasing situations in organizations will diversify their EM usage. Purchasing situations can be classified into economic importance of purchases and complexity of purchasing processes. With different purchased items and purchased volume the buyers have to think of different EMs; thus, they will not stick with only one type of EMs. The differences among three types of EMs with respect to purchasing situations will enable the buyers to decide which type of EMs is appropriate to their certain purchasing situations. This finding will help the buyers avoid mistakes in choosing EMs for purchasing, thereby saving a lot of their time and money.

Fifth, the findings pointed out the vital role of e-business readiness as a moderator in the context of EM usage. According to Davila *et al.* (2003), companies are uncertain about whether they have the appropriate resources and experiences to successfully utilize EMs. The success of EMs depends on the setting up EMs with the right technology platform which can be integrated with participants' existing systems (Brunn *et al.*, 2002). The supported positive moderating effect of e-business readiness on expected benefits show that experiences and readiness in using e-business for purchasing will be an excellent complement to benefits EMs create. Thus, the buyers who have high benefit expectations on EMs and high extent of e-business readiness will be able to exploit successfully benefits of EMs and, therefore, will use EMs at a greater extent. On the other hand, the significantly negative moderating effect of e-business readiness on perceived risks indicates a challenge to EM operators. When the buyers perceive high risks from EMs they will be reluctant in using them. If they already have the high extent of e-

business readiness, i.e. they have extensive experiences in using IS/IT and Internet for facilitating purchasing, then they may not decide to use EMs since they can select other online procurement solutions that they have used or build their own solution so that risks of EMs could be avoided.

7.3 Limitations of the Research

Although this research has significant contributions from both a theoretical and practical point of view, it also has some limitations, which are described below. The examination on those limitations will help researchers figure out encountered problems and have necessary improvements in future researches.

First, this research focused on the buyer side only and had not examined the seller side which is very important in the context of EM usage. Like buyers, sellers are also potential participants for EMs and there will be various factors that influence the seller's decision to utilize EMs for selling. That issue needs to be examined in future research and another comprehensive literature review needs to be done to figure out different factors in the EM usage from the seller perspective. If the SCM studies play an important role in determining expected benefits of EMs for buyers, the marketing studies would be targeted literature needs to be examined to determine expected benefits of EMs for sellers.

Second, in this research, a single respondent (purchasing professional) in an organization was asked to respond to issues dealing with utilizing EMs for purchasing. But many firms have not used EMs for purchasing, therefore, the respondent may not have sufficient information to answer all questions. In addition, among current users most of firms have used only one or two types of EMs and the respondent can provide

information about those types of EMs, but not other types. Accordingly, the use of single respondent may generate some measurement inaccuracy.

Third, since the percentage of respondents who are currently using EMs was rather low the extent of EM usage was skewed right, indicating the non-normality situation. That situation resulted in very low R^2 for moderating regression model of e-business readiness.

Fourth, because of time limitation and to keep the model at a manageable size, this research did not consider other factors in the model such as: organizational factors, cultural factors, and market factors. These are important issues to be addressed in a comprehensive research model that can give researchers and practitioners some deep insights about buyers in using EMs.

Fifth, since the percentage of current EM users was rather low in each type of EMs this research just considered expected benefits of EMs, but did not take into account of actual benefits which could be an important factors affecting the buyer's decision to join EMs for purchasing.

7.4 Recommendations for Future Research

This section discusses some interesting directions for future research based upon the limitations discussed above and careful considerations of the research potentials.

First, future research should revalidate measurement scales developed in this research by the similar reference populations. That validation will confirm our measurement instruments and create generalizability for those instruments.

Second, future research should conduct factorial invariance tests. Generalizability of measurement scales can further be supported by factorial invariance tests. Using the

instruments developed in this research, one may test for factorial invariance across industries, across different organization size, and across organizations.

Third, the current research is limited in the areas of America. Since e-commerce has been developed largely in other countries in North and South America, Europe, and Asia, it is necessary to expand this research into international issues and conduct a cross-national survey. Comparisons of EM usage among different countries in the world will give us more interesting findings. Factorial invariance across countries also can be tested.

Fourth, future research should apply multiple methods of obtaining data. The use of single respondent to represent what are supposed to be inter-organization wide variables may generate some inaccuracy, more than the usual amount of random error (Koufteros, 1995). Future research should seek to utilize multiple respondents from each participating organization as an effort to enhance reliability of research findings. Once a construct is measured with multiple methods, random error and method variance may be assessed using a multitrait-multimethod approach.

Fifth, other factors should be examined in the model of future research such as supply network, strategic related factors, organizational structural factors, employee's knowledge, top management supports, market related factors, and cultural factors. Those factors will bring more important insights into the context of EM usage.

Sixth, actual benefits of EMs need to be examined in future research besides expected benefits. Actual benefits are an important factor in the EM usage model. In addition, the comparison between expected benefits and actual benefits would provide interesting insights of EM usage decisions made by the buyer.

Seventh, the current research can be expanded by integrating EM usage issues with supply chain management which ultimately will lead to the issue of supply chain performance. With the evolving development of ISMs and PTNs which provide higher collaboration between suppliers and buyers, the entire supply chain would benefit from EM utilization of its entities. This would be an integrated research model examining various variables in supply chain management context.

Eighth, future research should develop a new research model from seller perspective. In this context, more literature in marketing need to be examined to explore various factors influencing the seller's decision to utilize EMs for selling. The findings of the current research (buyer perspective) can be combined with that future research (seller perspective) and give us interesting results in term of distribution of EM benefits between seller and buyer.

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APPENDIX A: MEASUREMENT ITEMS ENTERING Q-SORT

Expected Benefits of EMs

Market Aggregation
The EM is useful for finding new suppliers
The EM is useful for reaching a larger number of suppliers
The EM is useful for increasing price transparency
The EM is useful for seeking information about product availability
The EM is useful for performing price comparisons
The EM is useful for seeking lower materials/products cost
The EM is useful for seeking lower transactional commission and related fees
The EM is useful for eliminating out-of-contract ('maverick') purchases
The EM is useful for eliminating intermediaries
The EM is useful for paying at true market price

Inter-Firm Collaboration
The EM is useful for increasing supply chain-wide inventory visibility
The EM is useful for reducing concept-to-commercialization cycle time
The EM is useful for shortening order-to-delivery lead time
The EM is useful for streamlining purchasing processes
The EM is useful for improving logistics management
The EM is useful for collaborating with suppliers on product design and development
The EM is useful for collaborating with suppliers on the process of procurement
The EM is useful for sharing operational information with suppliers

Perceived Risks of EMs

Financial Risks
High cost of EM platform development inhibits our organization from procuring materials/products through EM
High business process coordination cost inhibits our organization from procuring materials/products through EM
High cost for IS integration inhibits our organization from procuring materials/products through EM

Trust Barriers
Potential leakage of sensitive business information to competitors inhibits our organization from procuring materials/products through EM
Uncertainties related to the settlement of disputes inhibit our organization from procuring materials/products through EM
Limited participation by suppliers inhibits our organization from procuring materials/products through EM
Uncertainties related to the identity of the suppliers inhibit our organization from procuring materials/products through EM

Incompatible inter-firm business processes inhibit our organization from procuring materials/products through EM
Uncertainties related to verification of the terms and conditions of the contract inhibit our organization from procuring materials/products through EM
Uncertainties related to supplier's fulfillment capability inhibit our organization from procuring materials/products through EM
Uncertainties related to financial settlement inhibits our organization from procuring materials/products through EM

Purchasing Situations

Economic Importance of Purchases
The EM is attractive for the procurement of materials/products that accounts for large purchase volume
The EM is attractive for the procurement of materials/products that are critical to final product quality
The EM is attractive for the procurement of materials/products that show strong demand growth
The EM is attractive for the procurement of materials/products that make their orders automatically generated by ERP systems

Complexity of Purchasing Processes
The EM is attractive for the procurement of materials/products that have high product complexity
The EM is attractive for the procurement of materials/products that have relatively few capable suppliers
The EM is attractive for the procurement of materials/products that involve high cost of switching suppliers
The EM is attractive for the procurement of materials/products that are supplied under long-term arrangements with preferred suppliers
The EM is attractive for the procurement of materials/products that need fulfillment to strict logistics requirements (e.g., defect free, JIT delivery)

E-Business Readiness

Information Technology for Facilitating Purchasing
To facilitate the purchasing process our organization uses traditional EDI (Electronic Data Interchange)
To facilitate the purchasing process our organization uses Internet-based EDI
To facilitate the purchasing process our organization uses ERP (Enterprise Resource Planning)
To facilitate the purchasing process our organization uses Electronic Request for Quotes (RFQ)/Request for Proposal (RFP)
To facilitate the purchasing process our organization uses Electronic Funds Transfer (EFT) and/or Electronic Payment

Internet Usage for Facilitating Purchasing

To facilitate the purchasing process our organization uses the Internet for announcing purchasing requirements

To facilitate the purchasing process our organization uses the Internet for receiving information about products from our suppliers

To facilitate the purchasing process our organization uses the Internet for placing orders on supplier's website

To facilitate the purchasing process our organization uses the Internet for tracking order status

To facilitate the purchasing process our organization uses the Internet for tracking payment information

To facilitate the purchasing process our organization uses the Internet for sharing design information with our suppliers

IT/IS Usage for Enhancing SCM

To facilitate supply chain management our organization uses IS/IT in production control systems

To facilitate supply chain management our organization uses IS/IT in inventory management systems

To facilitate supply chain management our organization uses IS/IT in automatic ordering systems

To facilitate supply chain management our organization uses IS/IT in resource management systems

To facilitate supply chain management our organization uses IS/IT in transportation management systems

To facilitate supply chain management our organization uses IS/IT in forecasting systems

To facilitate supply chain management our organization uses IS/IT in electronic bulletin boards for suppliers

Extent of EM Usage

Extent of Current Usage of EMs

The length of time our organization currently uses EM for the procurement of materials/products and/or services

The percentage of procurement spending our organization currently conducts through EM

The number of EMs our organization currently uses for purchasing

Extent of Usage of EMs Planned for Future

The length of time our organization plans to use EM for the procurement of materials/products and/or services

The percentage of procurement spending our organization plans to conduct through EM

The number of EMs our organization plans to use for purchasing

APPENDIX B: COHEN'S KAPPA AND MORRE AND BENBASAT COEFFICIENT

The Q-sort method is an iterative process in which the degree of agreement between judges forms the basis of assessing construct validity and improving the reliability of the constructs. The method consists of two stages. In the first stage, two judges are requested to sort the questionnaire items according to different constructs, based on which the inter-judge agreement is measured. In the second stage, questionnaire items that were identified as being too ambiguous, as a result of the first stage, are reworded or deleted, in an effort to improve the agreement between the judges. The process is carried out repeatedly until a satisfactory level of agreement is reached.

The following example describes the theoretical basis for the Q-sort method and the two evaluation indices to measure inter-judge agreement level: Cohen's Kappa (Cohen, 1960) and Moore and Benbasat's 'Hit Ratio" (Moore and Benbasat, 1991).

Let us assume that two judges independently classified a set of N components as either acceptable or rejectable. After the work was finished the following table was constructed:

Judge 1				
Judge 2		Acceptable	Rejectable	Totals
	Acceptable	X_{11}	X_{12}	X_{1+}
	Rejectable	X_{21}	X_{22}	X_{2+}
	Totals	X_{+1}	X_{+2}	N

Xij = the number of components in the i^{th} row and j^{th} column, for i,j = 1,2.

The above table can also be constructed using percentages by dividing each numerical entry by N. For the population of components, the table will look like:

Judge 1				
Judge 2		Acceptable	Rejectable	Totals
	Acceptable	P_{11}	P_{12}	P_{1+}
	Rejectable	P_{21}	P_{22}	P_{2+}
	Totals	P_{+1}	P_{+2}	100

Pij = the percentage of components in the i^{th} row and j^{th} column.

We will use this table of percentages to describe the Cohen's Kappa coefficient of agreement. The simplest measure of agreement is the proportion of components that were classified the same by both judges, i.e., $\Sigma_i P_{ii} = P_{11} + P_{22}$. However, Cohen suggested comparing the actual agreement, $\Sigma_i P_{ii}$, with the chance of agreement that would occur if the row and columns are independent, i.e., $\Sigma_i P_{i+}P_{+i}$. The difference between the actual and chance agreements, $\Sigma_i P_{ii} - \Sigma_i P_{i+}P_{+i}$, is the percent agreement above that which is due to chance. This difference can be standardized by dividing it by its maximum possible value, i.e., $100\% - \Sigma_i P_i + P_{+I} = 1 - \Sigma_i P_i + P_{+i}$. The ratio of these is denoted by the Greek letter kappa and is referred to as Cohen's kappa.

$$k = \frac{\Sigma_i P_{ii} - \Sigma_i (P_{i+} P_{+i})}{1 - \Sigma_i (P_{i+} P_{+i})}$$

Thus, Cohen's Kappa is a measure of agreement that can be interpreted as the proportion of joint judgement in which there is agreement after chance agreement is excluded. The three basic assumptions for this agreement coefficient are: 1) the units are independent, 2) the categories of the nominal scale are independents, mutually exclusive, and 3) the judges operate independently. For any problem in nominal scale agreement between two judges, there are only two relevant quantities:

p_o= the proportion of units in which the judges agreed
p_c= the proportion of units for which agreement is expected by chance

Like a correlation coefficient, k=1 for complete agreement between the two judges. If the observed agreement is greater than or equal to chance K <= 0. The minimum value of k occurs when ΣP_{ii} =0, i.e.,

$$\min(k) = \frac{-\Sigma_i (P_{i+} P_{+i})}{1 - \Sigma_i (P_{i+} P_{+i})}$$

When sampling from a population where only the total N is fixed, the maximum likelihood estimate of k is achieved by substituting the sample proportions for those of the population. The formula for calculating the sample kappa (k) is:

$$k = \frac{N_i Xii - \Sigma_i (X_{i+} X_{+i})}{N^2 - \Sigma_i (X_{i+} X_{+i})}$$

For kappa, no general agreement exists with respect to required scores. However, recent studies have considered scores greater than 0.65 to be acceptable (e.g. Vessey, 1984; Jarvenpaa 1989; Solis-Galvan, 1998). Landis and Koch (1977) have provided a more detailed guideline to interpret kappa by associating different values of this index to the degree of agreement beyond chance. The following guideline is suggested:

Value of Kappa	Degree of Agreement Beyond Chance
.76 - 1.00	Excellent
.40 - .75	Fair to Good (Moderate)
.39 or less	Poor

A second overall measure of both the reliability of the classification scheme and the validity of the items was developed by Moore and Benbasat (1991). The method required analysis of how many items were placed by the panel of judges for each round within the target construct. In other words, because each item was included in the pool explicitly to measure a particular underlying construct, a measurement was taken of the overall frequency with which the judges placed items within the intended theoretical

construct. The higher the percentage of items placed in the target construct, the higher the degree of inter-judge agreement across the panel that must have occurred.

Moreover, scales based on categories that have a high degree of correct placement of items within them can be considered to have a high degree of construct validity, with a high potential for good reliability scores. It must be emphasized that this procedure is more a qualitative analysis than a rigorous quantitative procedure. There are no established guidelines for determining good levels of placement, but the matrix can be used to highlight any potential problem areas. The following exemplifies how this measure works.

Item Placement Scores

CONSTRUCTS		ACTUAL						
		A	B	C	D	N/A	Total	% Hits
THEORETICAL	A	26	2	1	0	1	30	87
	B	8	18	4	0	0	30	60
	C	0	0	30	0	0	30	100
	D	0	1	0	28	1	30	93

Item Placements: 120 Hits: 102 Overall "Hit Ratio": 85%

The item placement ratio (the "Hit Ration") is an indicator of how many items were placed in the intended, or target, category by the judges. As an example of how this measure could be used, consider the simple case of four theoretical constructs with ten items developed for each construct. With a panel of three judges, a theoretical total of 30 placements could be made within each construct. Thereby, a theoretical versus actual matrix of item placements could be created as shown in the table above (including an ACTUAL "N/A: Not Applicable" column where judges could place items which they felt fit none of the categories).

Examination of the diagonal of the matrix shows that with a theoretical maximum of 120 target placements (four constructs at 30 placements per construct), a total of 102 "hits" were achieved, for an overall "hit ratio" of 85%. More important, an examination of each row shows how the items created to tap the particular constructs are actually being classified. For example, row C shows that all 30-item placements were within the target construct, but that in row B, only 60% (18/30) were within the target. In the latter case, 8 of the placements were made in construct A, which might indicate the items underlying these placements are not differentiated enough from the items created for construct A. This finding would lead one to have confidence in scale based on row C, but be hesitant about accepting any scale based on row B. In an examination of off-diagonal entries indicate how complex any construct might be. Actual constructs based on columns with a high number of entries in the off diagonal might be considered too ambiguous, so any consistent pattern of item misclassification should be examined.

APPENDIX C: MEASUREMENT ITEMS AFTER Q-SORT

Expected Benefits of EMs

Market Aggregation
The EM is useful for finding new suppliers
The EM is useful for reaching a larger number of suppliers
The EM is useful for increasing price transparency
The EM is useful for seeking information about product availability
The EM is useful for performing price comparisons
The EM is useful for seeking lower materials/products cost
The EM is useful for seeking lower transactional commission and related fees
The EM is useful for eliminating out-of-contract ('maverick') purchases
The EM is useful for eliminating intermediaries
The EM is useful for paying at true market price

Inter-Firm Collaboration
The EM is useful for increasing supply chain-wide inventory visibility
The EM is useful for shortening concept-to-commercialization cycle time
The EM is useful for shortening order-to-delivery lead time
The EM is useful for streamlining purchasing processes
The EM is useful for improving logistics management
The EM is useful for collaborating with suppliers on product design and development
The EM is useful for collaborating with suppliers on the process of procurement
The EM is useful for sharing operational information with suppliers

Perceived Risks of EMs

Financial Risks
High cost of EM platform development inhibits our organization from procuring materials/products through EM
High business process coordination cost inhibits our organization from procuring materials/products through EM
High cost for IS integration inhibits our organization from procuring materials/products through EM

Trust Barriers
Potential leakage of sensitive business information to competitors inhibits our organization from procuring materials/products through EM
Uncertainties related to the settlement of disputes inhibit our organization from procuring materials/products through EM
Limited participation by suppliers inhibits our organization from procuring materials/products through EM
Uncertainties related to the identity of the suppliers inhibit our organization from procuring materials/products through EM
Incompatible inter-firm business processes inhibit our organization from procuring materials/products through EM

Uncertainties related to verification of the terms and conditions of the contract inhibit our organization from procuring materials/products through EM
Uncertainties related to supplier's fulfillment capability inhibit our organization from procuring materials/products through EM
Uncertainties related to financial settlement inhibits our organization from procuring materials/products through EM

Purchasing situations

Economic Importance of Purchases
The EM is attractive for the procurement of materials/products that accounts for large purchase volume
The EM is attractive for the procurement of materials/products that are critical to final product quality
The EM is attractive for the procurement of materials/products that show strong demand growth

Complexity of Purchasing Process
The EM is attractive for the procurement of materials/products that make their orders automatically generated by ERP systems
The EM is attractive for the procurement of materials/products that must have strict technical specifications
The EM is attractive for the procurement of materials/products that have relatively few capable suppliers
The EM is attractive for the procurement of materials/products that involve difficulty in switching suppliers
The EM is attractive for the procurement of materials/products that are supplied under long-term arrangements with preferred suppliers
The EM is attractive for the procurement of materials/products that need fulfillment to strict logistics requirements (e.g., defect free, JIT delivery)

E-Business Readiness

Information Technology Usage for Facilitating Purchasing
To facilitate the purchasing process our organization uses EDI (Electronic Data Interchange)
To facilitate the purchasing process our organization uses ERP (Enterprise Resource Planning)
To facilitate the purchasing process our organization uses Electronic Request for Quotes (RFQ)/Request for Proposal (RFP)
To facilitate the purchasing process our organization uses Electronic Funds Transfer (EFT) and/or Electronic Payment

Internet Usage for Facilitating Purchasing
To facilitate the purchasing process our organization uses the Internet for announcing purchasing requirements

To facilitate the purchasing process our organization uses the Internet for receiving information about products from our suppliers
To facilitate the purchasing process our organization uses the Internet for placing orders on supplier's website
To facilitate the purchasing process our organization uses the Internet for tracking order status
To facilitate the purchasing process our organization uses the Internet for tracking payment information
To facilitate the purchasing process our organization uses the Internet for sharing design information with our suppliers

IS/IT Usage for Enhancing SCM
To facilitate supply chain management our organization uses IS/IT in production control systems
To facilitate supply chain management our organization uses IS/IT in inventory management systems
To facilitate supply chain management our organization uses IS/IT in automatic ordering systems
To facilitate supply chain management our organization uses IS/IT in resource management systems
To facilitate supply chain management our organization uses IS/IT in transportation management systems
To facilitate supply chain management our organization uses IS/IT in forecasting systems
To facilitate supply chain management our organization uses IS/IT in electronic bulletin boards for suppliers

Extent of EM Usage

Extent of Current Usage of EM
The length of time our organization currently uses EM for the procurement of materials/products and/or services
The percentage of procurement spending our organization currently conducts through EM
The number of EMs our organization currently uses for purchasing

Extent of Usage of EM Planned for Future
The percentage of procurement spending our organization plans to conduct through EM
The number of EMs our organization plans to use for purchasing

APPENDIX D: LARGE-SCALE MAIL SURVEY QUESTIONNAIRE

A SURVEY OF BUSINESS-TO-BUSINESS ELECTRONIC MARKETPLACE USAGE FROM BUYER PERSPECTIVE

General Instructions and Information

- This survey is being conducted by Dothang Truong, a Ph.D. candidate, The University of Toledo
- This research will address the issue of B2B Electronic Marketplace (EM) usage from buyer perspective. We hope to determine (1) various factors that influence EM usage, and (2) the extent of EM usage in USA.
- Please answer **all** questions. If you feel there is someone else in your organization who is better qualified to answer the questions in this survey, please ask them to complete the questionnaire. If you are not sure of an answer to a question, please provide your **best** estimate. Your responses will remain **strictly** confidential.
- We will be pleased to provide you with a copy of the results. Simply provide the information requested on the last page of the questionnaire.
- If you have any questions, please don't hesitate to contact:

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All RESPONSES WILL BE KEPT CONFIDENTIAL. DATA WILL BE USED FOR STATISTICAL ANALYSIS ONLY.

Section I: E-Business Readiness

These statements deal with your organization's readiness for e-business implementation. Please rate the extent to which your organization uses relevant information technologies, Internet, and information systems/information technology (IS/IT) to **facilitate the purchasing process**. Please use the following scale for rating.

1	2	3	4	5	NA
Not at all	To a small extent	To a moderate extent	To a considerable extent	To a great extent	Not applicable

1. To facilitate the purchasing process our organization uses the following information technologies

EDI (Electronic Data Interchange)	1	2	3	4	5	NA
ERP (Enterprise Resource Planning)	1	2	3	4	5	NA
Electronic Request for Quotes (RFQ)/Request for Proposal (RFP)	1	2	3	4	5	NA
Electronic Funds Transfer (EFT) and/or Electronic Payment	1	2	3	4	5	NA

2. To facilitate the purchasing process our organization uses the **Internet** for the following activities

Announcing purchasing requirements	1	2	3	4	5	NA
Receiving information about products from our suppliers	1	2	3	4	5	NA
Placing orders on suppliers' websites	1	2	3	4	5	NA
Tracking order status	1	2	3	4	5	NA
Tracking payment information	1	2	3	4	5	NA
Sharing design information with our suppliers	1	2	3	4	5	NA

3. To facilitate management of supply chain our organization uses IS/IT in the following

Production control systems	1	2	3	4	5	NA
Inventory management systems	1	2	3	4	5	NA
Automatic ordering systems	1	2	3	4	5	NA
Resource management systems	1	2	3	4	5	NA
Transportation management systems	1	2	3	4	5	NA
Forecasting systems	1	2	3	4	5	NA
Electronic bulletin boards for suppliers	1	2	3	4	5	NA

Section II: B2B Electronic Marketplace (EM) Usage

This section deals with the extent of current and planning usage of different types of Electronic Marketplaces. The definitions of the EMs are provided below.

Third-Party Exchanges (3PXs): an independent electronic marketplace founded and operated by an independent intermediary that does not participate in a transaction as either the seller or the buyer.

Industry Sponsored markets (ISMs): an electronic marketplace founded and operated by a consortium formed by leading companies in an industry.

Private Trading Networks (PTNs): a private electronic marketplace founded and operated by a single buyer or seller to link itself with a group of selected business partners.

1. Please rate the extent to which your organization **currently uses** B2B Electronic Marketplaces. Please use the following scale for rating

1 Not at all	2 To a small extent	3 To a moderate extent	4 To a considerable extent	5 To a great extent	NA Not applicable

Extent of current usage of 3PXs in purchasing in our organization	1	2	3	4	5	NA
Extent of current usage of ISMs in purchasing in our organization	1	2	3	4	5	NA
Extent of current usage of PTNs in purchasing in our organization	1	2	3	4	5	NA

2. Please indicate the extent of **current usage** of each type of EM in your organization in terms of *length of time, percentage of procurement spending,* and *number of EMs*

	3PXs	**ISMs**	**PTNs**
The *length of time* our organization currently uses this type of EM for the procurement of materials/products and/or services	1. None 2. Less than 6 months 3. 6 - 12 months 4. 12 - 24 months 5. 24 months or more	1. None 2. Less than 6 months 3. 6 - 12 months 4. 12 - 24 months 5. 24 months or more	1. None 2. Less than 6 months 3. 6 - 12 months 4. 12 - 24 months 5. 24 months or more
The *percentage of procurement spending* our organization currently conducts through this type of EM	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more
The *number of EMs* of this type our organization currently uses for purchasing	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5

3. Please rate the extent to which your organization **plans to use** B2B Electronic Marketplaces in the future. Please use the following scale for rating

1	2	3	4	5	NA
Not at all	To a small extent	To a moderate extent	To a considerable extent	To a great extent	Not applicable

Extent of usage of 3PXs planned for future in purchasing in our organization	1	2	3	4	5	NA
Extent of usage of ISMs planned for future in purchasing in our organization	1	2	3	4	5	NA
Extent of usage of PTNs planned for future in purchasing in our organization	1	2	3	4	5	NA

4. Please indicate the extent of **planned usage** of each type of EM in your organization in terms of *percentage of procurement spending*, and *number of EMs*

	3PXs	**ISMs**	**PTNs**
The *percentage of procurement spending* our organization plans to conduct through this type of EM in the future	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more	1. None 2. Less than 5% 3. 5 - 10 % 4. 10 - 20 % 5. 20% or more
The *number of EMs* of this type our organization plans to use for purchasing in the future	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5	1. None 2. Only 1 3. 2 - 3 4. 4 -5 5. More than 5

<u>Section III</u>: Expected Benefits of B2B Electronic Marketplaces

The following statements deal with the expected benefits of B2B EMs. Please rate the extent to which you agree or disagree with the statements. Please use the following scale for rating.

1	2	3	4	5	NA
Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Not Applicable

This type of EM **is useful for**…

	3PXs						**ISMs**						**PTNs**					
Finding new suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Reaching a larger number of suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Increasing price transparency	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Seeking information about product availability	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Performing price comparisons	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Seeking lower materials/products cost	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Seeking lower transactional commission and related fees	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Eliminating out-of-contract (‘maverick’) purchases	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Eliminating intermediaries	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Paying at true market price	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Increasing supply-chain-wide inventory visibility	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Shortening concept-to-commercialization cycle time	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Shortening order-to-delivery lead time	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Streamlining purchasing processes	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Improving logistics management	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Collaborating with suppliers on product design and development	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Collaborating with suppliers on the process of procurement	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Sharing operational information with suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA

<u>Section IV</u>: Perceived Risks of B2B Electronic Marketplaces

The following statements deal with the perceived risks of B2B EMs. Please rate the extent to which you agree or disagree with the statements. Please use the following scale for rating.

1	2	3	4	5	NA
Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Not Applicable

The following **inhibit or constrain** our organization from procuring materials/products through this type of EM

	3PXs						**ISMs**						**PTNs**					
High cost of EM platform development	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
High business process coordination cost	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
High cost for IS integration	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Potential leakage of sensitive business information to competitors	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Uncertainties related to the settlement of disputes	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Limited participation by suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Uncertainties related to the identity of the suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Incompatible inter-firm business processes	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Uncertainties related to verification of the terms and conditions of the contract	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Uncertainties related to supplier’s fulfillment capability	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Uncertainties related to financial settlement	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA

Section V: Purchasing Situations

The following statements deal with the purchasing situations of your organization. Please rate the extent to which you agree or disagree with the statements. Please use the following scale for rating.

1	2	3	4	5	NA
Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Not Applicable

This type of EM is an attractive e-commerce platform for the procurement of materials/products for our organization that

	3PXs						ISMs						PTNs					
Account for large purchase volume	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Are critical to final product quality	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Show strong demand growth	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Make their orders automatically generated by ERP systems	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Must meet strict technical specifications	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Have relatively few capable suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Involve difficulty in switching suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Are supplied under long-term arrangements with preferred suppliers	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA
Need fulfillment to strict logistics requirements (e.g., defect free, JIT delivery)	1	2	3	4	5	NA	1	2	3	4	5	NA	1	2	3	4	5	NA

Section VI: Actual Results

If you have used any types of EMs, please rate from *1 (lowest) to 5 (highest)* **how well the actual results have met your initial expectations** with regards to

	3PXs					ISMs					PTNs				
Overall cost saving	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Overall supply chain performance improvement	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

RESPONDENT PROFILE

1. About yourself (optional)

Your Title _____

Number of years you have been with company _____

Male_____ Female_____

2. About your company

Name of company (optional)_____

How long your company has been in business (in years)_____

Type of industry your company is in:

___ Food and Kindred Product
___ Printing, Publishing and Allied Industry
___ Fabricated Metal Product
___ Paper and Allied Products
___ Rubber and Miscellaneous Plastic Products
___ Electronic Equipment and Components
___ Transportation Equipment
___ Communication
___ Other

Number of employees _____

Annual sales (year 2002) _____ Annual purchasing budget _____

Website URL _____

Our company currently uses, or has a plan to use an EM for the procurement of materials/products and/or services

__ Yes __ No

If yes, please specify the name of EMs _____

_____

Our company used an EM before but not now

__ Yes __ No

Our company does not use an EM currently, but has a definite plan to use one within next 12 months.

__ Yes __ No

Our company currently uses an EM to purchase **direct** materials

__ Yes __ No

If yes, volume of direct material as a percentage of total volume _____

Our company currently uses an EM to purchase **indirect** materials

__ Yes __ No

If yes, volume of indirect material as a percentage of total volume_____

Please indicate if you would like a summary report of the results of this survey by filling in your address information below.

THANK YOU VERY MUCH FOR YOUR VALUABLE TIME

Your name: _____

Company _____

Address _____

City _____ State _____

Zip Code _____

Tel: _____ Fax:_____

Email address _____

APPENDIX E: ACRONYMS USED FOR CODING OF ITEMS IN EACH SUB-CONSTRUCT

Expected Benefits (EB)

MA	Market Aggregation (for each EM type: MA/3PX, MA/ISM, and MA/PTN)
IC	Inter-Firm Collaboration (for each EM type: IC/3PX, IC/ISM, and IC/PTN)

Perceived Risks (PR)

FR	Financial Risks (for each EM type: FR/3PX, FR/ISM, and FR/PTN)
TB	Trust Barriers (for each EM type: TB/3PX, TB/ISM, and TB/PTN)

Purchasing Situations (PS)

EI	Economic Importance of Purchases (for each EM type: EI/3PX, EI/ISM, and EI/PTN)
CP	Complexity of Purchasing Process (for each EM type: CP/3PX, CP/ISM, and CP/PTN)

E-Business Readiness (ER)

ITUSE	Information Technology Usage for Facilitating Purchasing
INTUSE	Internet Usage for Facilitating Purchasing
ISSCM	IS/IT Usage for Enhancing SCM

Extent of EM Usage

CU	Extent of Current Usage of EM (for each EM type: CU/3PX, CU/ISM, and CU/PTN)
PU	Extent of Usage of EM Planned for Future (for each EM type: PU/3PX, PU/ISM, and PU/PTN)