

**The Impact of Electronic Commerce on Buyer-Supplier  
Relationships in the Korean Electronics Industry**

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The candidate confirms that the work submitted is his own and that appropriate credit  
has been given where reference has been made to the work of others.

## **DEDICATION**

In memory of my mother and grandmother.

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## **ABSTRACT**

Buyer-supplier relationships are said to be developing toward more collaborative forms based on hierarchical cooperation and away from adversarial forms based on market competition. However, proponents of transaction cost economics (TCE) have predicted that e-commerce would lead to more competitive relationships because e-commerce reduces transaction costs.

Several theories have been employed in formulating the research framework for this study to explain these seemingly contradictory positions. The main underpinning for the conceptual framework of the research is based on the rationale of TCE, the dichotomy between market and hierarchy; while other theories, relational exchange theory (RET) and resource dependence theory (RDT) are used to complement TCE. This integrative view that combines TCE, RET and RDT proposes the research hypothesis that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence.

A questionnaire-based survey has been carried out into the Korean electronics industry since electronics industries of Korea are well developed, and the business culture of Korean industry is similar to that of other Asian countries. Exploratory factor analysis has been conducted on the data collected by the survey to discover the underlying structure for the questionnaire items. Structural equation modelling using AMOS Graphic 4.0 has been employed to test the research hypothesis.

Focusing on buyers (suppliers) and their key suppliers (buyers) in the electronics industry, this empirical study provides a support for the view that utilization of e-commerce is reconciled with growing tendency toward collaboration as an interaction strategy in an industrial market. This study claims that e-commerce contributes to building a long-term collaborative relationship rather than a transactional exchange for short-term economic gain. In addition, depersonalization caused by e-commerce has not happened yet, and electronic interconnection consolidates assets specificity, trust and dependence and collaborative relationship between trading partners either direct or indirect way.

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## CHAPTER 1. INTRODUCTION

### 1.1. Introductory Remarks

With the rapid advancement in information and communication technology (i.e., as the growth of the Internet and the World Wide Web), traditional paper-based business transactions in the physical marketplace have been changed into electronic digitized business transactions in electronic networks. This new type of business transaction (i.e., electronic commerce) has been expected to offer companies new ways to expand their markets, streamline their corporate business processes and attract customers, which ultimately results in improving financial performance such as profits and sales. Especially in the late 1990s, electronic commerce was considered to be crucial for firms to survive in the 21<sup>st</sup> century in which businesses would be driven by information and knowledge.

Such a blind optimistic view about electronic commerce had been founded to be too naive and rash. Contrary to early expectations, share prices of *dot.coms* plummeted in 2000 and most of the electronic marketplaces failed in making revenues (The Economist, 2001). As business situations made a reverse turn, many academics and practitioners became skeptical about the outcomes of electronic commerce on business, and a fundamental limitation of electronic commerce had been pointed out. For example, complex and differentiated goods became increasingly more important in industrial markets, but would be less suited for electronic transactions (Benjamin and Wigand, 1995).

Viewed in terms of the intrinsic nature of electronic commerce, however, it is not an unfounded proposition that electronic commerce would affect the traditional way of business. Electronic commerce is based on the widespread use of information technology (IT), which is characterized by low cost and high performance (Tang et al., 2001), and the development of the electronic markets, which are virtual spaces that allow buyers and suppliers to participate in exchanging information about goods and services (Bakos, 1991). Malone et al. (1987) categorized the impacts of electronic interconnection using information and communication technologies: (1) *electronic communication effect*: Electronic commerce enables more information to be communicated the same amount at less time, or the more amount at the same time, and decrease the costs of this communication dramatically, (2)

*electronic brokerage effect*: Electronic commerce can increase the number of alternatives, and decrease the cost of entire selection process, and (3) *electronic integration effect*: Electronic commerce is used not just to speed communication, but to change and lead to tighter coupling of the processes. In sum, electronic commerce should reduce transaction costs (or, coordination costs) of trading parties, which will result in higher productivity and cost efficiency to firms (Konings and Roodhooft, 2002). As many firms perceive the potentiality of electronic commerce, they are applying electronic commerce to functional activities such as marketing, purchasing, design, production, sales and distribution, human resource management, warehousing and supplier development (Gunasekaran et al., 2002).

In the 1980s, firms laid emphasis on total quality management (TQM), which focused on ways to make a product better, and little stress was on the value of buyer-supplier relationship. However, in the 1990s, since firms realized that they could no longer compete effectively without collaborating with their trading partners in the supply chain, supply chain management (SCM) has caught the interest of businesses and buyer-supplier relationship is in the spotlight of management (Tarn et al., 2002). Accordingly, among various activities, main concern of this research comes under supply chain management and focus of this study will be placed on supply chain relationship (i.e., buyer-supplier relationships) in industrial market.

Buyer-supplier relationships are traditionally characterized by dyadic types: adversarial and collaborative. According to Gules and Burgess (1996), the adversarial relationship is variously called exit, antagonistic and arm's length contracted relationship, whereas the collaborative relationship is called voice, cooperative, obligation and contractual relationship. In the 1980s, transactions between buyers and suppliers tended to rely on arm's-length agreements based on market price. However, the current trend of relationships is evolving towards a more collaborative form based on cooperation, mutual benefit, trust and relational exchange (Hoyt and Huq 2000, Tang et al 2001).

With regard to applying electronic commerce to supply chain management, we can find some contradictories about the influence of electronic commerce on buyer-supplier relationships. Judging from the logic of *transaction cost economics*, it is highly possible that electronic commerce shifts the trade-off between market mechanism and hierarchy mechanism in favour of the former, by cutting down transaction costs (Malone et al., 1987;

Wigand and Benjamin, 1997). In other words, proponents of transaction cost economics predicted that electronic commerce would lead to a more competitive relationship between trading partners in industrial markets. This is because electronic commerce reduces a transaction cost, which, in turn, makes a market coordination more efficient. Therefore, firms choose a market coordination rather than hierarchical integration in order to take advantage of efficiency derived from market coordination mechanism.

However, as referred to before, the current trend of buyer-supplier relationships in industrial markets is toward collaborative relationship. On the one hand the collaborative relationship between trading partners is more stressed in terms of supply chain management, on the other hand the competitive relationship between buyer and supplier would be expected to develop by electronic commerce according to the prediction of transaction cost economics. This contradiction concerning the future direction of buyer-supplier relationship may be interpreted by introducing the concept of *coopetition*, coexistence of competition and cooperation. As explained by Sharma (2002), the business-to-business strategy in this decade shifts toward simultaneous cooperation and competition, and the focus of a firm strategy moves from market share to market growth. The 'move to the middle' hypothesis simultaneously suggested by Bakos and Brynjolfsson (1993) and Clemons et al. (1993) might also be the answer. Namely, even though electronic commerce reduces coordination cost, which facilitates a firm to move from in-house production to market outsourcing, the firm would choose a close, long-term relationship with a reduced set of partners.

It is also meaningful to consider a fallacy of the naive technological determinism. In fact, the business may decide impacts of the technology even though a technology has the potential to transform business activities. It is likely that information technology affects the managerial decision, but it is not sure that information technology inevitably changes the way of management. It is more probable that firms may choose a business relationship in order to maximize long-term values for a sustainable competitive advantage rather than to minimize the total costs posited in transaction cost economics (Hoyt and Huq, 2000). It may be true that many firms have actually leveraged their use of electronic commerce to form a value added partnerships along the value chain. A step further, utilization of electronic commerce would facilitate the collaborative relationships between buyer and supplier in industrial market. For example, once EDI (electronic data interchange) process begins in industrial market, both buyer and supplier make specific assets and build structural bonds that are

difficult to break (Steinfiedl et al., 1997; Wilson and Vlosky, 1998; Kothandaraman and Wilson, 2001). When specific investments have been put in, trading parties usually prefer hierarchical governance (or collaborative relationship) to market mechanism (or competitive relationship) (Williamson, 1975; Haugland, 1999). For example, electronic interconnection via EDI shifts interfirm relationship towards a collaborative one.

Confronted with these dyadic arguments, both of which seems reasonable respectively but is contradictory to the other, it is interesting and necessary to examine which side of argument is more valid in the real world of business. In reality, business-to-business activity dominates more than ninety percent of electronic commerce and manufacturing leads all industry sectors (US Census bureau, 2001). Accordingly, an industrial market (or business-to-business sector) is more appropriate than a consumer market (or business-to-consumer sector) for the field of the study that examines the impacts of electronic commerce. In this context, a research question can be raised as follows:

“How does utilization of electronic commerce affect buyer-supplier relationships in industrial market?”

Several theories have been employed to formulate the research framework for the explanation of this question. Above all, the conceptual framework of this research is based on the rationale of transaction cost economics (TCE). Using dichotomy between market and hierarchy, TCE explains the impact of e-commerce on business relationship with simplicity. However, application of TCE reveals some weakness. For example, unlike TCE's logic, trading partners prefer long-term benefits of relational exchange to economic gain from saving transaction costs. Therefore, it is inevitable that other theories (i.e., relational exchange theory (RET) and resource dependence theory (RDT) complement TCE. This integrative view can provide comprehensive explanation with reality and validity more than the monolithic view can.

An empirical study will be made to test the conceptual framework. Considering the global characteristic of electronic commerce, a researcher may concern himself with all the industries around the world. However, the empirical study, in itself, is restricted by resources (i.e., time, cost etc.), so it is more efficient approach for an individual researcher to focus a specific area and interpret his results for generalization. In this context, the empirical

research will be carried out into the Korean electronics industry. Korea's enthusiasm for the digital economy is amazingly high, and manufacturing industries such as electronics industry are well developed. The Korean electronics industry occupies 5.6 % of the world electronics industry production, and holds fourth ranking among all the countries (MOCIE, 2003) in 2001. The business culture of Korean industries is similar to that of other Asian countries (i.e., Japan and China), in which social relationships play a more important role in business than in Western countries such as US and UK (Teng et al., 1999).

It is the aim of this study to examine the impacts of electronic commerce on buyer-supplier relationships in the Korean electronics industry. Judging from the goal, this study may have multiple purposes to explore, describe and explain the impacts of electronic commerce. Among these, however, the descriptive characteristic is more dominant than explanatory and exploratory one since the foremost concern of this study is to identify whether electronic commerce facilitate a competitive relationship, or a collaborative relationship. This nature of the study suggests that quantitative data be more appropriate rather than qualitative one. A consideration of the current state of e-commerce in Korea, which is in an early stage, leads to taking a cross-sectional approach rather than a longitudinal one.

With regard to method for data collection, a questionnaire-based survey technique is the most suited to this study. A survey research generally follows a common process to test and develop a theory, which is usually used in descriptive or explanatory research (Neuman, 2003). The questionnaire will be designed on the literature review. Most questions related to electronic commerce will be developed from the context of previous studies, and those related to buyer-supplier relationship will be drawn from the instruments of previous researches. The survey questionnaire will be pretested to clarify the meaning of questions, check the pattern of responses and match questions with an appropriate construct. The pilot test of the questionnaire will be carried out by both academic experts and sample companies. The main survey will be carried out by the method of traditional mailing. In addition, Internet e-mail will also be used for reminding respondents and enhancing a response rate.

Factor analysis will be conducted on the data collected by the survey to discover an underlying structure of the questionnaire items and reduce a complex set of data into a smaller set of factors, which are easy to manage. Structural equation modelling will be employed to test the research model and hypotheses because the model of this research will

consist of a set of variables (i.e., independent variable, dependent variable and mediating variables) and has to consider a series of relationships between variables simultaneously. Traditional statistical techniques such as multiple regression and canonical correlation analysis cannot be used for this research since all of them can examine only a single relationship at a time (Hair et al., 1998). Structural equation modelling (SEM) is the single comprehensive technique to examine a series of relationships simultaneously. Specifically, AMOS (analysis of moment structure) Graphic 4.0 package software is used for this research because AMOS provides easy specification, view and modification to the research model with simple drawing tools, while allowing an assessment of model fit and an adjustment (Teo and Choo, 2001).

In brief, this study will give a clear understanding of how electronic commerce affects buyer-supplier relationships in the Korean electronics industry. Theoretically, this study will identify which side of arguments for the impact of e-commerce on relationships is more empirically valid. Methodologically, this study will follow an advanced approach to simultaneously consider set of relationships in the model. Practically, this study will suggest a long-term competitive strategy in industrial markets by leveraging electronic commerce and interfirm relationship.

## **1.2. Construction of the Study**

The thesis will proceed as follows. In chapter 2, a critical review of the background of the study will be carried out. A literature review will cover the conceptual theories and empirical studies on electronics commerce, buyer-supplier relationships and the Korean electronics industry.

In chapter 3, a conceptual model will be proposed. The review of the background of the study in chapter 2 will raise a research question. In turn, a conceptual framework for the study will be explored and research hypotheses will be proposed.

In chapter 4, the research methodology will be described. It is the main issue of the chapter 4 that describes how the field study was planned and conducted to test the research model in the context of the Korean electronics industry.

In chapter 5, the statistical analysis of the data in the survey will be presented. At first, data will be set up for analysis, then descriptive statistics such as arithmetic means will be explained. Next, ANOVA (analysis of variance) and factor analysis will be employed to detect the underlying structure of the data in the survey, which will result in the creation of the reduced measures and the revision of the research model.

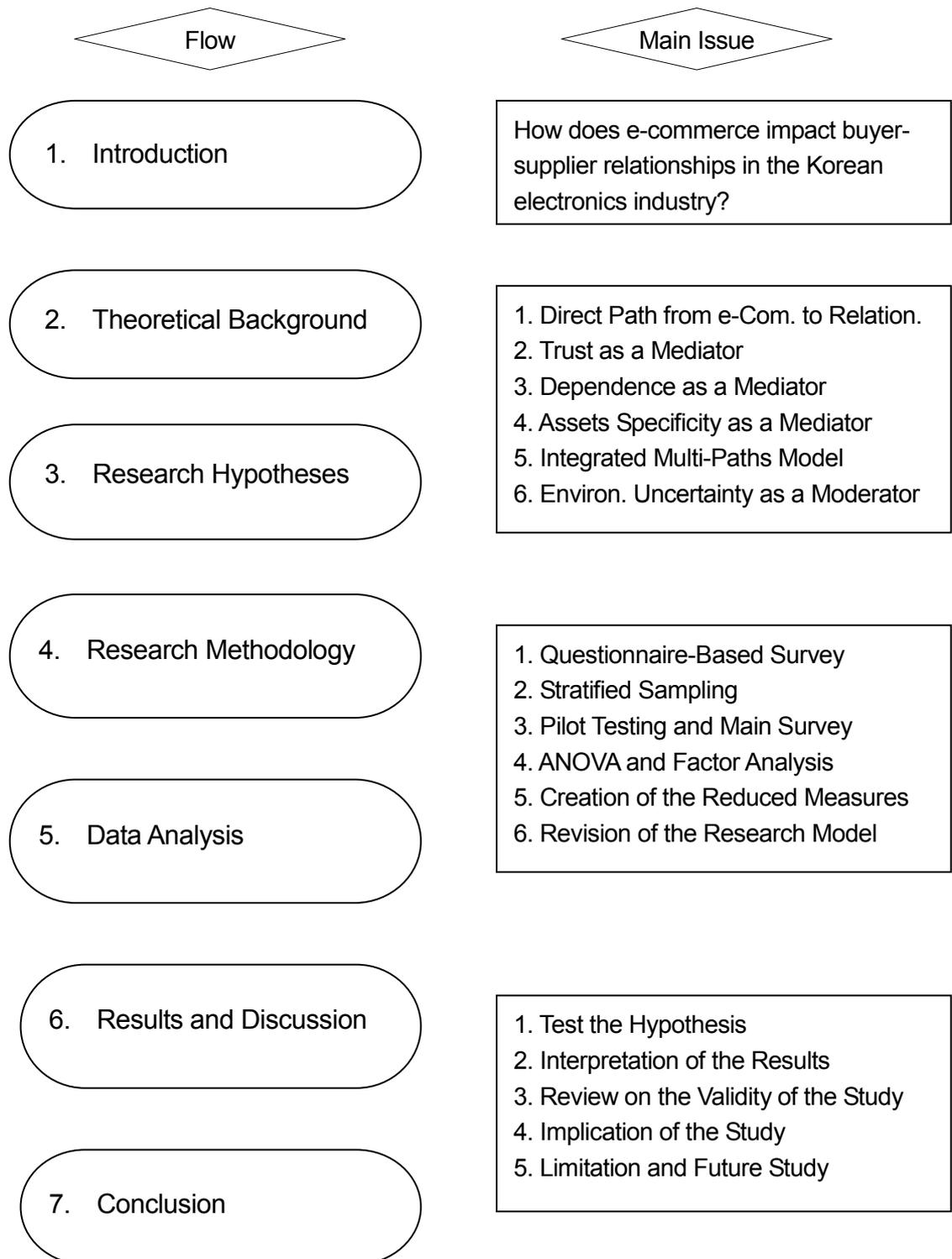
In chapter 6, the results of the research will be discussed. Namely, based on the analysis of Chapter 5, the research model and hypotheses will be tested and the results of the hypothesis-test will be interpreted. In this context, the internal and external validity of the research will be discussed.

In the final chapter, the conclusion of this study will be explained. At first, an outline of the research findings will be given and the implication of the study will be summarized from academic and managerial perspectives. In addition, the limitation of this study will be described and the direction for future research will be suggested.

Subsequently, reference and appendices will follow.

In brief, this study is framed as figure 1 (the next page).

*Figure 1. Study framework*



## **CHAPTER 2. THEORETICAL BACKGROUND OF THE STUDY**

### **2.1. Introduction**

In this chapter, theoretical background of this study will be examined, which will be composed of four sections: (1) electronic commerce, (2) buyer-supplier relationships in the value system, (3) conjunction of electronic commerce and buyer-supplier relationship, and (4) the Korean electronics industry. In each section, at first, the general understanding of each topic will be attempted and then, a theoretical review will be developed in the context of objective of this study.

The section of electronic commerce begins the discussion with referring to the brief history of electronic commerce. Following a broad approach to electronic commerce, electronic commerce will be defined as integrative as one can, and a subsequent review will focus on business-to-business e-commerce. To understand the current state of e-commerce, firms' attitude to electronic commerce will be described. It is the core of this section to investigate how e-commerce has been utilized in business in terms of three dimensions: (1) technology dimension, (2) activity dimension, and (3) intensity dimension.

In the following section, the role of buyer-supplier relationship will be introduced based on the concept of value system. In order to clarify the point at issue, various types of buyer-supplier relationships will be simplified into dyadic types: adversarial-competitive versus collaborative-cooperative. After a short consideration of the current trend of interfirm relationships, the review will concentrate on the underlying theories and determinant variables of buyer-supplier relationship. Transaction cost economics (TCE) will provide the framework for discussion and identify assets specificity and environmental uncertainty as a determinant. To completing TCE, relational exchange theory (RET) will propose trust and resource dependence theory (RDT) will suggest dependence as a determinant.

In the next section, most controversial topics in this review will be dealt with. This section starts with detecting how e-commerce is applied to supply chain for competitive advantage of firms. Prior to the debate, the review will give a concise explanation of how e-commerce influences business activities; especially supply chain relationship. In this context, direct and

indirect impacts of e-commerce on buyer-supplier relationships, which is the theme of this study, will be precisely analyzed from a various angles of underlying theories. This analysis will consist of five subsections: (1) the direct impact of e-commerce on buyer-supplier relationship, (2) the impact of e-commerce on assets specificity, (3) the impact of e-commerce on environmental uncertainty, (4) the impact of e-commerce on trust, and (5) the impact of e-commerce on dependence.

The description of the Korean electronics industry lies in the last section of this chapter. At first, Korean economy will be overviewed with regard to economic structure, business culture, and e-business development. The economic profile of the Korean electronics industry will also be summarized, which focuses on the production and structural features. Subsequent section will examine how electronic commerce has been utilized and what buyer-supplier relationship has been characterized in the Korean electronics industry.

## 2.2. Electronic Commerce

### 2.2.1. A Brief History of Electronic Commerce – Hype and Fall

In traditional commerce buyers and sellers come together in a physical marketplace to exchange information, products, services, and payments. Traditional media such as physical contact, phone or fax are commonly used for exchanging information for trade. However, with the development of information and communication technology, the media of exchanging information have been moved from physical contact, phone, or fax into digital communications networks and computer systems. Physical marketplaces also have been replaced by virtual marketplaces in which transactions occur across telecommunications networks. This process of buying and selling of products and services via electronic media is often called electronic commerce.

The initial development of electronic commerce began in the 1960s and 1970s, when banks began transferring money to each other electronically, using electronic funds transfer (EFT), and large companies began sharing transaction information electronically with their suppliers and customers via electronic data interchange (EDI). These transmissions generally occurred via private telecommunications network called value-added networks (VANs) (Napier et al., 2001). Traditional VAN-based EDI is expensive to set up and does not interface to other networks, however, Internet-based EDI is essentially moving the EDI transaction from the dedicated, secure and proprietary lines of VANs to the vast public network of the Internet (Threlkel and Kavan, 1999). The Internet has remarkable characteristics as a communication network. First, the Internet allows two-way communication, which enables organizations to target a specific audience and to get feedback from them. Second, the Internet is built around open standards (e.g., transmission control protocol (TCP) / Internet protocol (IP)), which enables the integration of one process with another. Third, it significantly lowers setup and operational costs and eliminates switching costs. In sum, the Internet's core advantage lies in its great capacity of efficient, interoperable, integrative, and interactive exchange of information (Avlonitis & Karayanni, 2000).

In the late 1990s, electronic commerce was considered to be crucial for firms to survive in the 21<sup>st</sup> century. Contrary to earlier expectations, however, most of the electronic marketplaces failed in making revenues, and share prices of *dot.coms* plummeted in 2000

(The Economist, 2001). Comparing the evolution with the revolution, Rosenbloom (2003: 93) described the hype and fall of electronic commerce as follows;

“As is now known, of course, this e-commerce revolution did not occur as predicted. Within the first year of the new millennium the e-commerce bubble, which peaked by the end of 1999, had already burst. Most of the super-hyped *dot.coms* were in bankruptcy and hundreds of billions of dollars in market capitalization disappeared. In both business-to-consumer (B2C) and business-to-business (B2B) markets, e-commerce was looking more and more to be at best an evolution rather than a revolution.”

## 2.2.2. Definition of (Business-to-Business) Electronic Commerce

### **Definition of Electronic Commerce – Broader Approach**

There are diverse definitions of the word ‘electronic commerce (or e-commerce)’. The term ‘e-commerce’ may be called interchangeably with the term ‘e-business’ (Napier et al., 2001). Some define that electronic commerce includes commercial transactions that take place electronically over any network (i.e., e-mail, electronic data interchange, the Internet), whereas others limit to commercial transactions that take place over open networks like the Internet. In terms of business activities, the narrower definition of e-commerce is constrained to transactions (e.g., purchase or sale) via electronic network. However, the broader definition is extended to non-trading activities (e.g., presale and postsale efforts, decision support, and cultivating business relationship) beyond transactions only if they are conducted on electronic network (Colecchia, 1999; Dou and Chou, 2002).

The narrower approach, in which electronic commerce is equivalent to ‘electronic commerce transactions’, is generally accepted by statistical institutions such as OECD and its member countries’ statistical agency. For example, OECD (2002: 131) defines electronic commerce as follows;

“An electronic transaction is the sale or purchase of goods and services between businesses conducted over computer-mediated networks. The goods and services are ordered

over those networks, but the payment and the ultimate delivery of the goods or services may be conducted on or off line. According to this definition, e-commerce includes orders received or placed on any on-line application used for automated transactions such as Internet applications, EDI, or interactive telephone systems.”

However, many practitioners and academics suggested that the term e-commerce need to be broadly defined. For example, Roberts and Mackay (1998) stated that electronic commerce should be defined in the context of its wider impacts to enable firms to redesign business process, to exploit information, to integrate internal systems and to support technologies and applications. Broadly defining electronic commerce, Strader and Shaw (1997) stressed that electronic commerce encompasses a wide range of applications such as electronic advertising, product ordering, delivery of digitizable products (e.g., e-books), payment system and electronic markets.

E-commerce can be diversely viewed from a number of perspectives (Kalakota and Whinston, 1997; Turban et al., 2002). From a communication perspective, e-commerce is the delivery of goods or services by electronic means such as computer networks. From a business process one, e-commerce is the application of technology toward automation of business transactions. From a service one, e-commerce is a tool to cut cost and improve a quality. From a collaboration one, e-commerce is the framework for inter- and intra-organizational collaboration. From a community one, e-commerce provides a gathering place for community members to transact and collaborate. Holsaple and Singh (2000) classified various definitions of electronic commerce into five categories; (1) trading view of definition concerns what kind of transaction can be done, (2) information exchange view focuses on exchanges of information, (3) activity view consists of a variety of business activities including non-trading ones, (4) effect view emphasizes goals, reasons and effects, and (5) value chain view sees e-commerce as value creating device of technology.

While each view has its own lens to focus on a distinctive aspect of e-commerce, sticking to a specific perspective involves the risk that the study is limited to a partial area of the subject. This study aims at investigating the impacts of electronic commerce. Viewed from the purpose of this study, it is necessary to define electronic commerce as integratively as possible. In a broad approach, electronic commerce can be generally defined as ‘doing business electronically’. This definition includes not just buying and selling of goods and

services but also collaborating with business partners and interacting within an organization only if they are done via an electronic network which refers to a linkage mediated by computer systems. However, as the empirical research of this study focuses on the inter-firm business between trading parties in an industrial market, the definition of electronic commerce needs to be adapted in the specific context of the study. Accordingly, this study defines electronic commerce as ‘doing business via a computer-mediated linkage with a trading party’.

### **Classification of e-Commerce – Business-to-Business Type Dominate**

By the nature of the transaction, e-commerce can be classified as the following; (1) business-to-business (B2B) e-commerce: inter-organizational information systems and electronic market transactions between organizations, (2) business-to-consumer (B2C) e-commerce: retailing electronic transactions with individual customers or consumers, (3) consumer-to-consumer (C2C) e-commerce: selling directly to other consumers via electronic network, (4) Intra-business (organizational) e-commerce: all internal organizational activities involving exchange of goods, services or information usually performed on intranets, and (5) others (e.g., People-to-People: P2P, Government-to-Citizens: G2C) (Turban et al., 2002).

Among these, it is considered that the greatest possibility for application of electronic commerce comes under the business-to-business sector (Dou and Chou, 2002). US census Bureau (2001: 1) confirmed that business-to-business e-commerce overwhelms the others:

“Between 2000 and 2001, business-to-business (B2B) activity, which depends critically on Electronic Data Interchange (EDI), dominates e-commerce. In 2001, 93 percent of e-commerce is B2B. Manufacturing leads all industry sectors with e-commerce shipments that accounts for 18.3% (\$725 billion) of the total value of manufacturing shipments.”

By the governance type of operations, B2B e-commerce can be classified as: (1) supplier-driven (one supplier - many buyer) type, (2) buyer-driven (one buyer - many supplier) type and (3) third party - driven (many supplier - intermediary - many buyer) type. Most of manufacturer-driven electronic marketplaces fall to the supplier-driven type, manufacturers’ electronic procurement systems go to the buyer-driven type and the

electronic intermediary marketplace where buyers and suppliers can meet and conduct businesses is the third party-driven type (Turban et al., 2002; Barnes-Vieyra and Claycomb, 2001; Dou and Chou, 2002). On the criteria of openness to participants, B2B e-commerce can be divided as: (1) closed-private network type or (2) open-public network type. Open-public and closed-private e-commerce will be compared in table 1.

*Table 1. Comparison of open and closed network*

Dimension	Open-Public Network	Closed-Private Network
Network structure	Open Network (e.g., w.w.w.)	Closed Network (e.g., Proprietary EDI)
Governance structure	Market	Hierarchy
Locus of control	Many buyer, and sellers	Single buyer and many sellers
Transactions	Buyers selects sellers on the transaction-by-transaction basis	Buyer and seller have a tightly coupled relationship
Complexity of goods	Low	High: buyer familiar with goods or services of seller
Relationship	Ephemeral	Based on a long-term or pre-existing relationship
Search costs	On-going: must occur for each transaction	Pre-determined : negotiated before hand
Loyalty	Low	High
Values	Can be different for buyers and sellers	Be similar for buyers and sellers (basis for trust)
Focus of concern	Security of transactions	Mitigation of opportunistic behaviors
Value Chain	Seller is involved indirectly with the value chain of the buyer	Seller is involved directly with the value chain of the buyer
Switching costs	Low	High
Effect	Brokerage	Integration
Strategy	Low Price	Differentiation and/or development of tight linkages between buyers and sellers

Adapted from: Marchewka and Towell (2000: 143)

Before the emergence of the Internet, most B2B e-commerce such as EDI comes under a closed-private type and participation in B2B e-commerce is restricted to existing trading partners. The shift from a proprietary network to a standardized network (e.g., Internet) extends the benefits of EDI to all of potential partners since participation can be open to all the public. An open network lowers entry barriers and creates greater incentives so that it is easier for new-comers to enter the market. This means that B2B e-commerce via open

network generates competitive effects. However, firms usually are reluctant to vulnerable competition. Accordingly, B2B e-commerce has developed along a closed-private type rather than an open-public type.

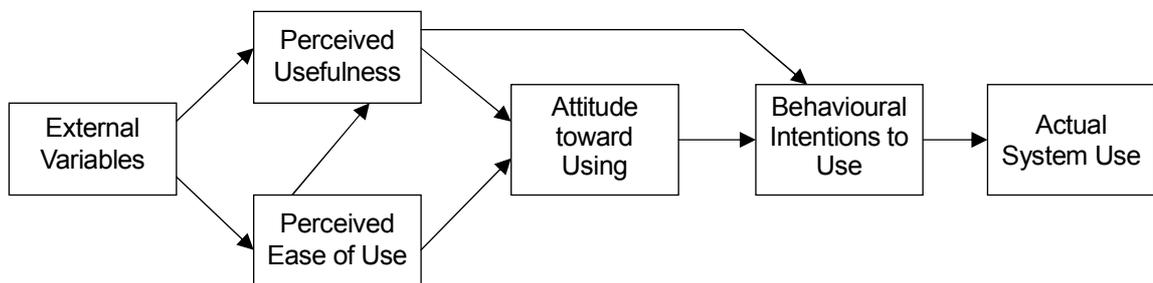
In sum, firms generally seem to be most interested in using open-public type of B2B e-commerce for procurement and sales activities, and closed-private type of B2B e-commerce for product design and development (Booz Allen Hamilton and Giga Information Group, 2001; Young, 2002).

### 2.2.3. Attitude to Adoption of Electronic Commerce

#### Factors influencing Acceptance of e-Commerce

Technology acceptance model (TAM), as illustrated in figure 2, is widely employed to explain information technology acceptance (Olson and Boyer, 2003). TAM is adapted from the theory of reasoned action (TRA) to identify the determinants of computer acceptance. Like TRA, TAM postulates that computer usage is determined by behavioural intention. While TRA asserts that intention is determined by behavioural attitude and subjective norm, TAM views intention as being jointly determined by the attitude toward using the system and perceived usefulness (Davis et al., 1989).

*Figure 2. Technology acceptance model*



Source: Davis et al. (1989: 985)

Following the work of Davis et al. (1989), Agarwal and Prasad (1999) confirmed that TAM is appropriate to understand the process of new technology adoption. They identified that main determinants of the acceptance of new technologies are attitude, belief about usefulness, ease

of use and comfort level.

Extending the logic of TAM to an Internet purchasing, Olson and Boyer (2003) identified four factors (i.e., perceived ease, perceived usefulness, comfort and attitude) as determinants of Internet purchasing acceptance. Unlike Olson and Boyer (2003), Beatty et al. (2001) selected potential facilitators of corporate website adoption on the basis of their relative importance in prior studies. These are perceived benefits, compatibility (organizational and technical), complexity and management support. Regarding the EDI adoption practice of small firms, Iacovou (1995) found that small companies adopted EDI system mainly due to external pressure, especially from trading partners. According to Iacovou (1995), external pressure can be the most critical external variable that, in sequence, determines perception and attitude toward behaviour.

Following the TAM, though it is mainly applied to individual rather than organization, this research takes three factors as determinants of firm's e-commerce acceptance: (1) perceived opportunities and threats, (2) external drivers, and (3) management support.

### **Perceived Opportunities and Threats of e-Commerce to Business**

*Table 2. Opportunities and threats of e-commerce to business*

	Buyers	Suppliers
Opportunities of e-Commerce	Wider product availability	Increased sales opportunities
	Access to global markets	Decreased transaction costs
	Minimize the supply chain inefficiencies	Reach narrow market segments
	Improve supply chain management	Promote customer relationship
Threats of e-Commerce	Competitive Pressure	Concerns about interoperability
	Concern of security and privacy	Intensification of competition
	Uncertainty about applicable law	Rapidly changing technology
	Concerns about total cost	Difficulty in integrating systems

Synthesized from: Timmers (2000), Napier et al. (2001) and Turban et al. (2002)

The opportunities and threats derived from e-commerce to business can be summarized as table 2. Opportunities of electronic commerce come from its geographical and temporal

freedom (Zott, 2000; Perry and Schneider, 2001; Whyte, 2001). Inter-organizational collaboration can also be improved by electronic commerce, which enables companies to seamlessly interact with other organizations at a distance (Whyte, 2001). On the other hand, existing businesses may be threatened by the growth of electronic commerce. For example, electronic commerce may intensify the competition between traditional suppliers (Whyte, 2001).

### **Drivers to Adopt Electronic Commerce**

Drivers of e-commerce adoption are basically affected by practical business considerations such as: (1) to expand market, (2) to improve coordination, (3) to reduce costs, (4) to imitate competitor's use, (5) to satisfy customer's requirement, (6) to respond partner's request, and (7) to get a government incentives (Iskandar et al., 2001; Kraemer et al., 2002). With the result of international comparative analysis, Thatcher (2002) found that there are some differences for US and Asian countries (e.g., China, Hongkong) on the drivers. Namely, compared to companies in U.S., those in Hong Kong felt that they were being forced to adopt B2B e-commerce by their customers, the government and their suppliers. Taiwanese companies appeared that larger electronics firms were strongly influenced by government policies that favored investment in B2B e-commerce (Thatcher, 2002).

### **Management Support for e-Commerce**

An active participation of top management in shaping the vision and strategies for the use of electronic commerce serves as powerful signals to the organization (Chatterjee et al., 2002). Organizational responses on electronic commerce may be dependent upon the will of management. Managerial support for e-commerce will establish use of electronic commerce as a central strategy to business and enable staffs to have enough knowledge of electronic commerce.

#### 2.2.4. Utilization of B-to-B Electronic Commerce

Utilization of e-commerce can be identified by three dimensions: (1) technology dimension, (2) activity dimension, and (3) intensity dimension. The technology dimension concerns what technologies firms adopt in order to take advantage of electronic commerce. Generally viewed, network technologies (e.g., e-mail, intranet, extranet, Internet, and website) and application technologies (e.g., EDI, eMarketplace, ERP (enterprise resource planning), SCM (supply chain management), and CRM (customer relationship management)) are used for electronic commerce. Activity dimension refers to which business activities electronic commerce technologies have been applied to. It is considered that most business activities such as marketing, supply chain management, product development, have been affected by electronic commerce. The last dimension is interested in the results of e-commerce-related activities. Namely, indicators of e-commerce intensity such as e-commerce penetration rate will be the concern. This will suggest the extent to which companies are utilizing e-commerce to undertake their normal business.

##### 2.2.4.1. Technologies Used for Electronic Commerce

E-mail, intranet, extranet, the Internet, and website are common network technologies used for electronic commerce. *E-mail* is the exchange of computer-created and computer-stored messages via a telecommunications network (Gunasekaran et al., 2002). *Intranet* means any private internal network. Companies use intranet to share files and utilize websites. Usually, the intranet cannot be accessed from the Internet, or may be connected to the Internet via firewalls. *Extranet* is a sort of intranet that has been extended to include access to or from selected external organizations such as suppliers, but not the general public. *The Internet* refers to a specific, historic and ubiquitous worldwide digital communication network. *Website* is a collection of interlinked web pages with a related topic, usually under a single domain name. Among network technologies, it is expected that e-mail will become the most frequently used method of communication for both buyers and suppliers (Leek et al., 2003).

EDI, eMarketplace, ERP, SCM and CRM are common application technologies used for electronic commerce. *EDI* (electric data interchange) is computer-to-computer exchange of business documents without human intervention. EDI enables enterprises to exchange

precisely formatted business orders, payments, or even engineering drawings, electronically via a direct communication link. An *eMarketplace* is an Internet-based broker of goods or services in a community of many buyers and many sellers. eMarketplace usually has open criteria for entry, and thus any buyer or seller can participate in it. According to Shim et al. (2000), e-commerce application technologies can be identified in the context of business process. Business process engineering, which streamlines and automates processes to improve business efficiency, can be implemented by applications of packaged software for enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM). SCM system and ERP system are compared as the following table 3 in terms of objective, focus, goal, and function (Tarn et al., 2002).

*Table 3. Comparison of SCM system and ERP system*

	SCM system	ERP system
Objective	Integrating and optimizing internal business processes of a single organization as well as the interaction of the organization with its business partners across the entire supply chain	Integrating and optimizing internal business processes within the boundary of a single organization
Focus	Optimizing information flow, physical distribution flow, and cash flow over the entire supply chain	Optimizing information flow and physical distribution flow within a single organization
Goal	Constraint-based tool providing reasonable and feasible business plans based on the availability of the required key resources	Non-constraint-based tools providing business plans without the consideration of the availability of key resources
Function	Manufacturing management, inventory management, logistics management, and supply-chain planning	Manufacturing management, financial management, and human resource management

Adapted from Tarn et al. (2002: 30)

#### 2.2.4.2. Business Activities Conducted via Electronic commerce

More and more companies are conducting business activities via taking advantage of electronic commerce. It is considered that most business activities have been affected by electronic commerce. First, the impacts of e-commerce can be found in the area of marketing

activities. Bloch and Segev (1996) stated that e-commerce enhances the promotion of products, creates a new distribution channel, saves cost of logistics, reduces delivery cycle time and improves customer services.

Second, product development has also been affected since e-commerce helps parts makers and assemblers to collaborate with. Contacting customers and simultaneously tying suppliers in buyer's production process will enable customers to order products on-line (Sculley and Woods, 1999).

Third, supply chains of firms have also changed due to the impacts of e-commerce. Information on distribution of goods gets relatively quicker to process and easier to share, firms are able to lower inventory costs and respond faster to changes in demand, and traditional distribution channels and middlemen are being threatened by new channels and intermediaries (Rao, 1999).

On the basis of transaction-structured approach, Hawkins and Verhoest (2002) classifies business activities that are related to electronic commerce as transaction preparation, transaction completion, or production support. Transaction preparation includes advertising, catalogues/stock lists, information services, and negotiation. Transaction completion consists of ordering, billing/payment, finance and delivery. Production support refers to capture of transaction information, information management, market analysis, and market development.

Chatterjee et al. (2002) condenses e-commerce businesses activities into seven items: (1) publishing company's specific facts/figures, (2) disseminating product/service information, (3) receiving payments from customers, (4) delivering products/services to customers, (5) providing customer service support, (6) testing products/services, and (7) conducting marketing surveys.

#### 2.2.4.3. Penetration of Electronic Commerce in Business

OECD examines the intensity of e-commerce such as the penetration rate and value of transactions, which measures the extent to which users are utilizing e-commerce to undertake

their normal business and social processes. Recent OECD (2002) official surveys on its member countries show that while the Internet and electronic commerce transactions are rising fast, they still play a small role. As reported in table 4, the ratio of Internet sales over total sales in business sector ranged from 0.4 percent in Italy to 1.8 percent in United Kingdom in 2000. Sales conducted over all sorts of computer-mediated network as well as Internet accounted for 4.0 percent in Spain, 5.2 percent in United Kingdom, 13.3 percent in Sweden of all sales in 2000. OECD explained that in the aftermath of the dot.com crash, many start-ups had disappeared and growth in electronic commerce transactions had been less spectacular than predicted. Nevertheless, OECD predicted that the volume of electronic transactions was growing and the Internet was increasingly used as a transaction channel, particularly for purchases.

*Table 4. Official estimate of e-commerce<sup>1</sup> sales in 2000 (percentage of total sales)*

Business Sector	2.0% Sweden	1.8% United Kingdom, 1.4% Spain, 1.0% Austria, 0.6% Norway, 0.4% Portugal	13.3% Sweden 8.1% Norway 5.2% United Kingdom 4.0% Spain 1.8% Portugal
Business Sector Excluding financial Sector	0.9% Denmark 0.7% Finland	0.94% United Kingdom 0.4% Italy	9.1% Finland 5.95% United Kingdom 5.7% Denmark 1.1% Italy
Retail Sector	0.1% France('99)	1.04% United Kingdom	1.39% United Kingdom 1.2% USA
	<b>Web commerce</b>	<b>Internet commerce</b>	<b>Electronic commerce</b>

Source: OECD (2002: 140)

Subject to the indicators to be compiled on an internationally comparable basis, Pattinson (2000) suggested core business sector indicators for measuring e-commerce. They consists of

<sup>1</sup> OECD defines that *an electronic commerce* is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organizations, conducted over computer-mediated networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off line. *An Internet commerce* is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, other public or private organisations, conducted over the Internet. *A Web commerce* is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, other public or private organizations, conducted over the Web.

(1) the number/proportion of business with computers, (2) the employment (level and share) of business with computers, (3) the number/proportion of businesses with access to the Internet, (4) the employment (level and share) of businesses with access to the Internet, (5) the number/proportion of businesses undertaking specific business processes on the Internet such as ordering, online payment, and digital delivery of services, (6) the number/proportion of businesses with websites, (7) the number/proportion of businesses which plan to use the Internet, (8) the number/proportion of businesses receiving orders over computer-mediated networks, (9) the value of orders of goods and services received over the Internet, (10) the value of orders of goods and services received over computer-mediated networks, (11) the proportion of orders of goods and services received over the Internet, and (12) the proportion of orders of goods and services received over computer-mediated networks.

#### 2.2.5. Summary of Electronic Commerce.

(1) Statistical institutions usually limit the definition of e-commerce to electronic transaction. However, this research defines electronic commerce as ‘doing business via a computer-mediated linkage with a trading party’. Not only sales and purchase but also inter-firm collaboration and intra-firm interaction for collaboration are considered as electronic commerce only where they are done via a computer-mediated network.

(2) The greatest possibility for the application of e-commerce seems to go to business-to-business (B2B) sector. Before the emergence of the Internet, most B2B e-commerce (e.g., EDI) used a closed-private type of proprietary network. Recently, companies are generally interested in open-public type of B2B e-commerce for procurement and sales, and closed-private type of B2B for product development.

(3) Viewed in terms of technology acceptance model (TAM), the adoption of e-commerce is affected by perceived benefits and threats, external drivers to facilitate the adoption, and managerial support. E-commerce enables firms to be free from geographical and temporal barriers, and thereby gives opportunities such as access to global market, decreasing transaction costs, improving supply chain, and promoting customer relationship. On the other hand, e-commerce may threaten an existing business by competition pressures.

Concerns of security, privacy, uncertainty, interoperability and total costs are also raised by e-commerce.

(4) This research identifies the utilization of e-commerce by three dimensions: technology, activity and intensity. E-mail, intranet, extranet, the Internet, and website are common network technologies used for e-commerce, while EDI, eMarketplace, ERP, SCM and CRM are common application technologies. Most business activities from transaction preparation to transaction completion to production support have been conducted with the support of e-commerce. The volume of e-commerce transactions is still relatively small, but it is rising fast. According to OECD (2002), sales conducted via all sorts of computer-mediated network including the Internet accounted for 4.0 % of all sales in 2000 in Spain, 5.2 % in United Kingdom, 13.3 % in Sweden.

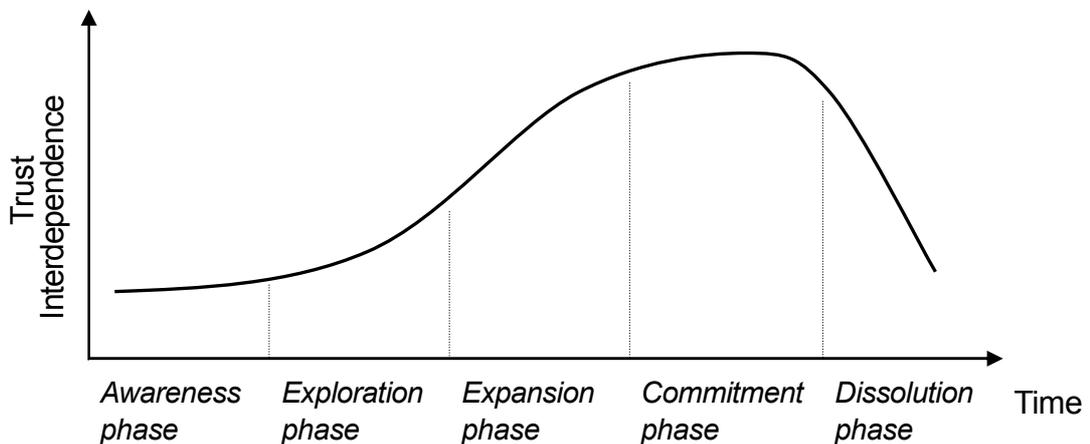
## 2.3. Buyer-Supplier Relationships in the Value System

### 2.3.1. Types and Characteristics of Buyer-Supplier Relationships

#### Developmental phases of buyer-supplier relationships- Time Series Analysis

Development of buyer-supplier relationships can be analyzed by the method of time-series analysis and cross-sectional analysis. In terms of time series analysis, the development process of relationships can be identified as five general phases like the following, as seen in figure 3 (Dwyer et al., 1987): (1) Awareness phase: firms try to enhance each one's own attractiveness, however, interaction between firms has not transpired in this phase. (2) Exploration phase: each party gauges and tests the goal compatibility, integrity, and performance of the other. (3) Expansion phase: trust and joint satisfaction established in the exploration phase lead to increase of mutual dependence in expansion phase. (4) Commitment phase: the most advanced phase of buyer-supplier relationship is characterized as three variables: inputs, durability and consistency. (5) Dissolution phase: every phase of relationship has the possibility of withdrawal or disengagement.

*Figure 3. Developmental phases of buyer-supplier relationships*



#### Continuum of Interorganizational Relationships- Cross-Section Analysis

In terms of cross-sectional analysis, various types of interorganizational relationships can be summarized as a continuum of relationships as seen in figure 4 (the next page). Hut and Spech (2001) categorize all ranges of exchanges into five sub-relationships as seen in the top

of figure 4: (1) pure transaction, (2) repeat transactions, (3) long-term transactions, (4) buyer-supplier partnerships, and (5) strategic alliances. In their model, pure transactions indicated a one-time exchange of value with no prior or subsequent interaction, long-term transactions are managed at arm's length with price being a focal issue, and strategic alliances involve a formal long-run linkage funded with direct co-investment.

*Figure 4. Continuum of relationships between firms*



<b>Hut &amp; Spech (2001)</b>	<i>Transactional exchange</i>			<i>Collaborative exchange</i>				
	Pure transactions	Repeat transactions	Long-term transactions	Buyer-supplier partnerships	Strategic alliances			
<b>Parker &amp; Hartley (1997)</b>	<i>Economizing on transaction costs</i>							
	Competition spot price	Adversarial competition	Preferred partner	Networks	Partnership	Joint ventures	Subsidiaries	Vertical integration

Compared to Hut and Spech, Parker and Hartley (1997) focused on the procurement side of the relationship based on transaction economics. On the left extreme of the continuum, the relationship between buyer and supplier is transitory, non-committal and arm's length. The typical form of the right extreme is the vertically integrated firm.

Patterson et al. (1999) classified inter-organizational relationships into three categories. First transactional buyer-supplier relationship is limited to single or short-term exchange of transactions. Second, transitional buyer-supplier relationship includes sufficient shared interests. Hierarchical controls, which may tend to make the relationship power-asymmetric, remain. Finally, transcendental buyer-supplier relationship is characterized by high levels of interdependence and ongoing commitment.

### **Dyadic Types of Buyer-Supplier Relationship**

In reality, a buyer is likely to maintain a portfolio of suppliers rather than one supplier and to develop different levels of relationships with each, based on need and value (Dyer et al., 1998). However, interorganizational relationships between buyer and supplier are traditionally characterized by dyadic types: adversarial and collaborative as extremes of a

continuum. A general comparison of adversarial-competitive and collaborative-cooperative relationships can be described as table 5.

*Table 5. Comparison of dyadic types of relationships*

Relationship factor	Adversarial-competitive Relationships	Collaborative-cooperative Relationships
Nature of competition	Competitive, Price based	Collaborative, Technology-based
Sourcing Decision	Competitive bidding	Long-term performance history
Information transfer	One-way; closed	Transparency of costs in each direction
Capacity Planning	Independent	Shared problem
Delivery practices	Erratic	Just in time or agree-based
Dealing with price changes	Win-lose	Win-win (collaboration on cost-reduction)
Input characteristics	Low value inputs	High value inputs
Product characteristics	Commodity, standardized products	Customized, non-standardized products
Interdependence of buyer-supplier	Low degree (sequential)	High degree (reciprocal)
Supplier management practice	Single functional interface and contractual safeguarding	Multiple functional interfaces and self-enforcing agreements
Role of R&D	Assembler designs and supplier makes to specification	Supplier is involved early in R&D process
Level of pressure	Low – purchaser will go elsewhere if dissatisfied	High – continuous improvements to identify better methods and materials leading to lower costs

Adapted from Lamming (1993: 152) and Dyer et al. (1998: 72)

Under the adversarial-competitive relationship, which has characteristics of tough negotiation, focus on price, short-term contracts and multiple sourcing, the primary goal of buying firms is to minimize the price of purchased goods and services (Shapiro, 1986; Tang et al., 2001). When such relationships are engaged, the buyer relies on a large number of suppliers in order to obtain a higher bargaining position compared to that of other suppliers. This relationship usually assumes that there are no differences in suppliers' abilities to provide value-added services, technology gains, process innovations, and other methods of gaining competitive advantage (Humphreys et al., 2001).

Under the collaborative-cooperative relationship between buyer and supplier, exchanging parties are working together to achieve mutual and individual goals jointly (Cannon and Perreault, 1999; Tang et al., 2001). There is a movement away from price-based criteria, in many organizations, to other performance criteria, such as quality and delivery for evaluating the purchasing decision (Mayhow, 1985). These collaborative relationships are characterised by norms of reciprocity, flexibility, and information exchange, which are manifested by behaviours of joint problem solving, open information sharing and relationship-specific investments (Campbell, 1997).

### **Current Trend of Buyer-Supplier Relationship**

As a result of a survey on buyers and suppliers in electronics and aerospace industries of USA, Forker and Stannack (2000) suggested that competition be more effective than cooperation in many buyer-supplier exchange relationships. They compared the effects of competitive relationships with those of cooperative relationships as for perception and satisfaction gaps between buyers and suppliers. In their research, there appeared to be a better-shared understanding within the competitive exchange than the cooperative exchange. In conclusion, Forker and Stannack (2000) argued that before buyers rush to set up partnerships with their suppliers, they should take a candid look at the need for such intimate relationships since the market mechanism may be sufficient to satisfy both parties to exchange.

However, the current trend of relationships in industrial markets is evolving towards a more collaborative form based on cooperation, mutual benefit, trust and relational exchange. (Gules and Burgess, 1996; Tang et al., 2001). Hoyt and Huq (2000: 750) described the shift in the characteristics of business relationship as follows;

“As late as the mid-1980s, transactions between buyers and sellers tended to rely on arms-length agreements, based on market price, while relationships in the 1990s rely more on trust derived from collaboration and information sharing.”

Skjøtt-Larsen et al. (2003) also confirmed the trend that characteristics of buyer-supplier relationships had been undergoing dramatic changes over the last decades from the

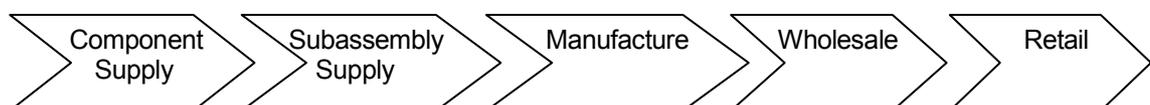
traditional arm's length type of relations towards the emerging relationships such as partnerships.

### 2.3.2. Roles of Buyer-Supplier Relationships

#### **Concept of Value Chain and Competitive Advantage**

Porter (1985) looked at the firm as a series of activities which were linked together into a conceptual model of *value chain*. In Porter's model, value chain consists of primary business activities and support activities. Inbound logistics, operations, outbound logistics, marketing & sales and after-sales service are defined as primary activities. Procurement, technology development, human resources management and firm infrastructure comprise support activities. These discrete activities are related by linkages within the chain. Linkages not only exist within a firm's value chain, but also between a firm's chain and the value chains of suppliers and channels (vertical linkages). According to Porter (1985), *competitive advantage* grows fundamentally out of the value that a firm is able to create for its buyers. The overall competitive advantage of an organization is not just dependent on the efficiency of a firm and the quality of its product, but also upon those of its suppliers, wholesalers and retailers (Whiteley, 2000). Products are the results of a complex web of relationships between manufacturers, component suppliers, wholesalers, retailers and the logistic infrastructure that links them together (Whiteley, 2000). Whiteley (2000) suggested very simple form of an overall value system for a manufactured product as shown in figure 5.

Figure 5. A simple form of manufacturing value system



#### **Buyer-Supplier Relationships for Competitive Advantage**

Empirical studies report the possibility that firm's critical value may be created beyond firm's boundaries. A typical manufacturing firm in the United States purchases fifty-five percent of the value of each product it produces (Dyer and Singh, 1998). Managed well

inter-organizational relationship has the potential to generate competitive advantage because it enables firms to focus on its own core competences and use links to other organizations to develop skills that would be difficult or impossible to develop alone (Kasouf and Celuch, 1997; Dyer et al., 1998). For example, by establishing close relationships with suppliers and customers, part producers could focus more on value-added services and rely less on price competition (Kasouf and Celuch, 1997).

Firms are engaged in a cooperative buyer-supplier relationships because they expect to benefit from the relationships (Dwyer et al., 1987). Competitive advantage may be generated as buyer and supplier move the cooperative relationships away from the attributes of a competitive market. This is because the cooperative relationship can be used for reducing the incentive for opportunistic behaviour in the presence of opportunism (Jap, 2001). In line with Jap (2001), as a result of empirical investigation, Carr and Pearson (1999) found that more cooperative buyer-supplier relationships with key suppliers enable firms to have higher levels of financial performance with respect to return on investment, profits as a percent of sales, and present value of the firm. Carr and Pearson (1999: 516) explained why financial performance could be improved by collaborative relationship by stating as follows;

“Suppliers often have knowledge about process and alternatives that can save the buying firm money on material acquisition costs. If a cooperative relationship exists and the supplier shares this type of information with the buying firm, the savings can be shared between both firms for a win-win outcome. Any savings the buying firm realizes on purchased materials goes straight to the bottom line profit.”

However, there are potential barriers (e.g., high risk exposure or operational difficulties) to these close relationships. Furthermore, companies might lose control over important elements of business and enhance the trading parties' bargaining power as a result of extensive partnering (Porter, 2001). A short-term operational benefit of outsourcing might actually results in a loss of strategic position to another firm (Devlin and Bleakley, 1988). Accordingly, it is more plausible strategy that firms segment their trading partners into strategic partners and durable arm's length partners rather than employ a 'one-size-fits-all' strategy (Dyer et al., 1998). Strategic partners are expected to play an important role in differentiating firms' final product and to improve competitive advantage, whereas arm's length suppliers are not.

### 2.3.3. Transaction Cost Economics: Assets Specificity and Environmental Uncertainty

#### Underlying Theories Explaining Buyer-Supplier Relationships

Several theories have been employed for prior studies on interfirm relationships. Among these, as reported in table 6, transaction cost economics (TCE) leads this area of researches and other theories (e.g., relational exchange theory (RET) and resource dependence theory (RDT)) complete TCE. Following a general tendency, this study places its theoretical ground on TCE, RET and RDT to identify determinants of buyer-supplier relationships.

*Table 6. List<sup>2</sup> of underlying theories on interfirm relationships*

Author (year)	Underlying Theory	Research Method	Relationship Context	Focus of Research
Buvik & Reve (2001)	Transaction cost theory	Empirical: 161 firms	B-S relationship in purchasing	Asymmetrical dependence structure
Kern & Willcocks (2000)	Organization theory, Social exchange theory, Relational contract	Exploratory research with interviews	Client-supplier relationship in IT outsourcing	Relationship property-interaction, contract, context, behavior
Bensaou & Anderson (1999)	Transaction cost theory	Empirical: 388 firms	B-S relationship in automobile	Assets-specific investments
Haugland (1999)	Transaction cost theory, Relational exchange theory	Empirical: survey and interview	Buyer-seller relationship in international fishery	Relational investment, hierarchical governance mechanism
Kim (1999)	Transaction cost theory, Competitive strategic perspective	Empirical: survey (276 firms)	Distributor-supplier relationships in industrial markets	Environmental uncertainty and joint action
Morgan & Hunt (1999)	Resource-based theory	Exploratory	Relationship in marketing	Relationship-based competitive advantage
Madhok & Tallman (1998)	Transaction cost theory, Resource-based theory	Theoretical	Collaborative inter-firm relationship	Transaction or relationship - specific
Holm et al. (1996)	Transaction cost theory, Social Exchange theory	Empirical: survey (136 samples)	B-S relationship in International business	Cooperation and the value of relationship
Stump & Heide (1996)	Transaction cost theory, Agency theory	Empirical: 164 firms	Manufacturer-supplier relation in chemicals	Interdependencies
Dowling et al. (1996)	TCE, Resource dependence theory	Exploratory	B-S multifaceted relationship	Cooperate and compete simultaneously
Stump (1995)	Transaction cost theory	Empirical: (161 firms)	B-S relationship in chemical industry	Purchasing concentration
Provan & Gassenheimer (1994)	Resource dependence theory	Empirical	B-S relationship in office system/furniture	Supplier commitment to buyers
Ring & Van De Ven (1994)	Transaction cost theory Agency theory	Exploratory	Inter-organizational relationship	Developmental process of cooperative relation
Christy & Grout (1994)	Transaction cost theory, Game theory	Exploratory	B-S relationship in supply chain	Safeguarding B-S relationship
Sriram et al. (1992)	TCE, Resource dependence theory	Empirical: (65 managers)	B-S relationship in aerospace automobile	Antecedents to B-S collaboration

<sup>2</sup> . This list is made on the basis of 'Web of Science' searched on 19<sup>th</sup> July 2002

## **Transaction Cost Economics (TCE) and Buyer-Supplier Relationships**

Coase (1937) proposed that under certain conditions, costs of conducting economic exchange in a market may exceed costs of organising the exchange within a firm. In line with Coase, Williamson (1975) developed transaction cost economics theory (TCE) by explaining the existence of firms in terms of comparative transaction cost advantages. Transaction cost refers to the cost that runs the system and includes such as ex ante costs as drafting and negotiating contracts and such ex post costs as monitoring and enforcing contracts (Heide and Stump, 1995; Standifird and Marshall, 2000). TCE frames the decision problem as a choice between a spot-market transaction (or market) and a complete vertical integration (or hierarchy) (Williamson, 1975; Heide and Stump, 1995; Roberts and Mackay, 1998; Standifird and Marshall, 2000). Malone et al. (1987: 485) described two possible mechanisms:

“Markets coordinate the flow through supply and demand forces and external transactions between different individuals and firms. Market forces determine the design, price, quantity, and target delivery schedule for a given product that will serve as an input into another process. Hierarchies, on the other hand, coordinate the flow of materials through adjacent steps by controlling and directing it at a higher level in the managerial hierarchy. Managerial decisions, not the interaction of market forces, determine design, price (if relevant), quantity, and delivery schedule at which products from one step on the value-added chain are procured for the next step.”

Two key assumptions of TCE are bounded rationality and opportunism, even though much of the attention has been paid to the problems of dealing with opportunism while bounded rationality has been considered as an exogenous variable (Rindfleisch and Heide, 1997). Bounded rationality is the assumption that our cognitive capabilities are limited in such a way that we cannot process all possible information perfectly, which implies that our intent of a rational choice is limited to the information we are able to process (Simon, 1955). Especially under environmental uncertainty, in which the circumstances surrounding an exchange cannot be specified ex ante and performance cannot be easily verified ex post, bounded rationality is a problem (Rindfleisch and Heide, 1997). Opportunism is the assumption that decision-makers may unscrupulously seek to serve their self-interests

(Williamson, 1985; Standifird and Marshall, 2000). It has not been limited to the self-interests alone, but has included malicious behaviour such as lying, cheating, deceit, and violations of agreements (Rindfleisch and Heide, 1997). Opportunism is always present, but poses a problem to organizations when transactions are supported by transaction specific assets (Williamson, 1975). Transaction specific assets are things that are uniquely suited to a specific exchange relationship and lose the value outside of the focal relationships. According to the logic of TCE, confronted with high transaction costs posed by high levels of uncertainty and assets specificity, firms tend to choose vertical integration (hierarchy) to minimize the transaction cost. By internalizing a market transaction firms replace market forces with organizational control, which both serves to safeguard specific assets as well as facilitate adaptation to uncertainty (Heide and Stump, 1995).

Using the rationale of dichotomy between market and hierarchy, TCE has greatly contributed to the study on institutional arrangements for economic relationships between organisations (Roberts and Mackay, 1998). According to the logic of TCE, trading parties such as buyers and sellers determine a binary choice on governance mechanism between market and hierarchy to economize on transaction cost. On the one hand, a market mechanism is the optimal solution for buyers and sellers in a case of the transaction that does not require specific investment and is done under a stable circumstance. On the other hand, confronted with high transaction cost posed by high levels of assets specificity and environmental uncertainty, buyer and sellers need to choose a vertical integration (hierarchy) to minimize a transaction cost.

However, in many situations, even if assets involved in transaction between buyer and seller become specific, many transactions are made outside of a vertical integration. Buyers and sellers engage in transactions with highly specific investments under the conditions of great uncertainty, but deliberately forgo the opportunity of a vertical integration and remain independent before and after the transaction (De Jong and Nooteboom, 1998).

Rather, a hierarchical integration is replaced by a middle-ranged governance mechanism. At the moderate level of assets specificity, a middle-ranged solution incurs lower transaction cost than market-based exchange by reducing incentives to act opportunistically (Standifird and Marshall, 2000). Individual firms might increase their resources and capabilities by coordinating their resources and achieving mutually beneficial relationships with their

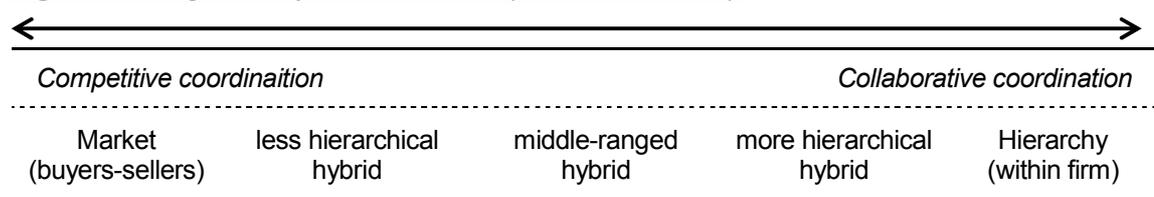
trading partners (Roberts and Mackay, 1998). Bensaou and Anderson (1999) argued that the trend that a vertical integration has been replaced by a middle-range solution is highly related to human nature. As for a matter of human nature, it may be a more realistic assumption that opportunism is far rarer and trust is far more common than they are posited in TCE. Williamson (1991) recognized a third alternative form of governance mechanism, named as the ‘hybrid’, which fills the gap between the extremes of markets and hierarchies.

This hybrid governance structure is variously called as ‘vertical coordination’, ‘alliance’, ‘joint venture’, ‘partnership’ and so on. Among these, ‘vertical coordination’ that is conceptualized by Buvik and Andersen (2002) shows a good picture of a hybrid form of governance structure as follows;

“Vertical coordination implies organization of the flow of activities, resources, and information between supplier and buyer that extends well beyond the normal, legally enforceable interactions associated with an arm’s length exchange of price and quantity information.”

A wide range of hybrid forms exist, even if they are different in the extent to which the characteristics of vertical integration are embedded. All ranges of governance structure can be summarized as a spectrum from market, to hybrid, to hierarchy as illustrated in figure 6.

*Figure 6. A spectrum from market, to hybrid, to hierarchy*



Accordingly, studies on application of TCE move their focus from firm’s binary choice between extremities (e.g., outsourcing in market and vertical integration into hierarchy) into a continuum of coordination structure between independent firms (Bensaou and Anderson, 1999; Ellram and Zsidisin, 2002). In this continuum, market-types of coordination structure is equivalent to market-like (i.e., competitive-adversarial) relationships between buyers and suppliers, while hierarchy-types of coordination structure corresponds to hierarchical (i.e., collaborative-cooperative) relationships between buyers and suppliers.

This indicates that the logic of TCE can be extended to a study on interfirm relationships between buyers and suppliers. On the one hand, a competitive-adversarial relationship is the optimal solution for buyer and supplier in case of transaction that does not require specific investment and is done under a stable circumstance. More competitive relationship could provide supplier and buyer with the efficiency of scale economy and specialization. On the other hand, confronted with high transaction cost posed by high levels of assets specificity and environmental uncertainty, buyer and supplier need to establish a cooperative-collaborative relationship to minimize transaction cost. More cooperative relationship between buyer and supplier could serve to safeguard assets as well as to facilitate adaptation to uncertainty.

A reasoning of interfirm relationships can be applied when examining impacts of e-commerce. E-commerce has the potential to affect transaction cost of buyer and supplier simultaneously, and therefore, to change forms of business relationships between buyer and supplier. For example, the Internet may reduce the cost of transaction between buyer and supplier that is currently conducted by phone or fax, save the cost of matching buyer and seller that is traditionally conducted by reading catalogs, and decrease opportunistic behaviours by leaving an electronic trails of buyer and supplier (Garciano and Kaplan, 2001). These suggest that more competitive relationship between buyer and supplier could be prevalent because the use of e-commerce reduces transaction costs of both buyer and supplier simultaneously.

More cooperative relationships between buyer and supplier could also be expected to increase under a certain situation where buyer and supplier adopt e-commerce to trade. For example, if only electronic data interchange (EDI) processes begin in industrial markets, both a buyer and a supplier make transaction specific investments (Wilson and Vlosky, 1998). Efficiency gains from EDI may simultaneously reduce transaction cost of the buyer and the supplier. However, the buyer's assets that are dedicated to the supplier for EDI may be worthless out of the relation with the supplier, which will cause the buyer a lot of costs to secure the transaction with the supplier. Simultaneously, as the other side of a same token, the supplier's assets that are suited to the buyer for EDI may lose value out of the trade with the buyer, which will make the supplier a lot of costs to ensure the transaction with the buyer. In this situation, the buyer tends to keep close-collaborative relationships with the supplier in order to obtain efficiency gain as well as to safeguard invested assets from opportunistic

behaviour of the supplier. It is beneficial for the supplier to keep long-term cooperative relationships with the buyer in order to get efficiency gain as well as safeguard invested assets from opportunistic behaviour of the buyer.

### **Assets Specificity: Key Determinant of the Coordination Structure in TCE**

One of key variables that play a critical role in determining the coordination structure of buyer-supplier relationships is assets specificity that refers to the extent to which assets are uniquely tailored to a particular exchange relationship. Williamson (1985) distinguished six types of assets specificity: site specificity, physical assets specificity, human assets specificity, dedicated assets, brand name capital and temporal specificity. A higher assets specificity is expected to shift the conditions of trade from those of market transactions to hierarchical solutions due to a need for safeguarding of specific assets at risk (Buvik and Reve, 2001). Malone et al. (1987: 486) explained why a highly specific assets is more likely to be acquired through hierarchical coordination than through market coordination:

“Transactions involving assets-specific products often involve a long process of development and adjustments for the supplier to meet the needs of the procurer. Moreover, since there are, by definition, few alternative procurers or suppliers of a product high in physical or human assets specificity, both parties in a given transaction are vulnerable. If either one goes out of business or changes its need for the product, the other may suffer sizable losses. The greater control and closer coordination allowed by a hierarchical relationship are thus more desirable to both.”

In short, under a high level of assets specificity, it is desirable for firms to abandon arm's length interaction (Heide and Stump, 1995).

### **Environmental Uncertainty: Key Determinant of the Coordination Structure in TCE**

An assumption of bounded rationality, which says that our cognitive capabilities are so limited that we cannot deal with all possible information perfectly (Simon, 1955), generates a problem under environmental uncertainty (Rindfleisch and Heide, 1997). Environmental uncertainty refers to the lack of information on external environment or the unpredictable

change of external environment (Buvik and Grønhaug, 2000). Paswan et al. (1998) suggested that environmental uncertainty should be measured in terms of a limited set of functional tasks like forecasting of volume or changes in technology. Environmental uncertainty enlarges the number of contingencies that may affect a market transaction, which results in the increase of both the potential for opportunistic behaviour and transaction cost (Williamson, 1985). According to the logic of TCE, hierarchical solution would be chosen to minimize the high transaction cost posed by high levels of uncertainty. A firm usually tends to avoid risks from uncertainty by making a stable relationship with others. When a volatile situation that price or quantity of a component fluctuates in a market, firms will try set up close ties with the trading partners to procure resources with stability. In short, under the presence of environmental uncertainty, it is desirable for firms to abandon arm's length interaction (Heide and Stump, 1995).

However, against the prediction of TCE, empirical research found that relations between environmental uncertainty and coordination mechanism were mixed (Kulkarni and Heriot, 1999; Boerner and Macher, 2001; Leiblein, 2003). Leiblein (2003: 943) explained these contradictory results as follows;

“For instances, empirical studies focusing on one aspect of behavioural uncertainty - measurement uncertainty - have demonstrated a positive relationship between the ability to measure an employee's productivity and the degree of vertical integration. In contrast, research focusing on technological uncertainty has demonstrated a negative relationship between uncertainty and integration. Research examining the influence of demand uncertainty has illustrated both negative and positive relationships with integration.”

Both demand and technological uncertainty may discourage vertical integration because firms are afraid that vertical integration limits their flexibility that is necessary to survive in a rapidly changing situation (Kulkarni and Heriot, 1999). Boerner and Macher (2001) proposed that contradictory empirical findings around environmental uncertainty should be understood in conjunction with assets specificity. They argued that TCE could predict that uncertainty leads to more hierarchical forms of governance only when assets specificity exists. In sum, it is theoretically probable that environmental uncertainty shifts the coordination structures in favour of vertical integration rather than market mechanism. In terms of empirical studies, however, there is still controversy over the role of environmental uncertainty in determining a governance structure between market and hierarchy.

#### 2.3.4. Relational Exchange Theory: Trust

##### **Relational Exchange Theory (RET)**

TCE has achieved a prominent role in the analysis of governance mechanisms for exchange relationships. However, it has been challenged by other theories that have their own primary domain of interest such as relational exchange theory (RET). Relational exchange theory insists that business transactions should be understood in the social context to which they are related (Haugland, 1999). A relational exchange is different from the discrete transactional exchange that is relatively adversarial because both the buyer and the seller attempt to achieve the best economic position (Fontenot et al., 1997). Relational exchange theory proposes that the norms that govern relational exchange have the long-term, continuous, and complex characteristics (Spinelli and Birley, 1996). Haugland (1999) distinguished the difference between long-term and short-term relationships in terms of relational exchange theory. Namely, in short-term relationships, goods are exchanged for money, whereas in long-term relationships buyer and seller cooperate on a variety of activities.

In industrial markets, unlike the premise of minimizing transaction cost in TCE, firms prefer long-term benefits of relational exchange to economic gains from saving transaction costs. Accordingly, shared norms such as long-term cooperation and trust, which are embedded in relational exchange, can control opportunistic behaviour and solve a safeguarding problem (Spinelli and Birley, 1996; Haughland, 1999; Berthon et al. 2003).

##### **Trust: Key Determinant of the Coordination Structure in RET**

From a general standpoint, the definition of trust is highly related to confidence and predictability in one's expectations about another's goodwill (Doney and Cannon, 1997; Pavlou, 2002). For example, Pavlou (2002; 219) suggested that interorganizational trust can be defined by two dimensions:

“Interorganizational trust reflects two dimensions: (a) credibility, which is based on the extent to which a buyer believes that a seller has the intention to perform the transaction effectively and reliably due to fears of imposing costs on opportunism, and (b) benevolence,

which is based on the extent to which a buyer believes that a seller has intentions and motives beneficial to them, even when new conditions without prior commitment arise.”

Sako (1992) proposed that there are three distinct types of trust. The first is contractual trust in which both parties fulfill their contractual obligations, the second is competence trust where both parties perform their roles competently, and the third is goodwill trust which is characterized by a willingness to share information and a predisposition to do more than is actually required by the formal contract. The adversarial relationship approach can be regarded as mainly contractual and competence trust but little goodwill trust between trading partners, whilst goodwill trust becomes highly significant in the collaborative relationship approach (Sako, 1992). Morgan and Hunt (1994) proposed that trust can be developed by; (1) providing resources, opportunities, and benefits that are superior to the offerings of alternative partners, (2) maintaining high standards of corporate values, (3) communicating valuable information, including expectations, market intelligence, and evaluations of the partner's performance, and (4) avoiding malevolently taking advantage of their exchange partners.

Trust has been considered a key variable with critical positive outcomes from multiple streams of literatures. According to Pavlou (2002), in the marketing literature trust has been related to desirable outcomes such as firm performance, from an economic perspective trust has been expected to reduce the transaction cost of exchange, and in the organization literature trust has been posited to diminish opportunism and promote cooperation. Trust is a necessary, even though not a sufficient, factor in achieving total organizational efficiency (Sako, 1992; Doney and Cannon, 1997). Supplying firms focusing solely on providing the lowest-cost product on a timely basis can not even be considered by the buying firm if they have not established a trusting relationship (Doney and Cannon, 1997). Accordingly, trust has assumed a central role in building cooperative relationships between buyer and supplier (Dwyer et al., 1987; Morgan and Hunt, 1994). Trust usually tends to prevent firms from taking excessive advantage of their exchanging partners even when the opportunity is available (Dyer and Chu, 2000).

In brief, trust is a key variable influencing coordination structure of interorganizational relationships in the context of relational exchange theory (Haugland, 1999).

### 2.3.5. Resource Dependence Theory: Dependence

#### **Resource Dependence Theory (RDT)**

Resource dependence theory (RDT) analyzes interfirm behaviours in terms of the requirements for survival and the acquisition of resources. Firms usually tend to rely on internal and external resources to gain their goals. Both a lack of self-sufficiency and an inequality of resources create dependences (Emerson, 1962). Firms are made up of a network of interdependences with other firms.

A basic assumption of resource dependence theory is that firms will try to establish interorganizational arrangements as a strategic response to environmental uncertainty and interfirm dependence (Buvik and Reve, 2002). Environmental uncertainty is expected to induce adaptation problems and each party tries to stabilize and control unpredictable conditions of trade through formal or semiformal links with its trading partners in order to gain its own goal (Buvik and Grønhaug, 2000). Interfirm dependence leads to situation where survival and continued success are uncertain, and thereby firms take actions to manage external interdependences (Pfeffer and Salancik, 1978). Corporate interlocking provides a stable means of communication and liaison among interdependent firms (Pfeffer and Salancik, 1978; Zang, 2001). A crucial function of corporate interlocking appears to exchange of information to minimize market uncertainties (Zang, 2001).

According to Crofts and Turner (1999), the motivation to form a cooperative relationship in the dependence theory model is asymmetrical. Cooperation comes when the motivated party is powerful enough to force or induce the other party to cooperate (Crofts and Turner 1999, Kim 2000). Ramsay (1996) argued that partnerships are found most commonly in relationships between what look like large powerful dominant buyers and smaller dependent suppliers.

#### **Dependence - Key Determinant of the Coordination Structure in RDT**

Emerson (1962) originally conceptualized that power is inversely related to dependence. Emerson (1962) stated that the power of actor A over actor B is directly proportional to the

dependence of actor B on actor A (i.e.,  $P_{ab} = D_{ba}$  or,  $P_{ba} = D_{ab}$ ). Accordingly, in business relationship between buyer and supplier, buyer's power is related to the degree of supplier's dependence, and supplier's power is measured by the degree of buyer's dependence.

Further, Emerson (1962) suggested that the dependence of actor A upon B is: (1) directly proportional to A's motivational investment in goals mediated by B, and (2) inversely proportional to A's availability of those goals outside of the A-B relation. In this context, dependence can be defined as the extent to which a target firm needs the source firm to achieve its goals (Andaleeb, 1995). Andaleeb (1995) suggested two important factors that create perceptions of dependence: (1) the importance or criticality of the resources provided by the source firm, and (2) the number of alternate sources available to the target firm for the needed resources. In addition, Emerson (1962) proposed that the dependence of one party provides a basis for the power of the other. In line with Emerson's conceptualization, in marketing channel literatures power has been defined as a potential influence (Cronin et al., 1994).

In terms of resource dependence theory, access to scarce resources gives an organisation relatively more power than those highly dependent on those resources (Hogarth-Scott, 1999). The bargaining power between buyer and supplier can relatively be measured by the criteria of the dependence on trading partner and the cost of replacing the trading partner (Hogarth-Scott, 1999; Buvik and Reve, 2002). In the same context, a power imbalance is related to the degree of one partner's dependence on the other partner. (Hogarth-Scott, 1999). For example, if supplier's costs for replacing the buyer rise, the supplier's dependence on the buyer will increase. Analogously, if market failure or barriers to entry place the supplier in a strong bargaining position, costs of replacing the supplier should increase and reinforce buyer-dependence (Buvik and Reve, 2002).

Berthon et al. (2003) indicated that power (and dependence) could be a determinant of structuring relationships between firms by comparing power in the channel literature to norms in the marketing literature. Theoretically, dependence can play a role of safeguard to constrain the opportunistic behaviour of trading partner. Joshi and Arnold (1997) proposed that dependent buyers (or, dependent suppliers) would not behave opportunistically against their supplier (buyers) because they wanted to (1) continue their supplier (buyer) relationship, and (2) avoid supplier (buyer) retaliation. This inference was empirically supported by some

study. For instance, Provan and Skinner (1989) found that dealers of agriculture equipment were less opportunistic when they depended on a primary supplier, whereas supplier with greater control over dealers' decisions exhibited greater opportunism.

Accordingly, it can be concluded that dependence is the decisive variable determining the coordination structure of interorganizational relationships from the perspective of resource-dependence theory.

### 2.3.6. An Integrative View and Determinant Variables of Buyer-Supplier Relationships

#### 2.3.6.1. An Integrative View that combines TCE, RET and RDT

As a framework for interpreting buyer-supplier relationships, this study takes an integrative view that combines transaction cost economics (TCE), relational exchange theory (RET) and resource dependence theory (RDT). The main underpinning for the conceptual framework is based on the rationale of TCE, the dichotomy between market and hierarchy, while RET and RDT are used to complement TCE.

As summarized in the table 7 (the next page), these three theories have their own primary domains of interest, and therefore, are different from each other in terms of main premise, primary assumption, interfirm coordination mechanism and attributes. TCE focuses on transactional and economic characteristics of interfirm exchange, while RET and RDT place their stresses on relational and social attributes embedded in interfirm exchanges. TCE clearly provides its prescription on interfirm coordination mechanism, whereas RET and RDT are more descriptive, implicit, contingent and long-term in explaining coordination mechanism between buyer and supplier. However, despite these distinctions, these theories can be reconciled and merged into an integrative view as a framework of this study.

At first, TCE interprets a transaction between buyer and supplier, as a unit of analysis, from the perspective of economic efficiency, however it needs to be completed by socio-relational

*Table 7. Comparison of TCE, RET and RDT*

Approach	Transactional Approach	Relational Approach	
Theory	TCE	RET	RDT
Main Premise	Firms choose a coordination mechanism between market and hierarchy to economize on a transaction cost.	Business transactions should be understood in the social context to which they are related	Firms establish interfirm arrangements as a strategic response to interfirm dependence
Primary Assumptions	Our rational choice is limited to the information acquired (Bounded rationality). Decision-makers unscrupulously seek to satisfy their self-interests (Opportunism).	Firms prefer long-term benefits of relational exchange to short-term economic gains. Relational exchange is governed by the norms that have long-term and trusting characteristics.	Power of one is inversely proportional to dependence of the other. Both a lack and an inequality of resources create dependencies between firms.
Interfirm Coordination Mechanism	Environmental uncertainty and assets specificity increases transaction cost for controlling opportunistic behaviour and safeguarding specific assets. Confronted with high transaction cost posed by high levels of uncertainty and assets specificity, firms choose hierarchical solution to economize transaction cost.	In exchanging relationships, shared norms control opportunistic behaviour and solve a safeguarding problem. Accordingly, shared norms such as trust can shift an interfirm relationship toward a collaborative form.	Under a situation of interfirm dependence, firms would not behave opportunistically because they want to continuously obtain resources and avoid retaliation. Accordingly, power-dependence can shift a buyer-supplier relationship toward a cooperative form.
Attributes	Predictive, Static, Short-term, Transactional, Clear, General	Descriptive, Interactive, Long-term, Relational, Implicit, Contingent	

approaches (i.e, RET and RDT) in order to analyze the totality of relationships in business markets where buyer and supplier often establish and develop lasting relationships with each other (Hallen et al., 1991; Dekker, 2004). Compared to TCE that has a singular eye to focus on transaction, the integrative view has a pair of binoculars that enable a researcher to simultaneously see transactional attributes of TCE and relational characteristics of RET and RDT.

Second, the assumption of opportunism that decision-makers unscrupulously seek to their self-interests in TCE has been challenged (Berthon et al., 2003). As for a matter of human nature implicitly posited in RET and RDT, it may be a more realistic assumption that opportunism is far rarer and trust is far more common than they are posited in TCE (Bensaou and Anderson, 1999). The integrative view takes a compromising, contingent angle on opportunism. On the spot market where price is a main concern of exchange firms become more opportunistic, while on the industrial market in which long-term value is appreciated firms become less opportunistic.

Third, coordination mechanism on interfirm relationships is oversimplified in TCE. According to the logic of TCE, confronted with high transaction cost posed by high levels of uncertainty and assets specificity, firms choose hierarchical solution to economize transaction cost. Norms such as trust and power-dependence do not play a role in a framework of TCE. However, shared norms such as trust, which are embedded in interfirm relation, control opportunistic behaviour and solve a safeguarding problem (Spinelli and Birley, 1996; Haugland, 1999; Berthon et al., 2003). Interdependent firms would not behave opportunistically against their trading partners because they need continuously resources and want to avoid retaliation of the partners (Joshi and Arnold, 1997). Trust and dependence as well as environmental uncertainty and assets specificity can be acknowledged as determinants of interfirm relationships, and thus all of these variables are adopted in the integrative view.

This integrative view on buyer-supplier relationship will be applied to the research framework of this study. At first (*direct path*), direct impact of e-commerce on buyer-supplier relationship will be investigated from a balanced perspective that

simultaneously considers economic-transactional attributes of e-commerce and socio-relational characteristics of e-commerce. Then (*mediating paths*), mediating role of each determinant variables (i.e., assets specificity, environmental uncertainty, trust and dependence) for the impact of e-commerce on buyer-supplier relationships will respectively be examined in the light of each theoretical reasoning. Lastly (*multi-path model*), all the separate structural paths made will be reconciled and integrated into a multi-path full model, which will be tested by structural equation modelling technique.

In sum, this integrative view can provide a comprehensive explanation with reality and validity more than a single view can. The explanatory power of this integrative framework is expected to be appreciated in the empirical study of this research because this study defines populations as the Korean electronics industry. In Korea, like the other Asian countries (Japan and China), social relationships play a more important role in business than in Western countries (US and UK) (Teng et al., 1999; Hitt et al., 2003). In the Korean electronics industry, which represent 5.6% of the world production in the electronics industry, most manufacturers and their suppliers keep cooperative relationships with their key trading partners, however a few-large sized assemblers (e.g., Samsung, LG, Daewoo and Hynix) dominate thousands of small- and medium-sized suppliers.

#### 2.3.6.2. Synthesis of Determinant Variables of Buyer-Supplier Relationships

Researchers have alluded to various variables that determine buyer-supplier relationships. According to the transaction cost theory of Williamson (1985), three variables, namely (1) frequency of transactions, (2) environmental uncertainty, and (3) assets specificity, determine whether transaction costs will be lowest in a market or in a hierarchical organization. In addition to three variables of Williamson (1985), trust and commitment, power and dependence, government policy and legal framework, structural bonds and social bonds, and technology factors have been proposed, as summarized in table 8 (the next page).

From these, this research takes four variables (environmental uncertainty, assets specificity, trust and dependence) as key determinants of buyer-supplier relationships. There are two reasons why this research limits determinants to four variables and abandons the others. First,

this research analyzes buyer-supplier relationships from the integrative perspective that combines transaction cost economics, relational exchange theory and resource dependence theory. Four variables (environmental uncertainty, assets specificity, trust and dependence) are derived from the integrative perspective. Those variables that are not directly derived from the integrative perspective, even though they have the potential to determine buyer-supplier relationships, are disregarded. In this context, technology factors, government policy and legal framework are deserted. Second, to clarify the issues of this research, the determinants of buyer-supplier relationships are simplified by uniting the variables that have similar concepts (e.g., trust and commitment, power and dependence) and removing the variables that do not have the spotlight (e.g., frequency, social bonds).

*Table 8. Determinant variables of buyer-supplier relationships*

<b>Author</b>	<b>Methodology</b>	<b>Determinants of buyer-supplier relationships</b>
Sako (1992)	Empirical (Japan-UK, electronics)	Social and moral norms, Technological factors, Economic factors, Government policy and legal framework, Corporate strategy and entrepreneurship, Financial and employment links (6)
Dyer et al. (1998)	Empirical (Korea-Japan- US, automotive)	Relation-specificity, Information sharing, Assistance, Trust/contracts (4)
Duke (1998)	Empirical (UK, grocery retailing)	Power, Nature of negotiation, Personal factors, Organizational factors, Retailer objective, Ambient social pressure, Political and government pressure, Stance of negotiating partner and inter-firm communications (8)
Wilson and Vlosky (1998)	Theoretical	Trust, Performance satisfaction, Power and dependence, Comparison level of alternatives, Non-transferable investments (5)
Artz & Brush (2000)	Empirical (OEM-supplier)	Assets specificity, Environmental uncertainty (2)
Sheth & Parvatiyar (2000)	Theoretical	Commitment, Trust, Cooperation, Mutual goals, Interdependence/power imbalance, Performance satisfaction, Comparison level of the alternative, Adaptation, Non-retrievable investments, Shared technology, Summative constructs, Structural bonds, Social bonds (12)
This research	Empirical	Environmental uncertainty, Assets specificity, Trust, Dependence (4)

### 2.3.7. Summary of Buyer-Supplier Relationships

(1) An overall competitive advantage of a company is not just dependent on the competency of the company, but also upon that of its trading partners such as suppliers, wholesalers, and retailers. Accordingly, well-managed interfirm relationships have the potential to generate a competitive advantage because firms can focus on its core competence and use connections to partners to develop skills that would be difficult to do alone.

(2) Interfirm relationships have five phases of development: awareness, exploration, expansion, commitment and dissolution phase. Buyer-supplier relationships are often characterized by dyadic types: adversarial-competitive versus collaborative-cooperative. The current trend of relationships is said to be evolving from a price-based competitive form toward a more collaborative one based on cooperation, mutual benefit.

(3) Transaction cost economics (TCE) originally focused on the firm's binary choice between a spot-market transaction and a hierarchical integration. Recently, application of TCE has moved into relationships between firms because middle-range solutions are actually more common than extremities. From the TCE perspective, assets specificity and environmental uncertainty are the key variable in determining the form of buyer-supplier relationships. A highly specific assets is more likely to facilitate hierarchical coordination than market transaction. It is theoretically probable that a high level of environmental uncertainty shifts the coordination structure in favour of vertical integration rather than market mechanism.

(4) Like assets specificity and environmental uncertainty in TCE, trust has assumed a central role in building collaborative relationships between buyer and supplier in the context of relational exchange theory. Additionally, dependence is the key variable in determining the coordination structure of interfirm relationships from the view of resource dependence theory.

(5) In terms of the integrative view that combines TCE, RET and RDT, it can be said that buyer-supplier relationships are dependent on four predictor variables: environmental uncertainty, assets specificity, trust and dependence.

## **2.4. Conjunction of Electronic Commerce and Buyer-Supplier Relationship**

### **2.4.1. Application of e-Commerce to Supply Chain**

#### **Emergence of Supply Chain Management**

In the mid twentieth century, firms began to have better access to mass production technology and it was the efficiencies of mass production that created value. However, since mass production and mass marketing activities could not satisfy customers' unique needs, mass-market techniques became less effective in the latter part of the twentieth century (Tarn et al. 2002). In response to changing situation, firms laid emphasis on total quality management (TQM) which focused on ways to make a product better. In the 1990s, supply chain management has caught concern of businesses since firms realized that they could no longer compete effectively without collaborating with their trading partners along supply chain (Tarn et al., 2002). It is not single firm but entire network of firms that generate economic worth (Lancioni et al., 2003).

An individual firm has to perceive that they should use links to other firms to survive in the new business environment. Many firms were rethinking their traditional supply chain and redefining value chain so that they might develop new ways to conduct business in the new economy (Napier et al., 2001; Sharma et al., 2001). Moreover, ubiquitous usage of the Internet convinced many firms that the ways to generate value have changed (Sharma et al., 2001). Supply chain has been reengineered by new network technologies and practices such as e-procurement, e-logistics, real-time demand forecasting and inventory management. (Lancioni et al., 2003). Accordingly, supply chain management has shifted from an ancillary concern to a key component in business strategy, and the topic has been in the spotlight of management in the twenty-first century.

#### **Usage of e-Commerce in Supply Chain**

Electronic commerce takes on an increasingly critical role in activities in supply chain (Wigand and Benjamin, 1997; Porter, 2001). For instance, in case of British Telecom (BT), supply management has taken the advantage of using electronic commerce in order to increase volume and type of messages exchanged, to simplify transaction processes, to build

closer relationship with key suppliers, and to improve services to end users across business (Roberts and Mackay, 1998).

As reported in table 9, e-commerce can be used for every functional elements in supply chain such as marketing, purchasing, design, production, sales and distribution, human resource management, warehousing and supplier development (Ganasekaran et al., 2002).

*Table 9. Usage of e-commerce in functional areas in supply chain*

Functional areas	Applications of e-commerce	E-commerce tools and systems
Marketing	Product promotion, New sales channels, Direct savings, Reduced cycle time, Customer services	B2B e-commerce, Internet ordering, Website for the company
Purchasing	Ordering, Fund transfer, Supplier selection	EDI, Internet-purchasing, Electronic funds transfer
Design	Customer feedback, Research on customer requirements, Product design, Quality function deploying, Data mining and warehousing	WWW integrated CAD, Hyperlinks, 3D navigation, Internet for data and information exchange
Production	Production planning and control, Scheduling, Inventory management Quality control	B2B e-commerce, MRP, ERP, SAP/BAAN/Peoplesoft/IBM e-commerce
Sales and distribution	Internet sales, Transportation, Scheduling, Selection of distribution channels, Third party logistics	EFT, On-line TPS, Bar-coding system, ERP, WWW integrated inventory management, Internet delivery of products and services
Human resource management	E-recruiting, Benefit selection and management, Training and education using WWW	E-mails, Interactive web sites, WWW based multimedia applications
Warehousing	Inventory management, Forecasting, Scheduling of work force	EDI, EFT, WWW integrated inventory management
Supplier development	Partnership, Supplier development	WWW assisted supplier selection, e-Mails, Research on suppliers and products with WWW

Adapted from: Gunasekaran et al. (2002: 195)

Porter (2001: 74) also acknowledged the critical role of information technology in value chain by stating the following;

“The basic tool for understanding the influence of information technology on companies is the value chain - the set of activities through which a product or service is created and delivered to customers. Because every activity involves the creation, processing, and communication of information, information technology has a pervasive influence on the value chain. The special advantage of the Internet is the ability to link one activity with others and make real-time data created in one activity widely available, both within the company and with outside suppliers, channels, and customers.”

#### 2.4.2. Impact of e-Commerce on Supply Chain Relationships

##### **Various Impacts of e-Commerce on Business**

Most business activities have been comprehensively affected by utilization of electronic commerce. Supply chains have been changed since (1) information on distribution of goods gets relatively quicker to process and easier to share., (2) just-in-time (JIT) procurement and deliveries get improved, and (3) traditional distribution channels and middlemen are being replaced by new channels and intermediaries (Rao, 1999). These impacts tend to be most significant in manufacturing sectors, such as automobiles, electronics, aerospace and chemicals, which have complex and extended supply chains (Vickery and Katsuno, 1999).

Impacts of e-commerce can be found in the area of marketing activities. Bloch and Segev (1996) summarized the impacts of e-commerce on marketing: (1) production promotion: e-commerce enhances the promotion of products and services through direct, information-rich and interactive contact with customers, (2) new sales channels: e-commerce creates a new distribution channel for existing products, owing to bi-directional nature of communication, (3) delivery cost savings: the cost of delivering information to customers over the Internet results in substantial savings to senders, (4) reduced cycle time: the administrative work related to delivery can be reduced significantly, (5) enhanced customer service: customer service can be greatly enhanced by enabling customers to find detailed information online.

E-commerce allows for more efficient product development through supporting collaboration of part makers and assemblers. Contacting customers and tying suppliers in the production process will enable customers to order products on-line (Sculley and Woods, 1999). These benefits are likely to be substantial in service sectors as well as manufacturing sectors (Vickery and Katsuno, 1999).

Final outcomes of firms are probably influenced by the utilization of e-commerce. In US stock market, e-commerce announcement made significant average abnormal returns in the late 1990s (Subramani and Walden, 2001; Chen and Siems, 2001). This result may indicate that e-commerce enables firms to improve firm's future performance.

It is necessary to examine impacts of e-commerce on final outcomes that are usually measured by financial performance such as return on investment, or profits as a percent of sales. However, it is not easy to measure how much electronic commerce influences financial performance. In order to evaluate financial achievements of e-commerce, costs and benefits associated with e-commerce should be measured and compared with each other. Whereas costs are relatively possible to measure, at least, the direct ones, however, it is significantly difficult to obtain hard evidence of expected benefits (Weil and Olson, 1989). The fact that e-commerce is still in early stage makes it more difficult to measure impacts of e-commerce on final outcomes.

Alternatively, impacts of e-commerce on business can be estimated by investigating how various areas of business have been changed. For example, the adoption of electronic commerce can improve materials management process of both buyer and supplier in areas such as inventory reduction, delivery lot-size reduction (Gurbaxani and Whang, 1991; Bakos and Brynjolfsson, 1993, McIvor et al., 2003). It is meaningful and somewhat unavoidable for an individual researcher to limit its scope of research to any specific area and compare his results to others for generalization in a world of empirical research.

Accordingly, the literature review of this study will focus on impacts of e-commerce on supply chain relationships.

## **Impacts of e-Commerce on Supply Chain Relationships**

As many firms acknowledged potential benefits of information systems in various areas of management, they got to link external relationships into these information systems as well as manage information internally (Wilson and Vlosky, 1998). On the basis of an empirical study, McIvor (2000) pointed out the significant influence of electronic commerce technologies on supply chain relationships.

According to McIvor (2000), the application of electronic commerce technologies is blurring the traditional boundaries in the value chain between supplier, manufacturer and end customer. In the same context, Easton and Araujo (2003) predicted that much of what was previously handled by people (i.e., all of the day-to-day routines and simple problems), would be handed over to machines, and people would handle only major crises, new developments, and the key human-to-human contacts.

Prior to the ubiquitous usage of the Internet, focusing on the external linkage rather than the internal management, Malone et al. (1987) predicted impacts of electronic interconnection into three categories: e-communication effect, e-brokerage effect and e-integration effect. *Electronic-Communication effect* means that information technology may (1) allow more information to be communicated in the same amount at the less time (or, the less amount at the same time), and (2) decrease the cost of this communication dramatically. *Electronic-brokerage effect* can (1) increase the number of alternatives that can be considered, (2) increase the quality of the alternative eventually selected, and (3) decrease the cost of the entire production selection process. *Electronic integration effect* occurs when information technology is used not just to speed communication, but also to change and lead to tighter coupling of the processes that create and use information. The benefits of the electronic integration effect are usually captured most easily in electronic hierarchies, but they are sometimes apparent in electronic markets as well (Malone et al., 1987).

It is still controversial, however, whether electronic commerce facilitates the collaborative relationship between buyer and supplier or whether it increases the competitive relationship between them. Literature that deals with the impact of electronic commerce on buyer-supplier relationships is divided into two opposite categories (Marchewka and Towell, 2000). On the one hand, interorganizational information systems (IOS) lock in partners by

integrating supplier into buyer's value chain processes, and thus strengthen collaborative business relationships (Steinfeld et al., 1997). On the other hand, the growing use of information technologies (IT) shifts toward more use of a market to coordinate economic activity, and thus enhances a competitive relationship in industrial markets (Malone et al., 1987).

Accordingly, the impacts of electronic commerce on supply chain relationships needs to be examined with more depth and breadth. In this context, both its direct and indirect aspects will be discussed in the next section by employing multiple perspectives integrating transaction cost economics, relational exchange theory and resource dependence theory.

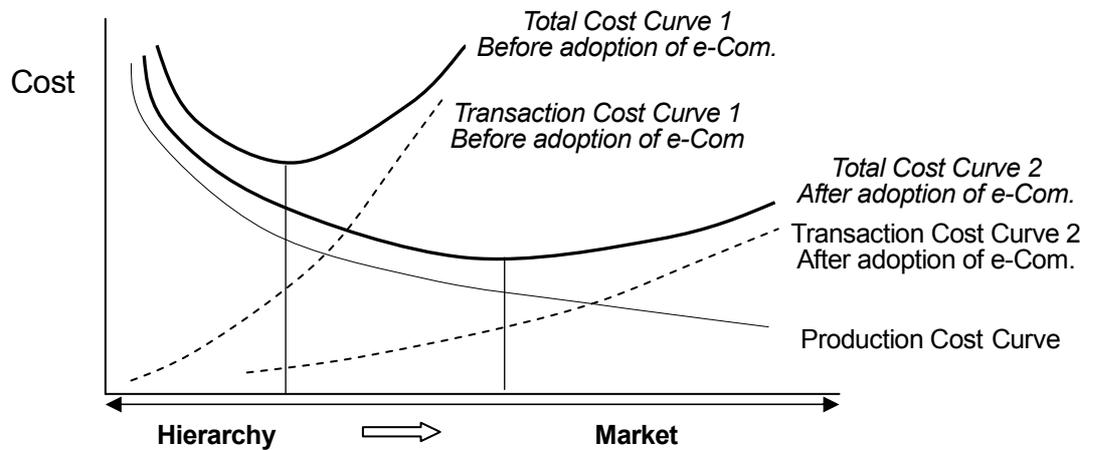
#### 2.4.3. Direct Impact of e-Commerce on Buyer-Supplier Relationships

The main premise of transaction cost economics (TCE) is that the firm chooses a coordination mechanism in order to minimize the sum of total cost (i.e. Total cost = production cost + transaction cost) (Williamson, 1975). In general, TCE assumes that market coordination provides more efficient production than hierarchical coordination due to the economics of scale and specialization, while the transaction cost in market are generally higher than that in hierarchy (Lin et al., 2002; Leiblein, 2003).

As a proponent of applying transaction cost economics to information economy, Malone et al. (1987) made a surprising and significant prediction that the overall effect of information technology would be to increase the proportion of economic activity coordinated by markets although the effects of information technology clearly make both markets and hierarchies more efficient.

Malone et al. (1987)'s prediction for the overall shift from hierarchies to market was based on two components: (1) the first was the assumption that the widespread use of information technology was likely to decrease the 'unit costs' of coordination, (2) the second component was based on the reasoning of transaction cost economics that the result of reducing coordination costs without changing anything else should be an increase in the proportion of economic activity coordinated by markets, as seen in figure 7 (the next page).

*Figure 7. Binary choice between market and hierarchy*



The described shifts from hierarchies to markets have been undergone in competing computerized reservation systems (e.g., American Airlines' SABRE CRS), certain firms in financial markets, and commodity markets (Wigand and Benjamin, 1997; Mariotti and Sgobbi, 2001). Applied to business relationships, it could be argued that competitive relationship would be prevalent in business market as the development of electronic commerce.

Contrary to the assertion of Malone et al. (1987), however, the *'move to the middle'* hypothesis - a move to more outsourcing, but from a reduced set of stable partnerships - was simultaneously proposed by both Bakos and Brynjolfsson (1993) and Clemons et al. (1993). Bakos and Brynjolfsson (1993) mainly focused on non-contractible investments (i.e, quality, innovation, and information), whereas Clemons et al. (1993) suggested manifold reasons such as transaction economies of scale, incentives, increased costs and reduced benefits of search, time to recoup investment, and learning curve effect. According to them, even if information technology reduces coordination cost, which facilitates a firm to move from in-house production to market outsourcing, the firm would choose a close, long-term relationship with a reduced set of partners (i.e., suppliers).

While Malone et al. (1987) emphasized the potential of information technology to reduce the unit cost of transaction, Clemons et al. (1993) focused their reasons of argument on the average cost of a transaction. In their words, Clemons et al. (1993: 25) proposed the *'transaction economies of scale'* for their reasoning as follows;

“Perhaps more significant IT costs are the organizations’ costs of establishing human relationships and business process. These fixed investments in the relationship create transactional economies of scale: the average cost of a transaction decreases with the volume of transactions. Thus, adding a new supplier has two effects. First, it requires a fixed investment to establish the new relationship. Second, it reduces the volume of transactions through each relationship. Both effects increase average costs and prolong the time taken for the investment in the relationship to pay off for the firm and the participating suppliers. Thus, increasing levels of explicit coordination argue for fewer suppliers on the basis of transactional economies of scale.”

On the other hand, there may be a fundamental weakness in the premise of transaction cost economics. Electronic commerce, which is a combination of technologies, applications, processes, business strategies and practices, enables firms to redesign business process, thus establish a flexible structure for value creation (Tang et al., 2001). Many firms have actually leveraged their use of electronic commerce to form value added partnerships along the value chains. Firms may choose a business relationship in order to maximize long-run values rather than minimize the total costs posited in transaction cost economics. In other words, firm’s activities should be understood in terms of creating and sustaining superior, what Porter (1985) called, competitive advantage. Choice of governance structure should be determined by the possession of resources that are a source of competitive advantage (Pitelis and Pseiridis, 1999).

Long-term collaborative relationships with a core group of partners can lead to a sustainable competitive advantage as collaboration enables firms to accumulate resources that are rare, valuable, hard to imitate (Dyer and Singh 1998, Hoyt and Huq 2000). A cooperative relationship with the trading partners may constrain incentives for opportunistic behaviour in the presence of opportunism (Jap, 2001). Collaborative relationship between buyer and supplier is more likely to generate a win-win outcome for both firms ultimately than competitive relationship does (Carr and Pearson, 1999).

Accordingly, firms tend to choose hierarchical arrangement rather than lower cost market transactions since electronic inter-organizational value chains enable them to improve their competitiveness by focusing on higher-quality products, increased customer satisfaction, and business reengineering (Benjamin and Wigand, 1995; Mustaffa and Beaumont, 2002).

#### 2.4.4. Impact of e-Commerce on Determinant Variables of B-S Relationship

As mentioned in the section 2.3.6. (Synthesis of determinant variables), four variables (i.e., environmental uncertainty, assets specificity, trust and dependence) are established as determinants of buyer-supplier relationships from the integrative perspective that combines transaction cost economics (TCE), relational exchange theory (RET) and resource dependence theory (RDT). Both environmental uncertainty and assets specificity are derived from TCE, trust is from RET and dependence is from RDT. Accordingly, to identify indirect impact of e-commerce on buyer-supplier relationships, it is necessary to examine how e-commerce affects these determinant variables.

##### **Impacts of e-Commerce on Assets Specificity**

A transaction cost-based prediction that market coordination structure has the economic advantage found some empirical support. For example, the predicted shift from hierarchies to markets was presented in computerized reservation systems in airline industry (e.g., American Airlines' SABRE CRS), and the growing use of the world wide web may support an overall shift towards more use of electronic markets (Marchewka and Towell, 2000).

However, Bakos (1991) acknowledged that electronic markets could impose significant switching costs on their participants since electronic markets might require sizable investments from their participants in hardware, software, employee training, and organizational transformations. These investments might become worthless when the organization decides to join a different system or to revert to the previous mode of operation. In line with the Bakos' statement, Clemons et al. (1993) claimed that relationship-specific investments were required for the coordination of business activities between firms. Such relationship-specific investments are worthless to firms in case of a breakdown in the relationship.

Hub firms that initiate electronic network (e.g., EDI linkages) are usually forced to provide incentives to their suppliers to make non-contractible investments in information sharing, quality initiatives, and innovation (Angeles and Nath, 2000). This tends to result in more tightly connected and integrated information networks. Wilson and Vlosky (1998) suggested

that once the electronic data interchange (EDI) process begins in industrial markets, both a buyer and a supplier make transaction specific investments that tend to hold them in the relationship. In addition, the linking of computer systems may build structural bonds that are more difficult and expensive to break (Steinfield et al., 1997; Marchewka and Towell, 2000; Kothandaraman and Wilson, 2001).

In brief, utilization of e-commerce tends to facilitate specific assets between buyers and suppliers in industrial markets.

### **Impacts of e-Commerce on Environmental Uncertainty**

E-commerce systems may allow more information to be exchanged in less time, and at lower cost (Kulkarni and Heriot, 1999). As trading partners adopt interorganizational e-commerce systems, information-sharing between them becomes more active. Uncertainty of supply and demand for buyer and supplier may be reduced due to information-sharing propelled by e-commerce (Ellram and Zsidisin, 2002; Lin et al., 2002). Ellram and Zsidin (2002: 271) indicated that information sharing facilitated by e-commerce would contribute to forming a collaborative relationship via environment uncertainty by stating as follows:

“Information sharing facilitated by IT, coupled with strategic alliances and market monitoring, can reduce the uncertainty of supply and demand for buyers and sellers. Better information also reduces the threat of opportunism that is often associated with assets specificity.”

However, it is not obvious that improved forecast of market condition (i.e., forecast on supply and demand) can decrease or moderate the technological uncertainty (or, technological dynamism) that is also considered as an important component of environmental uncertainty (Paswan et al., 1998). A step further, Golicic et al. (2002) argued that increased information does not decrease the perception of instability, but creates more the perception of confusion.

In sum, it is still a matter of controversy whether environmental uncertainty is influenced by the use of e-commerce, or it is independent of the use of e-commerce.

## **Impacts of e-Commerce on Trust**

On the Internet, all potential suppliers can be searched by a buyer, and thereby there may be little opportunity to face-to-face contact between buyer and supplier. This situation will make it difficult to develop goodwill trust between trading parties, and interfirm relationships can be characterized by an adversarial one (Turker and Jones, 2000; Leek et al., 2000). From the perspective of relational exchange theory, Leek et al. (2000: 7) predicted that e-commerce would lead to less trusting relationships between trading partners as communication becomes depersonalized and psychologically distant:

“In the past establishment of trust has occurred through the social process of face to face meetings. It is possible that the advent of new technology has decreased the frequency of face to face interaction between companies, leading to increasing task orientation, less compromise, less personal interaction which would lead to less trust being created and result in greater formalisation of agreements and contracts.”

However, the prediction of Leek et al. (2000) is not supported in their empirical study. Contrary to their expectation, responding firms of their survey did not think e-commerce leads to more impersonal relationship or more formal relationships, but still believed that there was a need for face-to-face visits (Carr and Smeltzer, 2002; Leek et al., 2003).

Rather, a trusting relationship can be prevalent due to greater information sharing facilitated by information technology (Ellram and Zsidisin, 2002). The trust is not easily shaken when EDI (electronic data interchange) enters the relationship that has a significant history of a trust (Wilson and Vlosky, 1998). For firms already within well developed buyer-supplier networks characterised by goodwill trust, the introduction of e-commerce may lead to a new form of lock-in effect that, in turn, corroborate trust between buyer and supplier (Morgan et al., 2002).

Accordingly, it is likely that e-commerce may assist in strengthening trust between supplier and buyer (Loughlin, 1999).

## **Impacts of e-Commerce on Dependence**

There are many empirical studies that deal with the relationship between power-dependence and electronic commerce. Most of them focused their research on (1) role of power in adopting e-commerce system, (2) effects of e-commerce on power shifts between trading parties, (3) influence of e-commerce on interdependence between trading parties.

Concerning the first issue, Min and Galle (1999) found that the buyer with a large purchase volume was a heavy user of electronic commerce and was likely to force its suppliers into the electronic commerce network. In line with Min and Galle (1999), Iskandar et al. (2001) argued that buyer's push seemed to be the most significant reason for supplier's EDI adoption based on the empirical examination of EDI adoption by U.S automobile industry suppliers. Focusing on the dyadic types of power in EDI adoption, Ratnasingam (2000) found that negative (coercive) power left smaller suppliers in a situation of conflict, whereas positive (persuasive) power resulted in open communication and building long-term trusting relationships between smaller suppliers and their buyers.

As regards the second issue, Zwass (2003) stated that e-commerce had contributed to lowering the cost of information and often reducing asymmetries of information between suppliers and buyers. Based on exploratory survey data, Nagayama (2000) found that automated information exchanges might lower wholesalers' bargaining power and strengthen supplier's bargaining power. However, Wilson and Vlosky (1998) found that the buyer clearly was perceived to have more power in the interorganizational relationships connected by information systems. According to Wilson and Vlosky (1998), there was a perception that if suppliers did not adopt interorganizational information systems, buyers would seek alternative suppliers that could satisfy their needs.

Even though the impact of e-commerce on interdependence is not a common issue for research, it is highly possible that electronic commerce facilitates information exchange and enhances, which, in turn, enforces mutual dependence for collaboration between trading partners.

Based on empirical study, Lee et al. (2003: 10) supported this reasoning as follows;

“The collaborative B2B e-commerce resulted in significantly higher levels of inter-firm dependence between retailers and manufactures. The high productivity gain in the collaborative B2B e-commerce is likely to be due to this increased inter-firm dependence, caused by new collaboration.”

#### 2.4.5. Summary of Interconnection between e-Commerce and B-S Relationships

(1) E-commerce takes on an increasingly critical role in the supply chain because firms leverage electronic links to increase the volume of messages exchanged, to simplify the transaction process, to build closer relationships with suppliers, and to improve service to customers.

(2) It is still unresolved whether e-commerce enhances the collaborative relationship between trading partners, or it increases the competitive relationship between them. On the one hand, e-commerce may attempt to lock in partners by integrating business interactions, which shifts interfirm relationship toward a collaborative type. On the other hand, e-commerce may facilitate a market transaction by reducing transaction costs, which leads to the dominance of a competitive type of interfirm relationship.

(3) Proponents (e.g., Malone et al., 1987) of transaction cost economics (TCE) predicted that the overall effect of information technology (IT) would be a shift of economic activities from hierarchies to markets, which indicated a shift toward competitive relationships between buyers and suppliers. They based this prediction on two assumptions. The one is that IT decreases the unit cost of coordination, and the other is that the decreased cost should lead to an increase of market coordination. However, Clemons et al. (1993) argued that firms would choose a close, long-term relationship with a reduced set of partners even though IT increased the extent of outsourcing. In addition, firms may choose a business relationship to maximize long-run values rather than minimize the total costs posited in TCE. Firms would prefer hierarchical arrangement to lower cost market transactions since electronic inter-organizational value chains enable them to improve their competitiveness, which suggested a shift toward collaborative relationships between buyers and suppliers.

(4) Electronic markets usually require sizable investments from their participants in hardware, software, employee training, and organizational transformations. Once an EDI process begins in industrial markets, both buyer and supplier make specific investments, which hold them in the relationship. In addition, the linking of computer systems may build a structural bond that is difficult to break. These imply that e-commerce tends to intensify assets specificity between trading partners in industrial markets.

(5) E-commerce systems allow more information to be exchanged in less time, and at lower cost, which may reduce uncertainty of supply and demand. However, it is still under debate whether environmental uncertainty is significantly influenced by the use of e-commerce, or whether it is independent of the use of e-commerce. The increased exchange of information is not sure to decrease the technological uncertainty. Furthermore, the increased information may create the perception of confusion as well as instability.

(6) From the perspective of relational exchange theory, e-commerce may lead to less trusting relationship between trading partners because interactions become depersonalized and task oriented. However, empirical studies reported that the use of e-mail complemented traditional methods (i.e., face-to-face) of communication. In addition, better information supported by e-commerce is likely to enhance the trust between buyer and supplier.

(7) Most empirical studies that apply resource dependence theory to e-commerce focused on issues such as a role of power in adopting e-commerce system, effects of e-commerce on power shifts, and influence of e-commerce on interdependence. It is highly possible that e-commerce is expected to enhance communication, and thus enforces mutual dependence.

## 2.5. The Korean Electronics Industry

### 2.5.1. Overview of the Korean Economy

#### Economic Profile: Strength and Weakness

Korea has achieved a remarkable record of growth since the late twentieth century. As reported in table 10, its GDP per head measured by purchasing power parity is seven times as much as India's, and comparable to the lesser economies of the European Union. Korean economy is characterized by (1) manufacturing predominate and service sectors rise (2) heavy dependence on international trade and (3) dominant position of *chaebol*, Korean conglomerates, on national economy ( The Economist, 2004<sup>2</sup>).

*Table 10. Comparison of national economic indicators (2000)*

Country	GDP (bn \$ at MER*)	GDP per head (\$ at PPP**)	Foreign Trade Ratio (Imp.+Exp. / GDP, %)
India	460.1	2,360	21.3%
South Korea	456.5	15,133	73.4%
Spain	1,070.7	20,080	42.3%
UK	1,415.0	24,506	43.1%
Japan	4,759.0	25,966	16.9%
USA	9,963.0	34,860	20.1%

Source: Economist (2004<sup>2</sup>), \*MER: Market Exchange Rate, \*\*PPP: Purchasing Power Parity

Suh (2000) explained that economic take-off in the 1960s and subsequent high economic growth could have been achieved by (1) authoritarian but committed political leadership, (2) intimate government-business interaction, and (3) high growth strategy through export push.

The growth of the Korean economy was shattered with the Asian financial crisis in 1997. Explanations of the origins of the crisis vary from a lack of liquidity to moral hazard of investors, to underlying structural weakness and policy distortion (Chopra et al., 2001). By 1999, GDP growth had recovered. Even though growth has been strong after recovery, there is a considerable pessimism in Korea about the future of the economy (Graham, 2000). Compared to pessimism, there is an also strong optimistic outlook on Korea's long-term economic prospects. In particular, recent trends show Korea is embracing the new paradigm

of the information age and a knowledge-based society. The nation's enthusiasm for the digital economy is amazingly high (SaKong, 2000).

### Business Culture

Kim et al. (1998) conducted a comparison of Chinese, Korean and American cultures. Based on six constructs proposed by Hall (1976) and Hofstede (1997), Teng et al. (1999) compared the cultural values of four countries; United States, United Kingdom, Singapore and Korea. Calhoun et al. (2002) compared Korean national culture with American one. To sum up their studies, as reported in table 11, Korean culture is relatively, compared to other countries, characterized by; (1) large power distance, (2) collectivism, (3) relationship-oriented (4) strong uncertainty avoidance, (5) long-term orientation, and (6) high communication context.

*Table 11. Cultural values of four countries*

	United States	United Kingdom	Singapore	Korea
Power Distance	Small	Small	Large	Large
Individualism	Both individualist		Both collectivist	
Masculinity	Achievement-oriented		Relationship-oriented	
Uncertainty Avoidance	Weak	Weak	Weak	Strong
Time Perspective	Both short term		Both long term	
Communication Context	Both low context		Both high context	

Adapted from ; Teng et al. (1999: 41) and Calhoun et al. (2002: 295)

With regard to Korean business culture (i.e., organizational and managerial characteristics of Korean companies), from a Westerner's view, Morden and Bowles (1998; 321) summarized it as follows;

“(1) A belief in the value of vertical communication, organizational formalization, and centralization., (2) A strong belief in the value of functional and role specialization., (3) A strong belief in the value of using functional authority in key areas such as strategic planning, finance, and personnel., (4) An approach to strategy formulation that is deliberate, logically incremental, long-term, and planned down (i.e., centralized and top-down model)., (5) A belief in rational models of strategic planning and resource allocation driven by a powerful and interventionist corporate centre., (6) A strong managerialist emphasis as opposed to the

delegation of authority., (7) An increasingly powerful and well qualified professional management., and (8) An alumni/network based selection of managerial recruits.”

### **Development of e-Business in Korean Economy**

The size of e-commerce transaction in Korea has continuously increased. As reported in table 12, the ratio of e-commerce over total commerce went up from 4.5 percent in 2000 to 8.6 percent in 2001 (MOCIE, 2002). Considering that e-commerce sales<sup>3</sup> occupied 1.1.% of total sales in Italy, 5.9 % in United Kingdom and 9.1% Finland (OCED, 2002), Korea showed high rate of e-commerce transaction.

*Table 12. Volume of e-commerce in Korea*

Year	Total volume of commerce (A)	Volume of electronic commerce (B)	Ratio of e-commerce over total commerce (B/A)
2000	1,270 tn KRW	58 tn KRW	4.5%
2001	1,308 tn KRW	112 tn KRW	8.6%

Source: MOCIE (2002)

Classified by the nature of transaction type, the ratio of business-to-business (B2B) e-commerce over total e-commerce amounted to 93.1 percent, while business-to-consumer (B2C) was 2.1 percent and business-to-government (B2G) was 4.5 percent in 2001 (NSO, 2003). Regarding B2B e-commerce, a buyer-driven type of e-commerce accounted for 78.4 percent of B2B e-commerce, whereas an intermediary-driven type was only 3.7 percent (NSO, 2003). This statistics indicates that major buying companies are well equipped with their e-commerce systems for procurement and supplying companies provide their raw and subsidiary materials via these buyers' systems.

Ministry of commerce and industry (MOCIE) of Korea examined the extent to which each industry developed in terms of e-business readiness (e.g., standardization degree of EDI, set up a mutual database, development of logistics and payment system) and e-business intensity (e.g., ratio of e-commerce transaction over total transaction, number of domains, and participation of electronic marketplace) (Lee and Lee, 2002). Results of this survey, as

<sup>3</sup> this refers to sales done in business sector excluding financial sector

reported in table 13, showed that electronics and automobile industries are the most developed sector in the aspects of e-business, followed by steel, electricity, textile, chemical, distribution and so on. This result can be interpreted that study on electronics industry as for e-commerce may present characteristics of whole industries as for e-commerce. This is because electronics industry is more advanced than other industries and shows what might happen in slower developing industries.

*Table 13. Classification of industries by the development of e-business*

	← Lowly ready and intensive		Highly ready and intensive →	
Industry	Stage 1:	Stage 2:	Stage 3:	Stage 4:
	Agriculture Furniture	Mechanics Shipbuilding Construction	Steel Electricity Textile Chemical Distribution	Automobile Electronics

Source: MOCIE (2002)

## 2.5.2. Economic Profile of the Korean Electronics Industry

### Dynamic Growth of Production

*Table 14. Production of electronics by country*

Country	1999 (US\$ Million, %)		2001 (US\$ Million, %)	
Worldwide Total	1,194,832	100.0	1,210,341	100.0
U.S.A	348,814	29.2	314,965	26.0
Japan	227,524	19.0	230,869	19.1
China	61,840	5.2	94,539	7.8
Korea	57,658	4.8	67,393	5.6
Germany	50,842	4.3	48,270	4.0
U.K	50,255	4.2	47,154	3.9

Source: Yearbook of World Electronics Data (2002)

In 2001, the Korean electronics industry was ranked the fourth in the world on the criteria of production by country. As reported in table 14, its full-year production amounts to US\$ 67.3

billion, representing 5.6% of the worldwide total production, following United States, Japan and China. In Korea, electronics industry reached 33.7 percent of national production of manufacturing sector, and accounted for 34.3 percent of national exports (MOCIE, 2003).

### **Structural Features of the Korean Electronics Industry**

From a comparative study on electronics industry of India and Korea, Kahn (1998) argued that Korea had developed over the last twenty years in the area of electronics industry thanks to target-oriented policy towards export, whereas India could not develop it due to overemphasis on indigenization. In line with Kahn (1998), Mathews and Cho (1999) argued that it was not government subsidies, or intellectual property rip-offs, tax breaks, or some other form of cheating but accelerated organizational learning that created the competitive advantage of Korean firms in electronics industry.

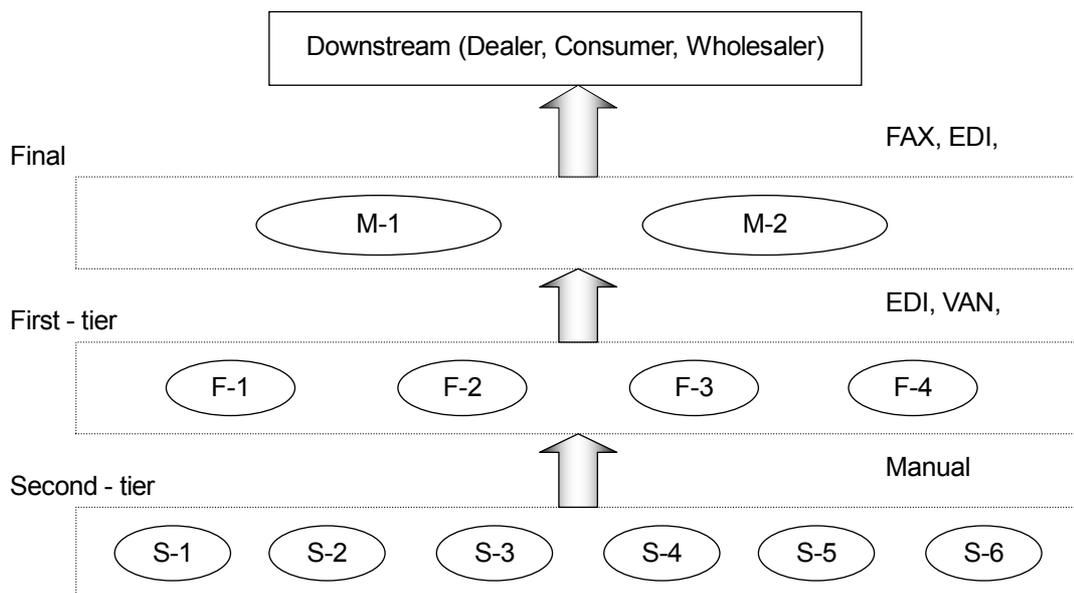
There are also negative aspects of the Korean electronics industry. Pecht et al. (1997) pointed out that economic dominance of huge *chaebol*, Korean conglomerates, continues to restrict the viability of innovative small- and medium-sized enterprises, despite government programs to nurture smaller enterprises. Ernst (1998) asserted that Korea's entry into the electronics industry has been a march to develop a mass production capacity that can only serve high-growth export markets for homogeneous products. He argued that very little upgrading into higher-end and rapidly growing market segments for differentiated products has occurred in the Korean electronics industry.

### **Value System of the Korean Electronics Industry**

Thousands of small- and medium-sized companies are vertically integrated with a few large-sized final manufacturers in the Korean electronics industry as seen in Figure 8 (the next page). There are more than eight thousand companies in the Korean electronics industry. However, one hundred and thirty large-sized companies accounts for fifty-one percent of total value added in the electronics industry (MOCIE, 2003). Furthermore, sales of four leading manufacturers (Samsung, LG, Hynix, and Daewoo) accounts for fifty-five percent of total production in the electronics industry.

Regarding the structure of communication networks, while final manufacturers and first-tier suppliers mainly relied on electronic networks for their transaction, transactions between first-tier suppliers and second-tiers were done through paper-based traditional methods in the late 1990s, as illustrated in figure 8. Most final manufacturers have their own electronic procurement systems and there is little interoperability between major manufacturers (Oh, 2001).

*Figure 8. Upstream value system of the Korean electronics industry*



Adapted from Oh (2001: 356)

### 2.5.3. Electronic Commerce in the Korean Electronics Industry

#### **Facilitation of Electronic Commerce**

In the Korean electronics industry, a buyer-driven type of e-commerce occupied seventy-eight percent of total e-commerce, whereas a supplier-driven type did nineteen percent and intermediary-driven type did just three percent in 2001 (NSO, 2003). By the criteria of openness, a closed-private type of e-commerce amounted for eighty-seven percent, while open-public type did for thirteen percent. This statistics indicates that e-commerce in the electronics industry has developed along established offline relationships between major manufacturers and their trading suppliers.

In an individual company level, e-Procurement system operated by major manufacturers comes under a representative form of e-commerce in the Korean electronics industry. Most companies have operated various levels of e-commerce system. For example, LG electronics employed e-commerce systems for more than two thousand suppliers, however closely connected to only fifty suppliers for linking ERP (enterprise resource planning) software in 2002.

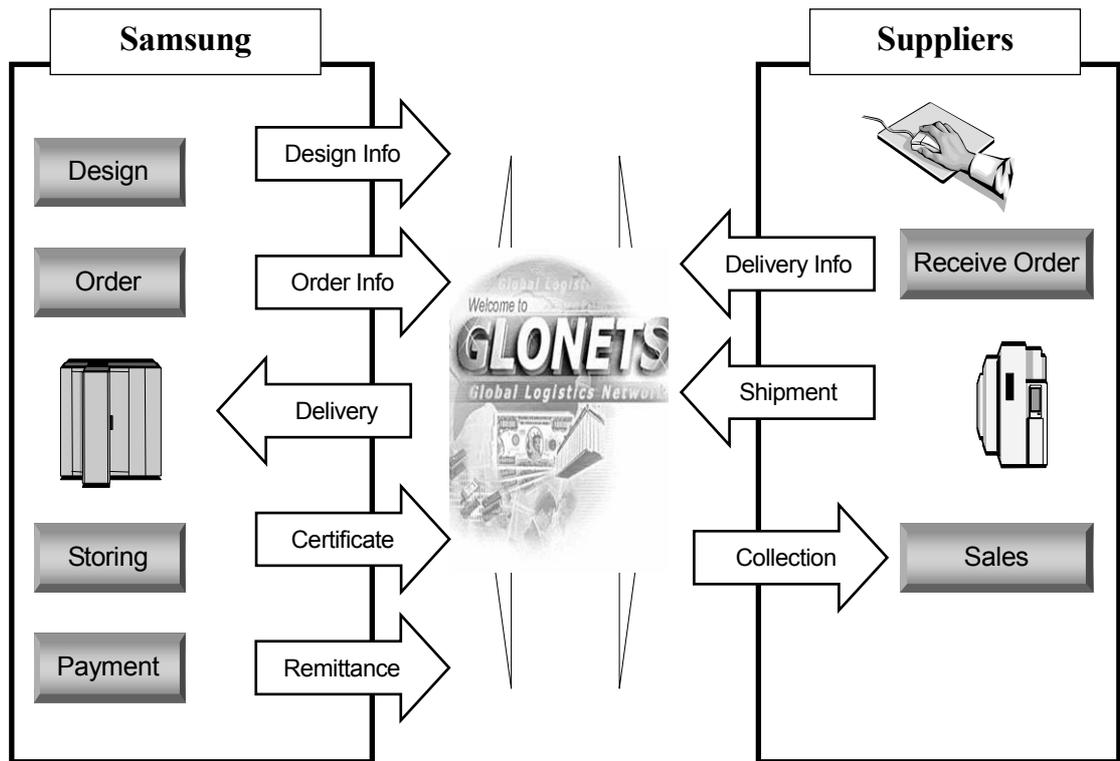
### **Public Electronic Commerce: An Infancy Stage**

In 1998, both major manufacturers and suppliers in the Korean electronics industry commenced a project to construct an interoperable EDI system and open a public virtual marketplace to trade electronic parts and components. This project was named as the *electropia project*. A number of companies, including four leading manufacturers, participated and government supported it. This project, however, had been confronted with many problems such as low rate of standardization (MOCIE, 2001). It was considered that it would take a long time to standardize business processes and electronics parts. Faced with such hurdles, major manufacturers such as Samsung electronics and LG electronics had launched their own public eMarketplaces in cooperation with multinational companies. Accordingly, public e-commerce is still in an infancy stage in the Korean electronics industry.

### **Private Electronic Commerce: A Growing Stage**

Major manufacturers have their own electronic networks, which are called proprietary EDI systems (e.g., GLONET in Samsung electronics as illustrated in figure 9 (the next page), LG-SCS Portal in LG electronics, and DWE EDI in Daewoo electronics), for linking their buyers and suppliers (Choi et al., 2001). These EDI systems are used for various business activities such as purchasing resources, forecasting demand, supporting production, identifying orders, delivery, payment, and inventory. Among these, EDI system has been mainly centred on procurement (NSO, 2003). Therefore, private e-commerce has been rapidly growing in the Korean electronics industry.

*Figure 9. Samsung electronics' EDI system*



Source: Choi et al. (2001: 67)

#### 2.5.4. Buyer-Supplier Relationships in the Korean Electronics Industry

##### **Buyer's Superiority over the Supplier**

In the Korean manufacturing including electronics industry, manufacturers generally have advantage over their suppliers, and suppliers are dependent upon their final assemblers (Oh, 2001). There are two main causes of final manufacturers' superiority (Baek et al., 1996). First, most suppliers provide their products for only a few buyers. Second, most suppliers produce standard goods that are homogeneous to other suppliers' products. These features are originated from the industrialization strategy of Korea. Parts production was commenced only after the assembling manufacturers took off. In early stage of industrialization, most critical parts were purchased from foreign vendors.

The imbalance of bargaining power between buyers and their supplier has been reflected into the price decision mechanism in the Korean manufacturing (KOSBI, 1998).

Accordingly, many suppliers have tried to diversify their trading partners in order to decrease dependence on a particular buyer (Lee, 1999).

### **Close Cooperation between Manufacturers and their Suppliers**

According to the survey on the Korean manufacturing conducted by KIET (Korean institute for industrial economy and trade), seventy-six percent of companies keep collaborative relationships with their key suppliers and eighty-four percent of companies have cooperative relationships with their key buyers (Bak, 2001). As reported in table 15, the survey also found that technology-related cooperation (e.g., joint R&D, production guide) is more activated than human-resource related cooperation (e.g., staff dispatch, skill training). In addition, non-financial type (e.g., material supply, sales support) of assistance is more frequent than financial type of assistance (e.g., provide credit). This statistics indicates that high degree of assets specificity and dependence facilitates collaborative relationships between final manufactures and their suppliers in the Korean manufacturing industry.

*Table 15. Type of cooperation with key trading partners*

Types of cooperation	Participation rate*		Types of Cooperation	Participation rate*	
	Buyer	Supplier		Buyer	Supplier
Dispatch staff	**16%	24%	Provide the capital	9%	16%
Train skilled manpower	41%	36%	Lease facilities	29%	16%
Joint R & D	56%	55%	Provide credit	13%	16%
Offer technical information	41%	36%	Furnish raw materials	58%	24%
Guide productive operation	58%	56%	Support sales	39%	25%
Guide management	22%	24%	-	-	-

\* Participation rate refers to how many percentage of companiens have an experience of cooperation.

\*\*For example, this means that 16 % of buyers out of total buyers have an experience of dispatching their staffs to key suppliers.

Source : Bak (2001: 22)

In addition, Ahn et al. (1999) argued that buyer-supplier relationships were highly related to the importance of trading goods. Their empirical study on the Korean electronics industry

found that highly specific assets and close collaboration came when supplier's components are critical to buyer, whereas behavioural and assets-specific linkages are to be low when goods traded are not so important.

### Segmentation of Relationships on the Rate of Trading Partners

It is usual for companies to segment their trading partners based on the importance of the partner. As reported in table 16, major manufacturers in the Korean electronics industry classify their suppliers as partner group, strategic group, or general group based on criteria such as purchasing volume and importance of components. Periodically, they grant a premium (e.g., pay a bill in advance) to well-performing partners, while they put a penalty (e.g., break a relation) on ill-performing suppliers (Choi et al., 2001).

*Table 16. Buyer's supplier selection criteria*

	Samsung electronics	Daewoo electronics.	LG electronics
Classification	Partners, Certificates, Generals, Specifics	-	Strategics, Generals, Commons
Criteria on Selecting Partners	Quality, Price, Delivery, CEO, Experience, Financial structure, Manpower, Long-term reliability	Management, Quality, Technology, Production	Technology, Quality, Price, Manpower, Financial structure
Criteria on Estimating performance	Synthesized Assessment (state, performance, contribution)	Quality, Price, Delivery, Originality, Cost saving	Sponsorship, Process operation, IT capacity
Others	Suppliers' association	Suppliers' association	Suppliers' association

Source : Choi et al. (2001: 61)

### 2.5.5. Summary of the Korean Electronics Industry

(1) High rate of growth in the late twentieth century, heavy dependence on international trade, and dominance position of *chaebol*, Korean conglomerate, have marked Korean economy. Korean business culture is characterized by collectivism, long-term orientation and high communication context. As for e-business, the ratio of electronic commerce over total commerce went up from 4.5 percent in 2000 to 8.6 percent in 2001. Automobiles and

electronics industries are the most developed sector in terms of e-commerce in Korean economy.

(2) The Korean electronics industry represented 5.6 percent of the worldwide production in 2001, following US, Japan and China. Export-push strategy and accelerated organizational learning were considered to create the comparative advantage of Korean electronics industries. Negative aspects of Korean electronics industries are said to be a narrow knowledge base, a sticky pattern of specialization, and a vulnerability to external shock.

(3) In the Korean electronics industry, buyer-driven, supplier-driven and intermediary-driven e-commerce accounts for 77.6 percent, 19.4 percent, 3.0 percent out of all e-commerce respectively. A close-private type of e-commerce occupies 87.2 percent, while an open-public type does 12.8 percent. This statistics indicates that e-commerce in the electronics industry has been developed along the established relationships between major buyers and their suppliers.

(4) Most assemblers and their suppliers keep cooperative relationships with their trading partners in the Korean electronics industry. However, a few large-sized manufacturers (i.e., Samsung, LG, Daewoo, and Hynix) have an advantage over thousands of small- and medium-sized suppliers. High degree of assets specificity and dependence are considered to facilitate a close cooperation between manufacturers and their suppliers.

## **CHAPTER 3. RESEARCH QUESTION AND HYPOTHESES**

### **3.1. Research Question**

With regard to the impact of electronic commerce on buyer-supplier relationships, some contradictories have been found as described in Chapter 2. (Theoretical background of the study). Proponents of transaction cost economics predicted that electronic commerce would lead to a more competitive relationship between trading partners in industrial markets (Malone et al., 1987; Wigand and Benjamin, 1997). This is because electronic commerce reduces transaction cost, which, in turn, makes a market coordination structure more efficient. Therefore, firms choose a market coordination structure rather than a hierarchical integration in order to take advantage of efficiency derived from electronic commerce.

However, as described in section 2.3. (Buyer-supplier relationships in the value system) the current trend of buyer-supplier relationships in industrial markets is toward collaborative relationship. According to the 'move to the middle' hypothesis, even though electronic commerce reduces coordination cost, firms would choose a close, long-term relationship with a reduced set of partners (Bakos and Brynjolfsson, 1993; Clemons et al., 1993). It is more probable that firms may choose a business relationship in order to maximize long-term values for a sustainable competitive advantage rather than minimize the total costs posited in transaction cost economics (Hoyt and Huq, 2000). Many firms have actually leveraged their use of electronic commerce to form a value added partnerships along the value chain. A step further, utilization of electronic commerce would facilitate collaborative relationships between buyer and supplier in the industrial markets. For example, electronic interconnection via EDI shifts a interfirm relationship towards a collaborative one.

Confronted with these dyadic arguments, both of which seem reasonable respectively but is contradictory to the other, it is interesting and necessary to examine which side of argument is more valid in the real world of business. As described in section 2.2. (Electronic commerce), in reality, business-to-business activity dominates electronic commerce and manufacturing leads all industry sectors (US Census bureau, 2001). Accordingly, the industrial market (or business-to-business sector) is more appropriate than the consumer market (or business-to-consumer sector) for a field of the study that examines the impacts of

electronic commerce. In the empirical study, it is more efficient approach for an individual researcher to focus a specific area and interpret his results for generalization. As described in section 2.4. (the Korean electronics industry) Korea's enthusiasm for the digital economy is amazingly high, and manufacturing industries such as electronics industry are well developed. The business culture of Korean industries is similar to that of other Asian countries (i.e., Japan and China), in which social relationships play a more important role (Teng et al., 1999).

In this context, a research question can be raised as follows:

“How does the utilization of electronic commerce affect buyer-supplier relationships in the Korean electronics industry?”

## 3.2. Hypotheses of the Research

### 3.2.1. Introduction

Several theories have been employed for explaining how electronic commerce may influence buyer-supplier relationships in industrial market. Above all, using dichotomy between market coordination (or, competitive coordination) and hierarchical governance (or, collaborative coordination), TCE explains the impact of e-commerce on business relationship with simplicity and lucidity. In a word, proponents of TCE predicted that information technology should reduce transaction cost, which leads to an overall shift toward more use of market coordination (Malone et al., 1987).

TCE provides a clear framework for theoretical reasoning. However, prediction of TCE has some limitations to describe the actual states of industrial market. First, at least in an early stage of adopting e-commerce it is more plausible that e-commerce increases assets specificity, which will make trading partners prefer hierarchical governance to market coordination. Second, from a view of relational exchange theory (RET), it is highly probable that long-term benefits of relational exchange take precedence of economic gains from saving transaction costs in industrial market. This indicates that trust plays a more decisive role in determining a coordination structure, and more emphasis of the study should be laid on examining the impact of e-commerce on trust. Third, according to resource dependence theory (RDT), inter-organizational dependence may play a role of safeguarding to constrain the opportunistic behaviour of actors in transaction. It means that dependence may be a substitute for assets specificity (and trust) as a determinant of coordination structure. At last, even though e-commerce reduces transaction cost, which, in turn allows a firm to move away from in-house production to market outsourcing, the firm will choose hierarchical coordination (or, collaborative relationship) with the trading partner rather than market coordination (or, competitive relationship) in industrial markets.

Accordingly, this research attempts to form hypotheses using an integrative perspective that combines TCE, RET, RDT. TCE is chosen for providing a principal framework of reasoning for hypothesis, and others are selected to give its own view to form hypothesis as well as complement TCE.

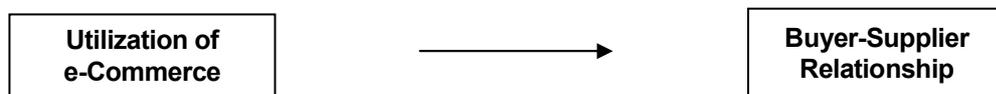
### 3.2.2. Direct Path from e-Commerce to B-S Relationship

As described in the section 2.4.3. (Direct impacts of e-commerce on relationships), proponents (e.g., Malone et al., 1987) of transaction cost economics (TCE) predicted that the overall effect of information technology (IT) would be a shift of economic activities from hierarchies to markets, which indicated a shift toward competitive relationship between buyers and suppliers. They based this prediction on two assumptions. The one is that IT decreases the unit cost of coordination, and the other is that decreased cost should lead to an increase of market coordination.

However, Clemons et al. (1993) argued that firms would choose a close, long-term relationship with a reduced set of partners even though IT increased the extent of outsourcing. In addition, firms may choose a business relationship to maximize long-run values rather than minimize the total costs posited in TCE. Accordingly, firms would prefer hierarchical arrangement to lower cost market transactions since electronic inter-organizational value chains enable them to improve their competitiveness, which suggested a shift toward collaborative relationship between buyers and suppliers.

Accordingly, a hypothesis can be proposed that *utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier in the Korean electronics industry, as illustrated in figure 10. (hypothesis 1)*

Figure 10. Direct path (hypothesis 1)



### 3.2.3. Assets Specificity As a Mediator Between e-Commerce and B-S Relationship

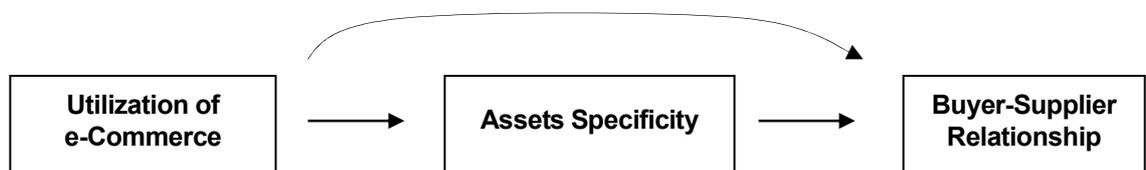
As described in the section 2.4.4. (Impact of e-commerce on determinant variables of buyer-supplier relationship), electronic markets usually require sizable investments from their participants in hardware, software, employee training, and organizational

transformations. Once an EDI process begins in industrial market, both buyer and supplier make specific investments, which hold them in the relationship. In addition, the linking of computer systems may build a structural bond that is difficult to break. These imply that e-commerce tends to intensify assets specificity between trading partners in industrial market.

As described in the section 2.3.3. (Transaction cost economics: assets specificity and environmental uncertainty), assets specificity is a key variable in determining the form of buyer-supplier relationship. Highly specific assets are more likely to facilitate hierarchical coordination than market transaction.

Consequently, a hypothesis can be proposed that *utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of assets specificity in the Korean electronics industry, as illustrated in figure 11. (hypothesis 2)*

Figure 11. Assets Specificity as a Mediator (hypothesis 2)



#### 3.2.4. Trust As a Mediator Between e-Commerce and B-S Relationship

As described in the section 2.4.4. (Impact of e-commerce on determinants of buyer-supplier relationship) in terms of relational exchange theory, e-commerce may lead to less trusting relationship between trading partners because interactions become depersonalized and task oriented. However, empirical studies reported that the use of e-mail complemented traditional methods (i.e., face-to-face) of communication. In addition, better information supported by e-commerce is likely to enhance trust between buyer and supplier.

As described in the section 2.3.4. (Relational exchange theory: trust), trust is a key variable to build a cooperative relationship between buyer and supplier. Trust usually tends to prevent

trading partners from taking excessive advantage of their exchanging partners even when the opportunity is available.

Therefore, a hypothesis can be proposed that *utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of trust in the Korean electronics industry, as illustrated in figure 12. (hypothesis 3)*

*Figure 12.. Trust as a Mediator (hypothesis 3)*



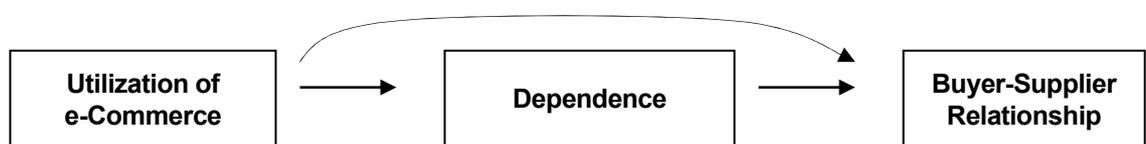
### 3.2.5. Dependence As a Mediator Between e-Commerce and B-S Relationship

As described in the section 2.4.4. (Impact of e-commerce on determinants of buyer-supplier relationships), it is highly possible that electronic commerce facilitates information exchange and enhanced communications, thus enforces mutual dependence between trading partners. In other words, electronic interconnection between buyer and supplier in industrial market leads to significantly higher levels of interfirm dependence between trading partners.

As described in the section 2.3.5. (Resource dependence theory: dependence), dependence can play a role of safeguard to constrain the opportunistic behaviour of trading partner. Dependence is a key variable determining the coordination structure of interorganizational relationships from the view of resource-dependence theory.

In this context, a hypothesis can be proposed that *utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of dependence in the Korean electronics industry, as illustrated in figure 13. (hypothesis 4)*

*Figure 13. Dependence as a Mediator (hypothesis 4)*



### 3.2.6. Integrated Full Model

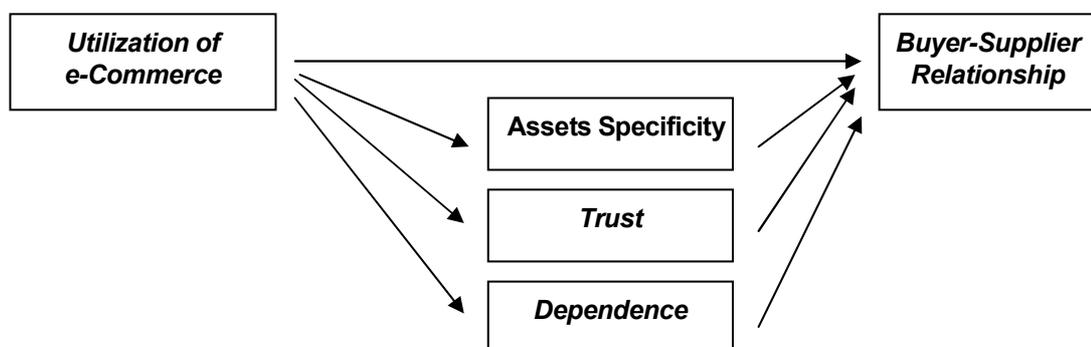
All separate structural paths dealt with earlier can be reconciled and integrated into a multi-path (full) model. Every hypothesis follows the framework of theoretical reasoning derived from transaction cost economics even though hypothesis 1 is mainly based on transaction cost economics and relational exchange theory, hypothesis 2 on transaction cost economics, hypothesis 3 on relational exchange theory and hypothesis 4 on resource dependence theory.

Like assets specificity in hypothesis 2, trust in hypothesis 3 and dependence in hypothesis 4 play a mediating role as a safeguard to constrain the opportunism. All mediating variables (i.e., assets specificity, trust and dependence) are assumed to be positively affected by utilization of e-commerce, and in turn, facilitate a collaborative relationship between buyer and supplier.

Four hypotheses of each structural path share a common premise that electronic integration effect predominates over electronic brokerage effect in industrial market, therefore, electronic commerce develops collaborative relationships between buyers and suppliers.

In sum, an integrated hypothesis can be proposed that *utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence in the Korean electronics industry, as illustrated in figure 14. (hypothesis 5)*

*Figure 14. Integrated model (hypothesis 5)*



### 3.2.7. Environmental Uncertainty as a Moderating Variable

As described in 2.4.4. (Impact of e-commerce on determinants of buyer-supplier relationship), it is still a matter of controversy whether environmental uncertainty is influenced by the use of e-commerce, or whether environmental uncertainty is independent of the use of e-commerce. Market uncertainty is expected to be reduced by information-sharing propelled by e-commerce. However, it is not obvious for the improved forecast of market condition to decrease technological uncertainty.

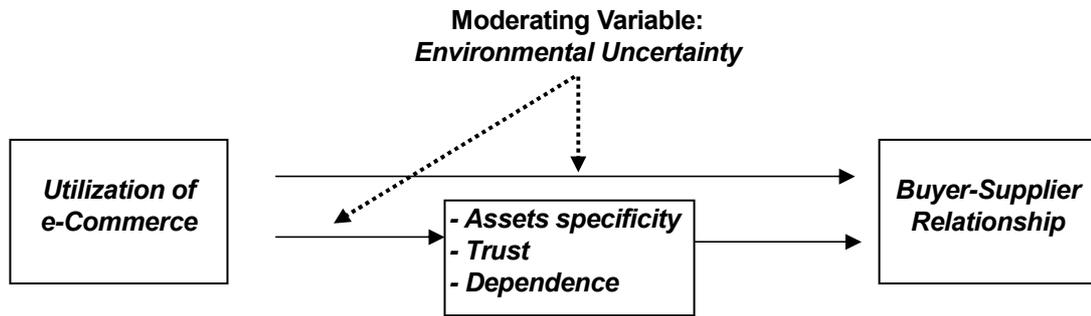
As described 2.3.3. (Transaction cost economics: environmental uncertainty and assets specificity), it is theoretically probable that environmental uncertainty shifts the coordination structures in favour of vertical integration rather than market mechanism. In empirical studies, however, there is still controversy over the role of environmental uncertainty in determining governance structure between market and hierarchy. Research focusing on technological uncertainty has demonstrated a negative relationship between uncertainty and integration. Both demand and technological uncertainty may discourage vertical integration because firms are afraid that vertical integration limits their flexibility that is necessary to survive in a rapidly changing situation.

In sum, there is still controversy over the role of environmental uncertainty in determining governance structure between market and hierarchy. Moreover, it is not evident whether environmental uncertainty is influenced by the use of e-commerce, or whether environmental uncertainty is independent of the use of e-commerce. Therefore, it is a more rational approach that we define and examine environmental uncertainty as a moderating variable rather than a mediating variable in the research.

For example, it is possible that e-commerce facilitates a shift toward hierarchical coordination between buyer and supplier under highly uncertain situation. On the other hand, under lowly uncertain situation, e-commerce may shift toward market coordination between buyer and supplier.

Accordingly, it can be proposed *that environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry, as illustrated, in figure 15 (the next page). (hypothesis 6)*

*Figure 15. Moderating role of environmental uncertainty (hypothesis 6)*



### **3.3. Summary**

(1) In the light of the theoretical background, the research question is raised “How does the utilization of electronic commerce affect buyer-supplier relationships in the Korean electronics industry?”.

(2) The research hypotheses are formed using an integrative perspective that combines transaction cost economics (TCE), relational exchange theory (RET) and resource dependence theory (TCE). TCE provides a principal framework of reasoning, and others are selected to give their own views as well as complement TCE.

(3) Direct path from utilization of e-commerce to buyer-supplier relationship is hypothesized. Namely, hypothesis 1 is that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier in the Korean electronics industry.

(4) Assets specificity, trust, and dependence are hypothesized as a mediating variable between utilization of e-commerce and buyer-supplier relationship. Namely, hypothesis 2 is that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of assets specificity. Hypothesis 3 is that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of trust. Hypothesis 4 is that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of dependence.

(5) All separate paths are combined to propose an integrated hypothesis. Namely, hypothesis 5 is that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence in the Korean electronics industry.

(6) Environmental uncertainty is hypothesized as a moderator between utilization of e-commerce and buyer-supplier relationship. Hypothesis 6 is that environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry.

## **CHAPTER 4. RESEARCH METHODOLOGY**

### **4.1. Introduction**

The previous chapter 3 framed the research model and proposed the research hypotheses. An appropriate methodology should be employed in order to collect data to test the hypotheses. This chapter will seek for the research methods that will be suited to this research. This chapter consists of five sections: (1) selection of research method, (2) sampling strategy, (3) operationalization of research variables, (4) pilot test, and (5) conducting the main survey.

The first section on research method attempts to identify the nature of this research because each type of research has consistency with a specific type of method. It is the primary concern to select a data collection method (e.g., case study, survey) in this section.

The sampling strategy section will select sampling methods (e.g., simple random sampling, stratified sampling) and determine population and sample frame for this research. The latter part of this section will focus on explaining how final sample will be extracted from the sample frame.

In the subsequent section, the research constructs comprising of the research model will be operationalized. It will be described how to design the research questionnaire for the survey. Prior to the operationalization, the goodness of measures will be discussed.

The pilot test section begins with explaining the purpose and method of pilot test, which consists of preliminary pretest and formal pretest. Then, it will be shown how the pilot test was implemented in this research. This section ends with providing the results of pilot survey.

The final section of this chapter will be dedicated to the description of conducting the main survey. The main issues of this section will be the survey design, procedure of the survey, and the results of data collection.

## 4.2. Selection of Research Method

### 4.2.1. Understanding the Nature of Research

It is important to select an appropriate research method. Concerning the choice of best method, Blaxter et al. (2001:59) state as follows;

“The choice of the best method is not simply the technical or practical question. Different kinds of research approaches produce different kinds of knowledge about the phenomena under study. The question ‘which method is best?’ is not solely about whether, for example, to use interviews, questionnaires or observations. Underpinning these research tools is more general philosophical questions about how we understand social reality, and what are the most appropriate ways of studying it.”

In order to decide a research method, several types of research will be discussed in this section. Understanding the characteristics of each type will be a key aid to select a specific type of method for this research.

*Table 17. Types of social research*

Dimension of Research	Major Types
Use of Research	Basic, Applied
Purpose of Research	Exploratory, Descriptive, Explanatory
Time Dimension in Research	Cross-Sectional, Longitudinal, Case Studies

Adapted from: Neuman (2003: 21)

As summarized in table 17, research can be classified on the criteria of use, purpose and time dimension. At first, research can be used differently: research chiefly carried out to enhance the understanding of certain problems that commonly occur is called *basic research*, whereas, on the other hand, research done with the intention of applying the results of the findings to solve specific problems is called *applied research* (Sekaran, 2000).

Basic research is undertaken purely to understand the process of business and management by universities as the result of an academic agenda. The findings of basic research contribute

to the building of knowledge in general, and are later applied to specific problem solving for business and management (Sekaran, 2000; Saunders et al., 2003).

Second, the purposes of research may be organized into three groups: exploratory, descriptive, and explanatory. *Exploratory research* aims at generating new ideas, as reported in table 18. Exploratory researchers tend to be less wedded to a specific theory, and adopt qualitative techniques for gathering data because qualitative techniques are more open to using a range of evidence and discovering new issues (Neuman, 2003). *Descriptive research* provides a detailed picture of a specific situation or relationship. Much of the social researches published in scholarly journals is descriptive. Descriptive researchers employ most data-gathering techniques such as surveys, field research, content analysis and historical-comparative research (Neuman, 2003). *Explanatory research* intends to identify the reason of something based on exploratory and descriptive researches. In other words, explanatory research looks for causes and reasons going beyond providing a picture of it (Neuman, 2003).

*Table 18. Purposes of research*

Type	Exploratory Research	Descriptive Research	Explanatory Research
Question	What is the problem?	How does it occur?	Why does it happen?
Purpose	Generate new ideas Create a general mental picture of conditions	Provide a detailed picture Clarify a sequence of steps or stages	Test a theory's predictions Elaborate and enrich a theory's explanation
Tool	Qualitative methods	Data-gathering methods	-

Adapted from: Neuman (2003: 29)

Third, the research varies in terms of dealing with the time: cross-sectional, longitudinal, and case study. *Cross-sectional research* (i.e., a single point in time) observes at one point in time and analyzes it in detail. Cross-sectional approach may be exploratory, descriptive, or explanatory. However, it is most consistent with a descriptive research (Neuman, 2003). *Longitudinal research* examines the object of study at more than one time. Though longitudinal approach is usually more complex and costly than cross-sectional approach, descriptive and explanatory researchers prefer longitudinal approach (Neuman, 2003). *Case-study research* investigates, in-depth, many features of a few cases over duration of time, while both cross-sectional and longitudinal research measure a common set of features

on many cases. Case study usually employs analytic logic instead of enumerative induction (Neuman, 2003).

Each type of research has consistency with a specific type of method. Hence, it matters to which type of research this study corresponds. This study aims at examining the impact of e-commerce on buyer-supplier relationships in the Korean electronics industry. Viewed in terms of the nature, this study comes under basic research rather than applied one. Judging from the goal, even though this study may have multiple purposes to explore, to describe and to explain, descriptive characteristic is more dominant than exploratory and explanatory one.

This suggests that quantitative data-gathering method be more appropriate rather than qualitative method. As for time dimension, both a longitudinal and a cross-sectional approach can be employed for this study. Among these, since e-commerce has still been in early stage, it is not easy to divide the object of this study by developmental phases. In addition, cross-sectional approach is more simple and effective way to achieve the research goal than longitudinal approach is. Accordingly, it is reasonable to take a cross-sectional approach for this study.

#### 4.2.2. Selection of Data Collection Method

Data collection methods may be classified into two groups: quantitative (in the form of numbers) and qualitative (in the form of words) as reported in table 19. In this section, major data-collection methods will be discussed.

*Table 19. Data collection methods*

Type of data	Type of method
- for Quantitative Data	Experiments, Surveys (Interviews, Questionnaires), Secondary analysis, Content analysis
- for Qualitative Data	Field research, Historical-comparative research

*Experiments technique* in social research borrows the logic found in natural science research. Researchers in experiments generally involve a relatively small number of people and address a well-focused question. Experiments are the most effective method for explanatory

research since the control and intervention in experiment minimize the risk of extraneous variables that confuse the results (Blaxter, 2001; Neuman, 2003). However, it is often difficult to design experiment, and sometimes impossible to control the predictor variables (Blaxter, 2001).

*A survey technique* is the method of collecting data by asking questions in a written questionnaire or during an interview and recording answers. Survey technique is generally used for descriptive or explanatory research that follows a common process of testing and developing a theory (May 2001, Neuman 2003).

A survey researcher usually employs a smaller selected group, and tries to generalize results of smaller group to a larger group from which the smaller group was chosen (Neuman, 2003). The survey may be an effective method to collect unbiased data, however its validity relies on breadth rather than depth of data (Blaxter, 2001).

In *secondary analysis research*, a source of previously collected information is located in the form of government research or previously conducted surveys, and a researcher reexamined the information by using various statistical procedures. This method may be used for exploratory, descriptive, or explanatory approach, but is most frequently used for descriptive research (Neuman, 2003).

In *field research*, a researcher observes and interacts in the field setting, and considers and refines ideas for a period from a few months to several years. Field research technique is heavily dependent on the researcher's capability of observation, thus its findings are sometimes challenged by a lack of generalization (May, 2001). Field research is usually used for exploratory and descriptive studies; sometimes for explanatory research (Neuman, 2003).

As discussed in the previous section 4.2.1. (Understanding the nature of the research), this study falls under the category of descriptive research, and takes the cross-sectional approach in time dimension. Viewed in terms of the nature of the research, a survey technique is the most suited to this study as a data-collection method.

### 4.2.3. Survey Scheme

This research aimed at examining the impacts of electronic commerce on buyer-supplier relationships in the context of the Korean electronics industry. Most questionnaire items on electronic commerce will be developed based on the literature review, and those related to buyer-supplier relationships will be drawn from the literatures of previous studies.

The survey questionnaire will be pretested by college-level students for clarity of meaning and matching questions with the appropriate construct in research model. The pilot test will be carried out by academic experts and sample companies. Reflecting the results of pilot test, the questionnaire will be revised. The main survey will be carried out by the traditional mailing. In addition, Internet e-mail will also be used for reminding respondents and enhancing a response rate.

The survey will be proceeded with the support of (1) the ministry of commerce, industry and energy of Korea (*MOCIE*), (2) the Korean institute for industrial economy and trade (*KIET*: one of the most authoritative institutes in the area of industry in Korea), (3) the electronics industries association of Korea (*EIAK*, the representative of the Korean electronics industry), (4) Korea Electronics Industries Cooperative (*KEIC*, the representative of small- and medium-sized firms of the Korean electronics industry), and (5) four leading companies in the Korean electronics industry: namely, *Samsung* electronics, *LG* electronics, *Daewoo* electronics and *Hynix* semiconductor.

### **4.3. Sampling Strategy**

#### 4.3.1. Introduction

##### **Representativeness in Survey**

*Representativeness* refers to the extent to which the characteristics of a sample represent those of the population from which the sample is drawn. Survey research usually employs a smaller group (or sample) of selected, and generalizes the results of the smaller group to a larger group (or population) from which the smaller group was chosen. As the results of the survey are intended to make generalizing claims about larger group (i.e., population), it is important that the smaller group (i.e., sample) is a representative of a larger group (May, 2001). Various sampling methods have been used for ensuring representativeness in a survey research, and among them probability sampling is considered as the surest way of achieving samples that represent the population (De Vaus, 2002).

However, it is unlikely that the sample will be perfectly representative with probability sampling. Representativeness can be established on the condition that population is adequately defined, sample frame is unbiasedly obtained, samples are properly selected (De Vaus, 2002; McNeill, 1990).

Accordingly, this section will define sample frame in the context of the Korean electronics industry, and explain how initial and final samples will be extracted from the sample frame by stratified sampling method.

#### 4.3.2. Sampling method

##### Probability Sampling Methods

There are four main types of probability sampling methods: simple random sampling, systematic sampling, stratified sampling, and multistage cluster sampling as seen in table 20.

*Table 20. Types of probability sampling*

Type of Sampling	Technique
Simple Random Sampling	Create a sampling frame for all cases, then select cases using a purely random process (e.g., random-number table)
Systematic Sampling	Create a sampling frame, calculate the sampling interval $1/k$ , choose a random starting place, then take every $1/k$ case
Stratified Sampling	Create a sampling frame for each of several categories of cases, draw a random sample from each category, then combine the several samples
Multistage Cluster Sampling	Create a sampling frame for larger cluster units, draw a random sample of the cluster units, create a sampling frame for cases within each selected cluster unit, then draw a random sample of cases, and so forth

Synthesized from: De Vaus (2002), Neuman (2003)

In *simple random sampling*, a researcher develops an accurate sampling frame, selects elements from the sampling frame according to a mathematically random procedure, then locates the exact element that was selected for inclusion in the sample (Neuman, 2003). In practical terms, simple random sampling has the problem that it requires a good sampling frame, but adequate lists are often not available for larger population of surveys of a city, region or country (De Vaus, 2002). In *systematic sampling*, a researcher creates a sampling frame, calculates the sampling interval, chooses a random starting place, and then takes every case that comes under sampling interval. In addition to the problems of simple random sampling, systematic sampling may encounter an additional one: a periodicity of sampling frame (De Vaus, 2002). In *stratified sampling*, a researcher divides the population into subgroups, and then draws a random sample from each subgroup. In stratified sampling, in order to avoid distortions due to the chance under- or over- representation of particular subgroup in the final sample, a researcher controls the relative size of each subgroup rather

than letting random processes dominate it (De Vaus 2002, Neuman 2003). Stratified sampling is designed to produce more representativeness and can produce more accurate sample than simple random sampling can if the information on stratifying is accurate. *Multistage cluster sampling* is an effective method when sample elements are concentrated in selected geographic areas. Cluster sampling is usually less expensive than simple random sampling, but it is less accurate (Neuman, 2003).

The selection of sampling method is dependent on the nature of the research question, the availability of good sampling frame, the cost (money and time), the desired level of accuracy in the sample and the data-collection method (De Vaus, 2002).

### **Sample Frame in the Research**

The Korean electronics industry is defined as the population of this study. According to the *Ministry of commerce, industry and energy (MOCIE)* of Korea, equivalent to the department of trade and industry (DTI) of UK, eight thousand companies are supposed to be in the Korean electronics industry. However, there is no available and reliable list that covers all the companies in the population of the study<sup>4</sup>. This suggests it is inevitable to leave some parts of population out of the sample frame of this study.

Alternatively, the sample frame of this study is made up by combining main associations in the electronics industry and synthesizing member companies of these associations. Namely, the sample frame consists of three subgroups: (1) member companies of EIAK (electronics industries association of Korea), (2) member companies of KEIC (Korea electronics industries cooperative) and (3) members of four leading companies, so called big four's (Samsung, LG, Daewoo and Hynix), suppliers associations.

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<sup>4</sup>. At first, in order to gain access to the list of eight thousand companies, the researcher contacted the official organizations: ministry of commerce, industry and energy (MOCIE) and national statistics organization (NSO). MOCIE relies on NSO for a source of data, and NSO is not permitted to open the information about individual company. Then, the researcher examined other lists covering the electronics industry, which were made by private agencies. Regrettably, there were many problems in those lists; for example, a lot of companies were left out without any explanation, or the information (e.g., address, e-mail id) of individual company was not updated. Consequently, the researcher could not obtain the list covering all the companies in the electronics industry, so looked for alternative list.

### EIAK (Electronics Industries Association of Korea)

Electronics industries association of Korea (EIAK) has 350 member companies. The median of staff among EIAK is ninety-eight, and that of annual sales is KRW 18,000 million, equivalent to GBP 9.9 million, in 2001. The summate sales of all EIAK members amounts to approximately ninety-six percent of total production in the electronics industry. This suggests that EIAK members come under the top layer of upstream value chain in the electronics industry as final assemblers as well as buyers. In addition, it is notable that big four (Samsung, LG, Daewoo and Hynix) companies, called as top chaebols, occupy more than three-quarters of total sales and half of total employees in the EIAK.

### KEIC (Korea Electronics Industries Cooperative)

Korea electronics industries cooperative (KEIC) was established by the small- and medium-sized companies in the electronics industry. KEIC was approved by the Korean Government in 1967 as the representative of the small- and medium-sized companies in the electronics industry. KEIC encourages the independent business activities of its members and assists the cooperation between its members and their buying companies subject to Article 28 of the small & medium industries cooperative association Law. KEIC has 605 companies that occupy the supplier layer of the electronics industry. The median of staff among KEIC members is nineteen, and that of annual sales is KRW 2,500 million, equivalent to GBP 1.3 million, in 2001.

### Big Four's (Samsung, LG, Daewoo, and Hynix) Suppliers Associations

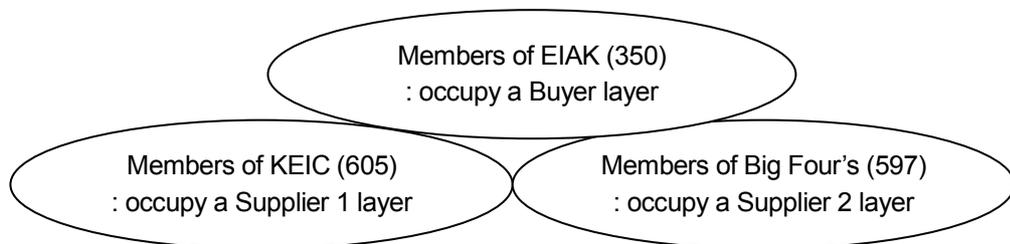
Samsung electronics' suppliers association consists of 193 member companies that provide the Samsung electronics with parts and material (SECSA, 2003). That of LG electronics', that of Daewoo electronics and that of Hynix consist of 246, 126 and 65 member companies, respectively. KEIC are independent of any specific buyer, whereas big four's suppliers associations are highly dependent on their specific buyer for their sales. Notably, most suppliers tend to belong to single association, however, there are a little overlapping belongings among these associations; twenty-three companies join in two suppliers associations, two companies join in three associations, and two companies join in four associations. In terms of company size (e.g., No. of staff, or annual sales), big four's

suppliers associations lie between EIAK and KEIC. For example, the median of staff among Daewoo electronics' suppliers association is sixty-three, and that of annual sales among LG electronics' suppliers association is KRW 5,105 million, equivalent to GBP 2.7 million, in 2001.

### **Stratified Sampling for the Research**

The sample frame has 1,552 companies that are composed of 350 members of EIAK, 605 members of KEIC and 597 members of big four. A total of 1,552 companies is the sum of member companies of three subgroups, from which the companies that belong to more than two associations are excluded. There is no overlapping company between subgroups of sample frame. In the context of value system in the Korean electronics industry, as seen in figure 16, buyers in the electronics industry are considered as the member companies of the EIAK, and suppliers are both members of KEIC and members of big four's suppliers associations.

*Figure 16. Composition of the sample frame*



Stratified sampling is expected to represent a sample frame better, and to produce more accurate sample than simple random sampling is in case that a sample frame is accurately divided into subgroups (Churchill, 1999). Since the sample frame is split into three subgroups, stratified sampling will be adopted as the sampling method of this research. In addition, the relative size of each subgroup also matters in stratified sampling, which will be discussed in the next section.

### 4.3.3. Decision about Sample Size

#### **An Optimal Sample Size**

An optimal sample size is an important issue in research because sample size plays a critical role in achieving statistical significance. If a sample size is too small or too large, there is a risk. Small sample size may result in either (1) little statistical power for the test to identify significant results or (2) easily overfitting of data that have no generalizability (Hair et al., 1998). On the other hand, large sample size needs many resources such as time and money, moreover it can make the statistical test overly sensitive, or significant. With too large a sample size, even weak relationships might reach significant level when in fact they may not be (Sekaran, 2000).

In addition, equal increase in sample size produces more substantial increase in accuracy for small samples than for large ones (Neuman, 2003). For example, an increase in sample size from 50 to 100 reduces errors from 7.1 percent to 2.1 percent, but an increase from 1,000 to 2,000 only decrease errors from 1.6 percent to 1.1 percent (De Vaus, 2002; Neuman, 2003). Many survey companies limit their samples to 2,000 since beyond this point the extra cost is not worth in terms of accuracy (De Vaus, 2002).

A required sample size for the research relies on four factors: (1) the degree of accuracy required for the sample, (2) the extent to which there is variability or diversity in population, (3) the number of different variables examined simultaneously in data analysis, and (4) the constraints of resources such as time and costs (Sekaran, 2000; De Vaus, 2002; Neuman, 2003). In case that everything else is equal, larger samples are preferred when high accuracy is wanted, population has a great deal of variability, or many variables need to be simultaneously examined in the data analysis (Neuman, 2003).

Sample size also affects results when the subgroups are involved in the analysis of the data. The sample size of each subgroup is required to be determined by the size and variation within each subgroup. Unequal sample size between subgroups influences the results of analyses between subgroups, and require additional interpretation (Hair et al., 1998; Black, 1999; Neuman, 2003).

Sekaran (2000: 296) states the rules of thumb for deciding an optimal sample size as follows;

“1. Sample size larger than 30 and less than 500 are appropriate for most research. 2. Where samples are to be broken into subsamples (males/females, juniors/seniors, etc), a minimum sample size of 30 for each category is necessary. 3. In multivariate research (including multiple regression analyses), the sample size should be several times (preferably 10 times or more) as large as the number of variables in the study.”

However, concerning the sample size of each subgroup, there are other suggestions; Neuman (2003) proposes 50 cases for each subgroup, and De Vaus (2002) does at least 50 to 100 cases. As for structural equation modelling technique, one of the advanced multivariate analyses, a sample size of 200 is recommended by Hair et al. (1998).

### **A Proportionate or a Disproportionate Stratified Sampling**

With a proportionate stratified sample, the number of sample in each subgroup is allocated in proportion to the relative number of each subgroup in a sample frame. One advantage of proportionate allocation is that only the relative size of each subgroup is required to determine the number of sample in each subgroup (Churchill, 1999). An alternative way of allocation method is used for the disproportionate stratified sampling. A key premise of disproportionate stratified sampling is that with a fixed sample size, strata exhibiting more variability should be sampled more than what is proportionate to their relative size, and those strata that are very homogeneous should be sampled less than what is proportionate to their relative size (Churchill, 1999). This assumption suggests that the relative variability of each subgroup should be recognized in order to employ the disproportionate stratified sampling. However, in a real world of research, disproportionate stratified sampling can be used on the basis of rational expectation. In this context Churchill (1999: 530) states as follows;

“One can sometimes anticipate the relative homogeneity likely to exist within a stratum on the basis of past studies and experience. Sometimes the investigator may have to rely on logic and intuition in establishing sample sizes for each stratum. For example, it might reasonably be expected that large retail stores would show greater variation in sales of some product than would small stores. That is one reason that the large stores would be sampled more heavily in the Nielsen Retail Index.”

## **Considering the Non-response**

For a variety of reasons, people selected in a sample may not respond. Non-response can reduce the sample size to an unacceptable level. In order to tackle the problem of sample size caused by non-response, it is necessary to draw an initial sample up to the level that is larger than optimal level as well as to employ techniques for enhancing response rate (De Vaus, 2002). For example, if non-response rate would be expected to be fifty percent, an initial sample might be drawn up to the level that is fifty percent larger than the final sample size.

## **Decision about Initial and Final Sample size**

Judging from a rule of thumb suggested by Hair et al. (1998), this research needs to collect a final sample size of two hundred since it will employ advanced techniques (e.g., multivariate regression analysis, structural equation modelling) to analyze the data and test the hypotheses. Although it is not main object of this study to compare each subgroup with the others, it is significant to examine the characteristics of each subgroup. For the significant results of each subgroup, a final sample size of each subgroup should be above fifty.

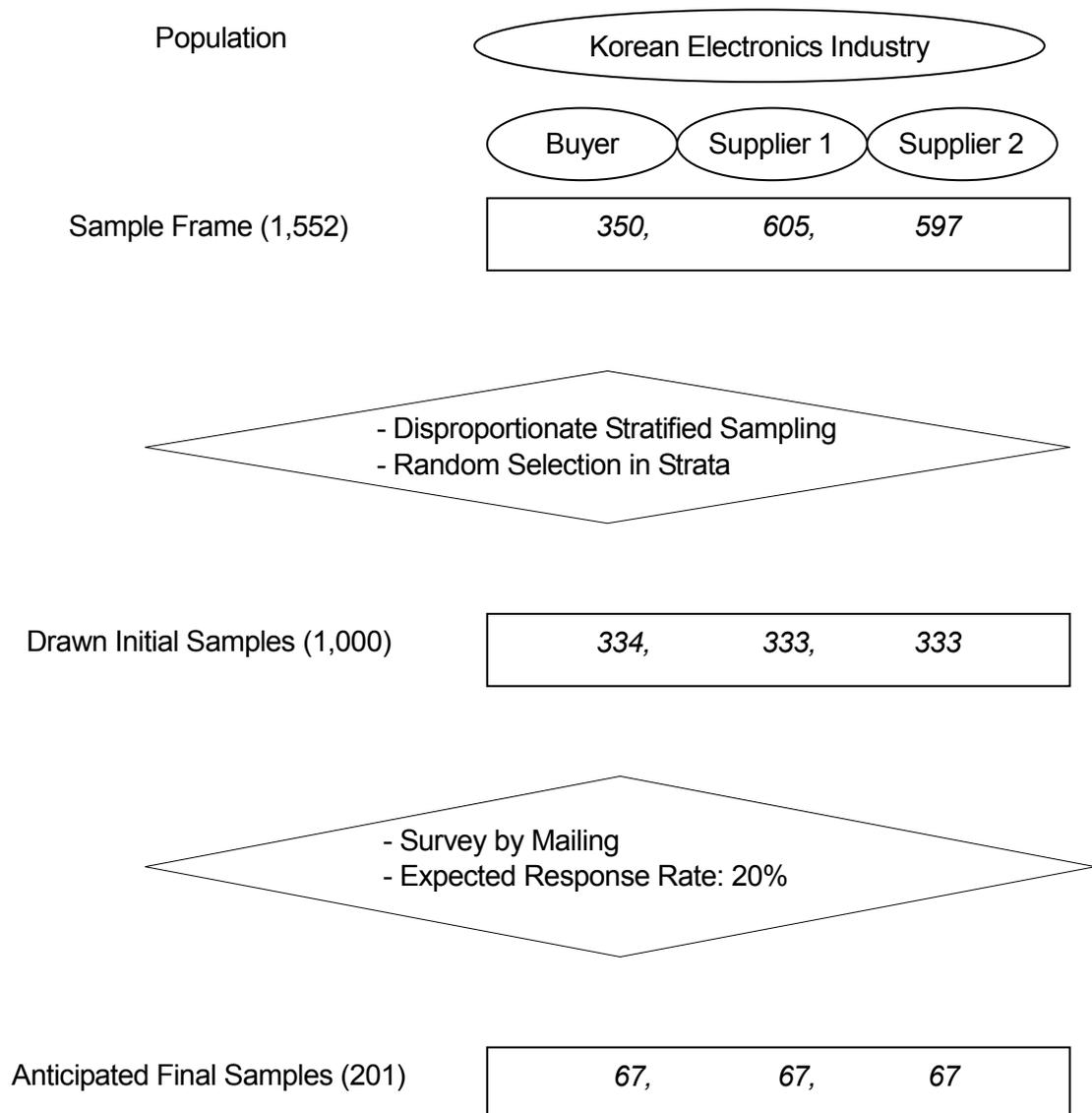
Regarding a firm size (i.e., annual sales, or number of employees), the variation of buyer subgroup is larger than those of the others (i.e., supplier 1 and supplier 2). Moreover, e-commerce has developed along established relationships between large-sized buyers and their suppliers in the Korean electronics industry. These indicate that buyer subgroup would show greater variations in the characteristics of e-commerce and buyer-supplier relationships than the other subgroups would. Accordingly, the buyer subgroup should be sampled more heavily than the others should.

Response rate is also high concern of this research. EIAK and KEIC often mark a twenty percent of collection rate when they conduct a survey to their member companies. Viewed in terms of general conditions of this study, the response rate of the survey is expected to be twenty percent.

Accordingly, as shown in figure 17 (the next page), a initial sample size for the survey should be one thousand: a initial sample size of buyer subgroup (i.e., members of EIAK) is three

hundred and thirty-four, that of supplier 1 (i.e., members of KEIC) is three hundred and thirty-three, and that of supplier 2 (i.e., members of Big Four's associations) is three hundred and thirty-three.

*Figure 17. A summary of sampling process*



## 4.4. Operationalization of Research Variables

### 4.4.1. Introduction

The integrated research model proposed in Chapter 3 consists of four sorts of variables: independent, mediating, dependent, and moderating variable. In addition, the literature review of this study suggested that utilization of e-commerce construct could be measured by three dimensions of e-commerce. In other words, utilization of e-commerce is the second-order (or, high level of) construct that represents three first-order (or, low level of) constructs comprised of technologies for e-commerce, business activities via e-commerce and penetration of e-commerce. Accordingly, as reported in table 21, the model of this research is made by one second-order construct (i.e., utilization of e-commerce) and five first-order constructs (i.e., assets specificity, environmental uncertainty, trust, dependence and buyer-supplier relationship).

*Table 21. Composition of research variables*

	First-order (low-level) Construct	Second-order (high-level) Construct
Independent Variable	Technologies for e-commerce, Business activities via e-commerce, Penetration of e-commerce	Utilization of e-commerce
Mediating Variable	Assets specificity, Trust, Dependence	
Dependent Variable	Buyer-supplier relationship	
Moderating Variable	Environmental uncertainty	

Every construct would be operationalized by multi-item questionnaire method, and every item of questionnaire would be measured by a five-point Likert scale. Most of the questions would be designed by directly drawing or slightly adapting from the previous studies in principle. However, some of questions (e.g., penetration of e-commerce) would be developed for this study because there were no exactly appropriate instruments in previous researches. Prior to operationalization, the goodness of measures (i.e., reliability and validity of measures) will be discussed so as to make sure that the questionnaire is indeed accurately measuring constructs in the research model.

#### 4.4.2. Goodness of Measures; Reliability and Validity of Measures

A questionnaire is supposed to measure research variables with accuracy. A better questionnaire leads to more accurate results, which in turn enhances scientific quality of a research. Therefore, it is necessary to evaluate the goodness of measures, which is established through measurement reliability and validity.

The *reliability* of measures indicates the extent to which the measure offers consistent measurement. The reliability of measures comprises stability and consistency as reported in table 22. According to Sekaran (2000), the ability of measures to maintain stability over time is indicative of its stability and low vulnerability to change in the situation. The stability of measures is investigated by test-retest reliability and parallel-form reliability. The internal consistency of measures is indicative of the homogeneity of the items (Sekaran, 2000). The most popular indicator of interitem consistency reliability is *Cronbach's alpha*. Four ways are recommended to increase the reliability of measures (Neuman, 2003): (1) clearly conceptualize all constructs, (2) use a precise level of measures, (3) use multiple indicators, and (4) use a pilot test.

*Table 22. Goodness of measures*

Types of Reliability and Validity	Description
Reliability	Dependable measures
Stability	Test-retest reliability, parallel-form reliability
Consistency	Interitem consistency reliability, Split-half reliability
Validity	True measures
Content validity Face validity	Does the measure adequately measure the concept? - Do the measures are true from the perspective of experts?
Criterion validity Concurrent validity Predictive validity	Does the measure differentiate in a manner that helps to predict a criterion variable? - The measure agrees with a preexisting measure. - The measure agrees with future behavior.
Construct validity Convergent validity Discriminant validity	Are multiple measures consistent? - Two instruments measuring the (same) concept correlate highly. - The measure has a low correlation with a variable that is supposed to be unrelated to this variable.

Adapted from: Sekaran (2000: 205) and Neuman (2003: 183)

As a test for the goodness of measures, measurement reliability is not sufficient but necessary condition (Sekaran, 2000). It is the concept of *validity* that instruments correctly measure the construct set out to measure. There are three types of validity tests that are commonly used to test the goodness of measures as reported in table 22 (the previous page).

*Content validity* is a test of how well the measure represent the domain of the concept being measured. Neuman (2003) states that content validity involves three steps: (1) specifies the content in a construct's definition, (2) samples from all areas of definition, and (3) develops an indicator that reflects all of the parts of the definition. *Face validity* is a judgement by the scientific community that an indicator really measures the construct (Neuman, 2003). It is considered as the most basic kind of validity and a special type of content validity; however, some researchers do not see it as a valid component of content validity (Sekaran, 2003). Criterion validity uses some standard or criterion to measure a construct accurately (Neuman, 2003). Criterion validity is composed of concurrent validity and predictive validity. Criterion validity whereby an measure is associated with a preexisting measure that is judged to be valid is defined as *concurrent validity*, while criterion validity whereby an measure predicts future events that are logically related to a construct is called as *predictive validity* (Neuman, 2003). *Construct validity* indicates how well the various measures operate in a consistent manner. This is measured by convergent validity and discriminate validity. *Convergent validity* is established when the scores by two different instruments measuring the same concept are highly correlated, and *discriminant validity* is established when two measures are predicted to be uncorrelated and empirically found to be uncorrelated (Sekaran, 2000).

Social research usually deals with the constructs that tend to be ambiguous and not directly observed, and thereby, it needs to establish well-validated and reliable measures. Alternatively, researchers often borrow the measures that have already been found to be good rather than laboriously develop their own measures. However, at times, the existing measures drawn from the previous studies may have to be adapted according to the individual researcher's own context. In this case, it would be desirable to test the adequacy of validity and reliability (Sekaran, 2000).

#### 4.4.3. Designing Questionnaire for the Survey

##### **Procedure of Designing Questionnaire**

Churchill (1999) suggested the procedure for developing a questionnaire in step-by-step fashion. The first step of his procedure is to specify what information will be sought. The second is to determine a type of questionnaire and method of administration. The third is to determine the content of individual questions. The fourth is to determine a form of response to each question. The fifth is to determine wording of each question. The sixth is to determine the sequence of questions. The seventh is to determine the physical characteristics of questionnaire. The eighth is to re-examine steps one to seven and revise if necessary. The ninth and last is to pretest questionnaire and revise if necessary. Following but simplifying the instruction of Churchill (1999), the questionnaire of this study was designed through three phases as the following.

##### **At First Phase: Determining the Content of Each Question**

At first phase, while considering the content validity of measures, the research variables are derived in the context of the research model, and the contents of individual questions that measure the variables are determined based on the literature review. As explained in the section of 4.4.1. (Introduction), there are six constructs (i.e., utilization of e-commerce, assets specificity, environmental uncertainty, trust, dependence and buyer-supplier relationship), but utilization of e-commerce construct comprises three low level of (observable) construct of e-commerce: technologies for e-commerce, business activities via e-commerce and penetration of e-commerce (observable constructs). Accordingly, the research model consists of eight observable constructs. Each construct is composed of eight to thirteen items in the questionnaire.

Utilization of e-commerce construct is measured by combining twenty-nine items that comprise three (observable) constructs. First, technologies for e-commerce construct is intended to include major network technologies (e.g., e-mail, intranet, extranet, Internet, website) and application technologies (e.g., private e-commerce systems, public eMarketplace, SCM/CRM/ERP software). Second, business activities via e-commerce construct consists of ten items of business processes that are divided into three subsections: transaction preparation, transaction completion and production support. Penetration of

e-commerce construct comprises core business sector indicators for measuring the intensity of e-commerce such as hours using e-network, period of adopting e-commerce, investment on e-commerce, trade via a proprietary network, and trade via a non-proprietary network. As reported in table 23, these were mainly developed from Hertog et al. (1999), Pattinson (2000), Chatterjee et al. (2002), Hawkins and Verhoest (2002), OECD (2002), Thatcher (2002) and Drew (2003).

*Table 23. Operationalization of utilization of e-commerce*

Questionnaire Items (measured by Likert-scale) *	Reference**
<b>Technologies for e-commerce construct</b>	
1. E-mail is widely used for communication with the partner.	Developed from T.(2002), Drew(2003)
2. Intranet is widely used for internal knowledge sharing.	Developed from T.(2002), Drew(2003)
3. Extranet is widely used for communication with the partner.	Developed from T.(2002), Drew(2003)
4. Our own Internet website is widely used for trading with the partner.	Developed from T.(2002), Drew(2003)
5. The partner's website is widely used for trading.	Developed from T.(2002), Drew(2003)
6. Private e-commerce system(EDI) is widely used for data exchange.	Developed from T.(2002)
7. Public eMarketplace system is adopted for trading with the partner.	Developed from T.(2002)
8. SCM software is used for collaboration.	Developed from T.(2002)
9. ERP software is used to collaborate with the partner.	Developed from T.(2002)
<b>Business activities via e-commerce Construct</b>	
1. E-network is used for providing (receiving) information on our policy.	Developed from C.(2002), H.&V.(2002)
2. E-network is used for providing (receiving) data on the products.	Developed from C.(2002), H.&V.(2002)
3. E-network is used for negotiating prices, quantities and terms of product.	Developed from H.&V.(2002)
4. E-network is used for placing (receiving) orders.	Developed from C.(2002), H.&V.(2002)
5. E-network is used for taking (confirming) delivery.	Developed from C.(2002), H.&V.(2002)
6. E-network is used for making (receiving) payments for product.	Developed from C.(2002), H.&V.(2002)
7. E-network is used for supporting the partner's production.	Developed from H.&V.(2002)
8. E-network is used for supporting the partner's developing new product.	Developed from H.&V.(2002)
9. E-network is used for our developing new products.	Developed from C.(2002), H.&V.(2002)
10. E-network is used for conducting market research.	Developed from C.(2002), H.&V.(2002)
<b>Penetration of e-commerce construct</b>	
1. The staff for the partner use e-network longer than other staff.	Developed from H.(1999), P.(2000)
2. Our company uses e-network longer than other buyer (supplier).	Developed from H.(1999), P.(2000)
3. We adopt e-com for the partner earlier than for other partner.	Developed from H.(1999), P.(2000)
4. Our company adopted e-com earlier than other buyer (supplier).	Developed from H.(1999), P.(2000)
5. We invest in e-com for the partner more than other partner.	Developed from H.(1999), O.(2002)
6. Our company invest in e-com more than other buyer (supplier).	Developed from H.(1999), O.(2002)
7. We trade via proprietary e-com from the partner more than other partner.	Developed from H.(1999), P.(2000), O.(2002)
8. We trade via proprietary e-com more compared to our competitor.	Developed from H.(1999), P.(2000), O.(2002)
9. We trade via non-proprietary e-com from the partner more than other partner.	Developed from H.(1999), P.(2000), O.(2002)
10. We trade via non-proprietary e-com more compared to our competitor.	Developed from H.(1999), P.(2000), O.(2002)

\* The partner means the largest, in terms of transaction volume, partner.

\*\*Abbreviations; C.: Chatterjee et al., H.: Hertog et al., H.&V.: Hawkins and Verhoest, O.: (OECD), P.: Pattinson, T.: Thatcher

Questionnaire for determinants of buyer-supplier relationship could be borrowed from the previous studies as reported in table 24. Environmental uncertainty construct is composed of eight items to measure the extent of market volatility and technological uncertainty, which were drawn from Artz and Brush (2000), Buvik and Grønhaug (2000), and Cannon et al. (2000). Assets specificity construct consists of ten items of specificity that are divided into three subsections: human assets specificity, physical assets specificity and specific organizational procedure, which were drawn from Artz and Brush (2000), Buvik and Reve (2001) and Cannon et al. (2000). Trust construct is made up of nine items that are related to concepts such as honesty, benevolence, and credibility, which were drawn from Ganesan (1994), Geyskens et al. (1996) and Doney & Cannon (1997). Dependence construct comprises eight items to measure the extent of unavailability of alternative source, size of switching cost, and degree of importance of the partner, which were drawn from Ganesan (1994), Andaleeb (1995), Geyskens et al. (1996), and Joshi and Arnold (1997).

*Table 24. Operationalization of determinant variables of B-S relationship*

Questionnaire Items (measured by Likert-scale) *	Reference**
<b>Environmental uncertainty construct</b> 1. Prices for products of the partner are difficult to predict. 2. Design trends for products of the partner are unpredictable. 3. Expected volumes for the partner are difficult to forecast. 4. Market for end products is unstable. 5. Products of the partner have a very high innovation rate. 6. Products of the partner have a short life cycle. 7. Technological development for products is difficult to predict. 8. Design for end product is frequently adjusted.	Drawn from A.&B. (2000), B.&G.(2000) A.&B. (2000), B.&G.(2000) A.&B. (2000), B.&G.(2000), A.&B. (2000), B.&G.(2000), B.&G.(2000), C.(2000) B.&G.(2000), C.(2000) B.&G.(2000), C.(2000) Developed from B.&G.(2000)
<b>Assets specificity construct</b> 1. Time/Money is committed to training of staff for the partner. 2. Just for the partner, we have recruited new staff. 3. The staff for the partner needs good knowledge of their product. 4. We made significant investment to meet demand of the partner. 5. We committed resources to adapt to standards of the partner. 6. We Invested in information system dedicated to the partner. 7. Just for the partner, we changed equipments and tools. 8. Time/Money was spent for integrating our procedure with the partner. 9. Our knowledge on operation method is dedicated to the partner. 10. Just for the partner, we have changed purchasing procedure.	Drawn from A.&B.(2000), B.&R.(2001) C.(2000) A.&B.(2000) B.&R.(2001) B.&R.(2001) B.&R.(2001) C.(2000) B.&R.(2001) B.&R.(2001) C.(2000)

\* The partner means the largest, in terms of transaction volume, partner.

\*\*Abbreviations; A.&B.: Artz & Brush, B.&G.: Buvik & Grønhaug, B.&R.: Buvik & Reve, C.: Cannon et al.,

<b>Trust construct</b> 1. The staff of the partner are open to our company. 2. The staff of the partner are honest about the problem. 3. The staff of the partner have been frank with our company. 4. In important decisions, the partner concerns our welfare. 5. We feel that the staff of the partner are like friends. 6. The partner made sacrifices for us in the past. 7. We find it unnecessary to be cautious with the partner. 8. The partner keeps promises it makes to our company. 9. The partner does not make false claims.	Drawn from Ga. (1994) Ga. (1994), D.&C.(1997) Ga. (1994), Ge.(1996) Ga. (1994), Ge.(1996), D.&C.(1997) Ga. (1994) Ga. (1994) D.&C.(1997) Ga. (1994), D.&C.(1997) Ga. (1994),
<b>Dependence construct</b> 1. To find a replacement for the partner is difficult. 2. To make up trading volume from alternatives is difficult. 3. It costs a lot for us to switch from the partner to another. 4. Switching from the partner would have negative effects on us. 5. Switching from the partner would lose a lot of investment. 6. Maintaining the partner is critical to profitability. 7. The partner is currently important to our business. 8. The partner is crucial to our future performance.	Drawn from Ga. (1994), A.(1995), J.&A.(1997) Ga. (1994), A.(1995) Ga. (1994), A.(1995), J.&A.(1997) Ga. (1994), J.&A.(1997) Ga. (1994), J.&A.(1997) Ga. (1994), A.(1995) Ga. (1994), Ge.(1996) Ga. (1994), Ge.(1996)

\* The partner means the largest, in terms of transaction volume, partner.

\*\* Abbreviations; A.: Andaleeb, D.&C.: Doney & Cannon, Ga.:Ganesan, Ge.: Geyskens et al., J.&A.: Joshi & Arnold

Subsequently, as reported in table 25, the last construct consists of thirteen items that measure the concept of buyer-supplier relationship in terms of solidarity, reciprocity, communication and continuity, which were drawn from Andaleeb (1995), Doney and Cannon (1997), Joshi and Arnold (1997), Cannon and Perreault (1999), and Artz and Brush (2000).

*Table 25. Operationalization of buyer-supplier relationship*

Questionnaire Items (measured by Likert-scale)*	Reference**
<b>Buyer-supplier relationship</b> 1. Both the partner and we actively work together. 2. Both the partner and we should work together to be successful. 3. We plan to develop our cooperation with the partner further. 4. Problems with the partner are joint responsibilities. 5. Conflicts are solved by together rather than third party. 6. Both the partner and we will not use a strong bargaining position. 7. We made ongoing adjustment to cope with circumstances. 8. We have an excellent communication with the partner. 9. We share proprietary information with the partner. 10. We regularly exchange information about market conditions. 11. Both of us expect our relationships to last for a long time. 12. A long-term relationship with the partner is important to us. 13. We focus on long-term goals in relationship with the partner.	Drawn from A.(1995) C.&P.(1999) A.&B.(2000) C.&P.(1999) C.&P.(1999) C.&P.(1999) C.&P.(1999) A.&B.(2000) A.&B.(2000), D.&C.(1997) A.&B.(2000), J.&A.(1997) Ga. (1994), J.&A.(1997) Ga. (1994), J.&A.(1997) Ga. (1994), J.&A.(1997)

\* The partner means the largest, in terms of transaction volume, partner.

\*\*Abbreviations: A.: Andaleeb, A.&B.: Artz & Brush, C.P.: Cannon &Perreault, D.&C.: Doney & Cannon, Ga.:Ganesan, J.&A.: Joshi & Arnold

Additionally, fifteen items are added in to understand the current state of e-commerce in the Korean electronics industry as reported in table 26. Among these, ten items are closed-ended questions for attitude to e-commerce (i.e. basic perception on e-commerce, drivers of e-commerce adoption and management support) and five items are open-ended questions for ratio measures of e-commerce. The former was developed from Chatterjee et al. (2002), Thatcher (2002) and Drew (2003), the latter was from Hertog et al. (1999), Pattinson (2000) and OECD (2002).

*Table 26. Questionnaire on attitude to e-commerce and ratio measure of e-commerce*

Questionnaire Items*	Reference**
<b>Attitude to e-commerce (measured by Likert-scale)</b>	
1. E-commerce causes major change in way of working.	Developed from C.(2002), T. (2002), D.(2003)
2. E-Commerce gives new opportunities for growth.	Developed from C.(2002), T. (2002), D.(2003)
3. E-commerce represents a high risk (Reverse).	Developed from C.(2002), T. (2002), D.(2003)
4. We adopt on our own initiative.	Developed from C.(2002), T. (2002)
5. We adopt to keep up with our competitors.	Developed from C.(2002), T. (2002)
6. Our partner demands to participate its network.	Developed from C.(2002), T. (2002)
7. Government incentives help to engage in e-commerce.	Developed from C.(2002), T. (2002)
8. Top management has a great interest in e-commerce.	Developed from C.(2002), T. (2002), D.(2003)
9. Our staff have enough knowledge of e-commerce.	Developed from C.(2002), T. (2002), D.(2003)
10. E-commerce is central to business strategy.	Developed from C.(2002), T. (2002), D.(2003)
<b>Ratio measures of e-commerce (open-ended question)</b>	
1 When did your company adopt e-commerce?	Developed from H.(1999), P.(2000)
2. How many hours per week do your personnel use electronic network on average?	Developed from H.(1999), P.(2000)
3. How many years has your company collaborated with the partner via electronic networks?	Developed from H.(1999), P.(2000), O.(2002)
4. How much has your company traded from the partner via proprietary e-commerce system over the last year?	Developed from H.(1999), P.(2000), O.(2002)
5. How much has your company traded from this supplier via non-proprietary e-commerce system over the last year?	Developed from H.(1999), P.(2000), O.(2002)

\* The partner means the largest, in terms of transaction volume, partner.

\*\*Abbreviations; C.: Chatterjee et al. (2002), D.: Drew (2003), H.: Hertog et al. (1999), O.: OECD (2002), P.: Pattinson (2000), T.: Thatcher (2002),

## **At Second Phase: Determining the Methods of Each Question**

### **(1) Focusing on the relation with key trading partner**

This research is basically interested in the issue at the industry level. Research questions have been raised in the context of the electronics industry. However, the questionnaire will

be asked to individual company, and thus each question was designed to be answered at the company level. As for buyer-supplier relationship, each company can keep both a cooperative relationship with one partner and an adversarial relationship with another partner at the same time. Every company generally tends to differentiate the type of relationships according to the grade of trading partner. Like buyer-supplier relationship, each company usually adopts different form for interorganizational electronic connection based on the rate of trading partner. It is possible that an individual company is highly connected with one partner using an advanced e-commerce technology (i.e., ERP software), and loosely communicated with another partner using a simple technology (i.e., e-mail) at the same time.

In order to examine the exact impact of e-commerce on buyer-supplier relationships, the same trading partner should be chosen both when measuring a type of e-commerce for a trading partner and when measuring the relationship with the partner affected by the type of commerce. It is more desirable to focus on the relations with key partners rather than auxiliary collaborates because most of companies have adopted and developed e-commerce along business with the key trading partners. Accordingly, questions in the survey will ask respondents to focus on a key supplier (or buyer), regardless of the type of purchase such as capital equipment, MRO items, etc (Carr and Pearson 1999, Kim 2000). Each respondent will be assigned to consider its largest supplier (or buyer) in terms of the volume of transaction to avoid respondents' bias when selecting a key supplier (or buyer).

## **(2) Closed Form for Research Constructs and Open-ended form for Additional Information**

Respondents are free to reply in open-ended questions, whereas they are limited to choose from a set of alternatives in closed-form of questions (Churchill, 1999). Closed-ended form of questions are adopted in this research because well-developed closed-ended form of questions are useful where a questionnaire is long, respondents' motivation is not high, or a questionnaire is self-administered rather than administered by a skilled interviewer (De Vaus, 2002). In addition, open-ended form is included in the questionnaire for additional information on the current state of e-commerce.

## **At Third Phase: Pilot test and Revision**

This will be discussed in the next section 4.5. (Pilot test).

## 4.5. Pilot Test

### 4.5.1. Introduction

Before fixing a final version of questionnaire in hypothesis-test situation, evaluating a preliminary version of questionnaire is called as *pretest or pilot test*. Pilot test sometimes refers to prior test of various aspects of research: questionnaire, sample design, research method, research hypothesis, a computer program and so on (Babbie, 1990).

However, this research limits the scope of pilot test to the questionnaire. Pilot test usually involves a small number of respondents. Main purpose of pilot test is to examine appropriateness of questions and patterns of response, thus it can improve the reliability of measurement (Baker, 1999; Sekaran, 2000; Neuman, 2003).

Pilot test is implemented by two types of pretest: preliminary pretest and formal pretest (Baker, 1999). Preliminary pretest might be done with acquaintance. Formal pretest is done with the revision of the questionnaire as a result of the preliminary pretest. The formal pretest should be done as similar as actual survey. While preliminary pretest usually focuses on the meaning of questions, formal pretest examines patterns of response as well as appropriateness of questions.

As for the principles of revising the questionnaire, Baker (1999) suggested that the following types of questions should be modified: (1) questions that many respondents skip, (2) questions that every respondent seems to answer alike, (3) open-ended questions that are answered ambiguously, (4) questions in which respondent seems to have merely circled all the same numbers without seeming to have read the items carefully.

In the same context, De Vaus (2002) recommended that individual questionnaire items should be checked over in terms of six points: variation, meaning, redundancy, scalability, non-response and acquiescent response set.

#### 4.5.2. Process of the Pilot Test

Pilot test of this study was comprised of preliminary pretest and formal pretest, as reported in table 27. The draft of survey questionnaire was preliminary pretested by senior lecturers and PhD students to clarify the meaning of questions and to match questions with appropriate constructs. This preliminary pretest had been conducted for two months, and the draft of questionnaire had repeatedly been revised.

After the preliminary pretest was done, the questionnaire needed to be translated into Korean for the formal pretest. At first, the researcher prepared the questionnaire in both Korean and English. Other Korean researcher, who lived in UK, translated the questionnaire in the opposite direction. Namely, he interpreted the Korean version of questionnaire into the English one. Then, the researcher modified the Korean version by comparing his work with the other's. In addition, another researcher who lived in Korea investigated the English version as well as the modified Korean version, and confirmed the accuracy of translation.

*Table 27. Comparison of preliminary and formal pretest*

	Preliminary Pretest	Formal Pretest
Participant	Academics	5 experts, and 25 sample companies
Focus of Test	Clarity of questions	Clarity of questions, Structure of questionnaire Pattern of response
Communication Method	Informal discussion	Internet e-mail
Language	English	Korean
Period	Two months	Three weeks

The modified Korean version of the questionnaire was sent to five academic experts and twenty-five sample companies in Korea by e-mail for formal pretest. While, as summarized in table 27, preliminary test focused on the clarity of questions, formal pretest dealt with reviewing the structure of questionnaire, the pattern of response and the clarity of questions. Five experts, who are Korean acquaintance of the researcher and major in e-commerce or interorganizational relationship, were asked to examine clarity of question and structure of questionnaire. Twenty-five companies, which belong to sample frame and had been chosen by each firm's own will, were asked to review and answer the questions in the context of practical terms.

#### 4.5.3. Results of Formal Pretest

Twenty respondents out of thirty answered the questions and provided their opinions about the questionnaire. Respondents' opinions could be summarized into three categories: (1) structure of questionnaire, (2) clarity of meaning, and (3) pattern of response. As reported in table 28, the questionnaire was remodified according to the comments of respondents.

*Table 28. Summary of respondents' comments and revision*

	Respondents' Comments	Revision
Structure of Questionnaire	<ul style="list-style-type: none"> <li>- There are too many questions in the questionnaire. It is desirable to take out less important questions and shorten the length of the questionnaire.</li> <li>- The questionnaire covers various aspects (e.g., sales, procurement, technology, strategy). It is difficult for one respondent to deal with all questions.</li> <li>- Four questions that measure 'drivers of e-commerce adoption' are not directly related with the construct of attitude to e-commerce.</li> <li>- It is necessary to ask a job-level (e.g., working-level, or managerial-level) in addition to a job-title.</li> </ul>	<ul style="list-style-type: none"> <li>- Every variable has multiple measures and every question in the questionnaire is indispensable.</li> <li>- The respondent will be asked to represent not his position but his company.</li> <li>- Four questions will be excluded from measuring the construct of attitude to e-commerce. However, they will be included in final questionnaire for understanding the current state of e-commerce in Korea</li> <li>- In the cover-letter, the respondent will be asked to be a managerial-level.</li> </ul>
Clarity of meaning	<ul style="list-style-type: none"> <li>- It is vague whether the respondent should represent his company, or his own opinion when answering questions.</li> <li>- Meaning of <i>electronic network</i> in the questionnaire is vague.</li> </ul>	<ul style="list-style-type: none"> <li>- In order to make it clear that the respondent should stand for his company, 'you' will be converted into 'your company' in the questionnaire.</li> <li>- Examples will be attached. The term will be converted into '<i>electronic network</i> (e.g. intranet, extranet, Internet, etc.)' in the questionnaire.</li> </ul>

	<ul style="list-style-type: none"> <li>- The meaning of e-commerce is ambiguous. In the forefront, e-commerce is equivalent to <i>e-business</i>. However, in the variables of e-commerce technology, activity and penetration, questions are confined to <i>electronic transaction</i> between two firms.</li> </ul>	<ul style="list-style-type: none"> <li>- The forefront questions focused on the generic circumstance of firm, however the other questions did on the specific situation between two firms. Respondents are asked to understand the concept of e-commerce in the context of each question.</li> </ul>
<p>Pattern of Response</p>	<ul style="list-style-type: none"> <li>- Responding companies preferred closed-ended questions to open-ended questions. Moreover, it is expected that most respondents will ignore or skip open-ended questions in the main survey.</li> <li>- Most responding companies use basic technologies such as e-mail and Internet. Therefore, it is almost impossible to expect varied responses to these questions.</li> </ul>	<ul style="list-style-type: none"> <li>- Open-ended questions will be included in the final questionnaire for the purpose of understanding the current state of e-commerce in Korea. However, they will be excluded from measuring the research constructs.</li> <li>- The questions are changed for focusing 'the wide use' instead of 'use'. For example, the question that 'our company uses e-mail' will be replaced by the question that 'our company widely uses e-mail.'</li> </ul>

## 4.6. Conducting the Main Survey

### 4.6.1. Introduction

After the questionnaire (see Appendix 1<sup>5</sup>) was refined through pilot test, the initial sample was drawn from the sample frame, as explained in section 4.3. (Sampling strategy), consisted of three subgroups: buyer, supplier 1, and supplier 2. Each subgroup drew its sample by simple random sampling; namely, (1) Let each firm's name enter a row in one column in *Excel software*. Each firm can be identified as the number of row., (2) Generate a random number (in Excel, *Randbetween (1, 350), (1,605) or (1,597)* ), (3) Repeat generation of random number and ignore repeated random number until getting a total of 334 (or, 333) random numbers., and (4) Select 1,000 companies according to the associated random numbers.

Survey is traditionally conducted by mail and self-administered questionnaire method (e.g. postal survey), or interview methods (e.g., face-to-face survey, telephone survey). Interview method can effectively deal with a long, complex questionnaire and has a high rate of response, but it has the disadvantages of high cost, and needs trained interviewers . On the contrary, mail and self-administered method is the cheapest and can be conducted by a single researcher, however it may result in a low response rate (Babbie, 1990; Neuman, 2003). Since the middle of 1990s, the Internet has been used for surveys. Internet surveys (e.g., e-mail survey or web-page survey) are more prone to low response rate than the others are because they require the Internet access as well as reading and writing in mail survey (De Vaus, 2002).

As the questionnaire was not complex and the researcher was constrained by resources, this research took a combined postage-mail and e-mail method. The survey was primarily conducted by the traditional way of postal survey, and e-mail was additionally sent to an individual respondent to enhance response rate by reminding the survey and facilitating participation.

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<sup>5</sup>. The final version of the questionnaire is fully described in the appendix 1.

#### 4.6.2. Procedure of the Main Survey

The questionnaire, which included the cover letter, pre-paid envelope for returning, and the recommendation letter of minister, was sent to initial sample companies by first-class postage mail. One day later, e-mail was sent to facilitate participation of the survey. Usage of e-mail, carefully written cover-letter, pre-paid envelope for returning, follow-up postcard for non-responding companies, and the recommendation letter of ministry of commerce, industry and energy (MOCIE) were employed for the purpose of enhancing response rate. In the cover letter, the researcher explained the purpose of the study, gave the name and contact point (e.g., phone number, e-mail address), and guaranteed confidentiality.

Monetary incentives were not used due to the constraint of cost, instead, a summary of the research would be provided to respondents as a token of thanks. According to De Vaus (2002), both maximizing non-material rewards such as feeling of doing something useful and treating the respondent as important as possible is more effective than material incentives. In this context, the recommendation letter from the ministry of commerce, industry and energy (MOCIE) was expected to attract the attention of respondents since it made this survey seemed to be legitimate.

The questionnaire needed to be answered by key informants who were in charge of electronic commerce and interfirm relationship in each company. The postage mail was sent to the specific name of CEO. The name of CEO was designated as the recipient of the first-class postage mail. Key informants were illustrated by examples such as directors of purchasing in buying companies or marketing in supplying companies in the cover letter.

Two well-skilled researchers in the KIET (Korean Institute for Industrial Economy and Trade) conducted the practical tasks of postal survey (e.g., printing the questionnaires, sending them by post, and collecting them later) on behalf of the researcher. The role of them was strictly confined to the area of data collection. In other words, they were not involved in the data analysis procedure.

In sum, the procedure of the main survey is summarized in figure 18 (the next page).

*Figure 18. Procedure of the main survey*

Time	Main Action
10 <sup>th</sup> May	The Questionnaire was refined. - The questionnaire had been revised through pilot test.
15 <sup>th</sup> May	Initial sample was drawn from sample Frame. - 1,000 sample companies were drawn from sample frame. - Each subgroup draw its samples by simple random sampling.
	
02 <sup>nd</sup> June	The Questionnaires were sent by first-class postage mail. - Cover letter, pre-paid returning envelope were included. - The recommendation letter of Minister was attached.
03 <sup>rd</sup> June	E-mail was sent to facilitate respondents' participation on the survey. - Individual e-mail was sent to individual staff or CEO of sample companies. - The questionnaire was attached to the e-mail for reference.
	
22 <sup>nd</sup> June	First Due Date of the Survey - For three weeks, 144 companies replied.
25 <sup>th</sup> June	Reminder postcard was sent to non-responding companies.
26 <sup>th</sup> June	E-mail was sent again for reminding. - The questionnaire was also attached to e-mail for reference.
	
23 <sup>rd</sup> July	Final Due Date of the Survey - For seven weeks, a total of 232 companies replied.

#### 4.6.3. Results of Data Collection

When the last response arrived in late July 2003, the researcher had finally accumulated two hundred and thirty-two responses. Among these, twenty-three responses were not appropriate for analysis because they had significant missing values. So, they were removed from the analysis. The final two hundred and nine sample companies consisted of seventy-three from buyer subgroup (21.8% of response rate), sixty from supplier 1 subgroup (18.0% of response rate), and seventy-six from supplier 2 subgroup (22.8 % of response rate) as reported in table 29 (the next page).

Similar size of response rate among three subgroups leads to the result that three subgroups have approximately similar weight in the final sample; namely, 35 % of the samples belong to buyer subgroup, 29 % do to supplier 1, and 36 % do to supplier 2.

*Table 29. Results of data-collection*

Subgroup	Sample Frame (No. of firms)	Initial Sample (No. of firms)	Final Sample		
			No. of firms	Response rate	Composition
Total	1,552	1,000	209	20.9%	100%
Buyer (members of EIAK)	350	334	73	21.8%	35%
Supplier 1 (members of KEIC)	605	333	60	18.0%	29%
Supplier 2 (members of Big Four)	597	333	76	22.8%	36%

Overall response rate is considered to be one of guides to representativeness of sample respondents (Babbie, 1990). The higher response rate the researcher achieves, the less chance of significant bias the sample has. A response rate of more than fifty percent is generally preferred for analysis.

However, overall response rate of twenty-one percent, of this survey, can be considered to be acceptable compared to the former empirical studies reported in table 30 (Angeles and Nath, 2000).

*Table 30. Examples of self-administered mail survey response rate*

Author	Research topic (Sample frame)	Response rate (No. of samples)
Angels & Nath (2000)	EDI partner selection in customer-supplier relationship (National association of purchasing management, US)	8% (152)
Nakayama (2000)	e-Commerce and firm bargaining power shift (Uniform code council EDI member directory, US)	18% (185)
Iskandar et al. (2001)	Adoption of EDI and the role of buyer-supplier relationship (Six large suppliers and their partners in auto industry, US)	22% (103)
Park et al. (2001)	Quality management and buyer's supplier rating (Suppliers of a major Korean automotive assembler, Korea)	24% (121)

#### **4.7. Summary**

(1) Viewed in terms of the nature, this study comes under basic research. Judging from the goal of this research, a descriptive characteristic is more dominant than exploratory or explanatory one, and a cross-sectional approach is more effective than longitudinal one. These suggest that the survey technique is the most appropriate as a data-collection method of this study.

(2) The Korean electronics industry is defined as the population of this study. The sample frame is made up by combining main associations in the Korean electronics industry. As the sample frame is split into three subgroups (i.e., 350 members of EIAK, 605 members of KEIC, and 597 members of Big Four's suppliers associations), this study adopts stratified sampling as a sampling method.

(3) This research needs to collect a final sample size of two hundred because it will employ an advanced techniques (e.g., structural equation modelling) to test the hypotheses. The response rate is expected to be twenty percent. Accordingly, an initial sample size for the survey should be one thousand: that of buyer subgroup is 334, that of supplier 1 is 333, and that of supplier 2 is 333.

(4) Every construct is operationalized by multi-scaling questionnaire method, and each item of the questionnaire is measured by a five-point Likert scale. Most questionnaire items are principally designed by directly drawing or slightly adapting from the previous studies, whereas many e-commerce related items are developed for this study because there was no exactly appropriate measure.

(5) The draft of survey questionnaire was preliminary pretested by senior lecturers and PhD students for clarifying the meaning of questions and matching questions with appropriate constructs. Subsequently, five experts and twenty-five companies in Korea participated in the formal pretest and reviewed the questionnaire in the context of practical terms. The questionnaire was revised according to the comments of respondents.

(6) The questionnaire was sent to initial sample companies by first-class postage mail, which included a cover letter, a number of questions, pre-paid envelope for returning, and the recommendation letter of Minister. One-day later, e-mail was sent to facilitate the participation of respondents. For six weeks, the researcher had finally accumulated two hundred and nine responses. Overall response rate of twenty-one percent can be considered as acceptable compared to the previous empirical studies.

## **CHAPTER 5. DATA ANALYSIS**

### **5.1. Introduction**

As described in the chapter 4, the survey finally gathered a total of two hundred and nine responses, which were converted into numerical data. It is time for the researcher to analyze the data for interpreting underlying meanings. This chapter consists of six sections: (1) arranging data ready for analysis, (2) descriptive statistics, (3) ANOVA (analysis of variance) for independence test, (4) factor analysis, (5) new reduced measure, and (6) revising the research model.

At first, problem of missing value will be handled to find an alternative to missing value, non-response bias will be conducted to check representativeness of the data, and general profiles of sample companies will be examined to understand the characteristics of samples.

Genuine analysis will commence with calculating descriptive statistics (e.g., mean value, ranking, and standard deviation) with regard to every item in the questionnaire, which will show the current state of e-commerce and buyer-supplier relationship. ANOVA will be followed to test the independence of three subgroups and to amalgamate them. Based on the results of ANOVA, factor analysis will be employed to discover an underlying structure in the data and reduce complex set of variables to a smaller set of factors.

Reflecting the results of factor analysis, the researcher will create new reduced measures. The reliability and validity of new measures will be examined because they will be used for subsequent inferential analyses. Before the hypotheses testing, the research model will be revised in response to the introduction of new reduced measures.

## **5.2. Arranging Data Ready for Analysis**

### **5.2.1. Handling a Problem of Missing Value**

#### **Missing Values in the Final Sample**

In a self-administered questionnaire survey, every respondent does not fill in every item in a questionnaire. Some values are usually missing because a respondent does not understand the meaning of question, does not know the correct answer, simply avoids a specific question, or skips by chance. If a substantial number of questions have been left unanswered, it is desirable to throw the questionnaire. However, if only two or three items are left blank in a questionnaire, a decision must be made about how these missing values are to be handled (Sekaran, 2000).

As explained in the section 4.6.3. (Results of data collection), two hundred and thirty-two questionnaires were returned in the survey. Among these, a total of twenty-three responses were initially removed because they had unacceptably poor entries. For example, some responses did not answer to any items on general profile of the responding companies, or some responses left more than ten items without filling in. These were finally left out two hundred and nine of samples for analyzing the data.

There are some missing values, even if not critical, in two hundred and nine samples. At first, the survey asked general information of company and respondent, which consists of six items: name of company, annual sales, number of full-time employees, number of years in operation, type of ownership structure, and job title of respondent. There were no missing value for two items (i.e., annual sales, number of full-time employees), one missing value for two items (i.e., number of years in operation, ownerships structure), and two missing values for one item (name of company). This low rate of missing could be achieved because ownership structure was asked by closed-end question, and other four items (annual sales, full-time employees, years in operation, and name of company) were completed by searching the Internet homepage of responding company. However, there were nine missing values for respondent's job title. This result shows respondents' preference for anonymity.

Second, as seen in table 31, there were five items of open-ended questions to identify the current state of e-commerce. These items were just made for the informative purpose, and not included in measuring the research constructs. Against the expectation, many respondents left these questions unanswered. It was regarded that a great deal of missing values, first of all, were caused by respondents' refusal to open-ended question. Missing values also came from respondents' inability to answer because, for example, their companies did not have appropriate data.

*Table 31. Missing data for information of e-commerce*

Questions	Missing Rate
1. When did your company adopt e-commerce?	17.2 %
2. How many hours per week do your personnel use e-network on average?	8.6 %
3. How many years has your company collaborated with the partner via e-networks?	17.2 %
4. How much has your company purchased from the partner via proprietary e-commerce system (e.g., Van-EDI) over the last 12 months?	33.5 %
5. How much has your company purchased from this supplier via non-proprietary e-commerce system (e.g., Electropia) over the last 12 months?	39.7 %

Third, there were a total of twenty-four missing values pertaining to the questionnaire items that measure research constructs. Unlike those of items that measure general profile of company and information of e-commerce, missing values of the items that directly measure the research constructs should be carefully dealt with. Compared to the total number of values, missing values may be not an issue. The ratio of the number of missing values over the number of total values is below 0.2 percent. In addition, missing values are spread across questionnaire items. It is difficult to refer missing to selective loss such as refusal or inability to respond. However, it is necessary to pay attention to the fact that more than eight percent of total cases in data have missing values.

### **Alternative for Handling Missing Data**

Dropping, at least, may be a solution for five items that measured by open-ended question. This is no impact on hypothesis test because dropped items do not belong to research constructs that consist of the research model. However, if these items were excluded from analysis, there remain no ratio measures on e-commerce.

Deleting cases, (e.g., listwise deletion of missing data<sup>6</sup> or, pairwise deletion of missing data<sup>7</sup>), can be a good solution for the items that measure research constructs. However, it needs the assumption of missing completely at random (MCAR). In this survey, a listwise deletion (LD) of cases would reduce the size of data by 8.1%, and thus significantly reduce the power of dataset.

Alternatively, instead of deleting cases, missing values can be replaced by statistically produced values. There are many kinds of statistical method for replacing missing values (Olinsky et al., 2003): MS (mean substitution), GMS (group mean substitution), IR (imputation by regression), SEMA (structural equation modelling approach), Hot-deck imputation, EM (expectation maximization), FIML (full information maximum likelihood), and MI (multiple imputation). Among these, this research would employ the method of mean substitution (MS) for multivariate analysis such as factor analysis, regression analysis or structural equation modelling technique. In MS, the mean value of variable for all existing values is calculated and substituted for all cases of a missing value for that variable (Olinsky et al., 2003).

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<sup>6</sup> Listwise deletion (LD) is the method that simply excludes an entire data of a case from the data analysis when at least one data of the case is missing. This can reduce the size of the dataset drastically.

<sup>7</sup> PD (Pairwise deletion) is the method that allows the case to remain in the analysis if the pair of variable being referenced have complete data for that case.

## 5.2.2. Non-Response Bias Check

### Representativeness of the Sample

For the purpose of generalizing the results of this research, it is important that the sample is a representative of the sample frame. This study drew the initial sample by following the probability sampling method that is considered as the surest way of achieving representativeness of the sample (De Vaus , 2002). However, non-response in the survey can create both reduction of sample size and bias. The reduction of sample size in this research did not matter since the final sample size and response rate were acceptable. Accordingly, in this section, non-response bias would be discussed.

### A Method to check Non-Response Bias

Non-response bias occurs when answers of survey respondents (i.e., final sample) do not accurately represent potential respondents (i.e., initial sample) to whom the survey mail was sent. One method to check non-response bias is to divide the final sample into two subgroups according to the responding time, and compare the answers of two subgroups: namely, early (i.e., first contact) versus late (i.e., follow-up contact) respondents. If there is no statistically significant difference between two subgroups, then it can be supposed that non-response bias is not evident in the research (Churchill, 1999; Carter, 2000; White and Johnson, 2001). A key assumption of this method is that non respondents are more like late respondents than early respondents.

*Table 32. Date of collection: early vs. late respondents*

	Period	Frequency	Percent	Cumulative Percent
Early (before reminder)	3 weeks	123	58.9	58.9
Late (after reminder)	4 weeks	86	41.1	100.0
Total	7 weeks	209	100.0	

In this research, three weeks after the initial questionnaire was sent out a reminder postcard was followed-up. Accordingly, the respondents' replies have been split into two groups on the basis of date of receipt: before reminder versus after reminder. As reported in table 32, fifty-nine percent of respondents come under the earlier (or, before reminder) subgroup, and forty-one percent of them fall under the later (or, after reminder) subgroup.

Chi-square test is appropriate to compare each set of groups regarding demographics such as annual sales or the number of employees. One-way ANOVA test or nonparametric test such as Mann-Whitney test is appropriate to compare each set of groups regarding the key research variables (Carter 2000, White and Johnson 2001).

### Chi-Square Test: Regarding Firm Size

Chi-square test is conducted to compare each set of groups regarding firm size. As for firm size (i.e., number of full-time employees<sup>8</sup>), two groups: namely, early (before reminder) and late (after reminder) respondents, are distributed as reported in table 33.

*Table 33. Crosstabulation - date of receipt vs. No. of employees*

		No. of employees*			Total
		Small size	Medium size	Large size	
Date of receipt	Before reminder	40	57	26	123
	After reminder	28	43	15	86
Total		68	100	41	209

\* According to the 'Framework Act on Small- and Medium-sized Enterprises' of Korea, No. of employees is divided into three subgroups: Small (1-49), Medium (50-299) and large (300- ).

The statement of the null and alternative hypotheses for Chi-square test for independence between date of receipt and No. of employees is;

*Ho: There is no relation between date of receipt and No. of employees.*

*Ha: There is a relation between date of receipt and No. of employees.*

Like table 34, Chi-Square value for the test is 0.494, and *p* value is 0.781. Accordingly, null hypothesis would not be rejected at the significance level of 0.05, and there is no statistically significant difference between early and late respondents regarding distribution of No. of employees.

*Table 34. Chi-square statistics for non-response bias*

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	<sup>a</sup> .494	2	.781
N of Valid Cases	209		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.87.

<sup>8</sup> The number of full-time employees is chosen as it is generally considered as the most representative variable among many characteristics of demographics in the Korean electronics industry.

## Mann-Whitney Test for Key Variables

Every variable in a survey does not usually meet the assumption of normality. Accordingly, instead of one-way ANOVA, *Mann-Whitney U test*, which makes no assumption about the distribution of the data, was conducted for comparing early and late respondents (Black, 1999).

As for thirteen variables that measure buyer-supplier relationship<sup>9</sup>, the hypotheses for the Mann-Whitney test for comparing two groups, early and late respondents, are;

$H_0$  : The means of two groups (early and late respondents) are equal regarding thirteen variables that measure buyer-supplier relationship.

$H_a$  : The means of two groups (early and late respondents) are unequal regarding thirteen variables that measure buyer-supplier relationship.

As reported in table 35, all the Mann-Whitney test statistics are bigger than 4677, and  $p$  value is bigger than 0.079. Accordingly, null hypothesis would not be rejected at the significance level of 0.05, and there is no statistically significant difference between early and late respondents regarding thirteen variables that measure buyer-supplier relationship construct.

*Table 35. Mann-Whitney test statistics for non-response bias*

Variable	Relation 1	Relation 2	Relation 3	Relation 4	Relation 5	Relation 6	Relation 7
Mann-Whitney U	5263	5370	5206	5324	4850	5033	5074
Asymp. Sig. (2-tailed)	.686	.888	.576	.898	.134	.398	.364
Variable	Relation 8	Relation 9	Relation 10	Relation 11	Relation 12	Relation 13	
Mann-Whitney U	4914	5234	5244	5306	4677	5102	
Asymp. Sig. (2-tailed)	.205	.726	.659	.761	.079	.493	

a Grouping Variable: date of receipt

In sum, the results of Chi-Square test and Mann-Whitney test show that non-response bias does not appear in the survey. This indicates that the characteristics of the final sample represent those of the sample frame in this research.

<sup>9</sup> The variables that measure buyer-supplier relationship are chosen as buyer-supplier relationship is the key construct in the research model.

### 5.2.3. General Profile of Sample Companies

#### Distribution of Sample Companies

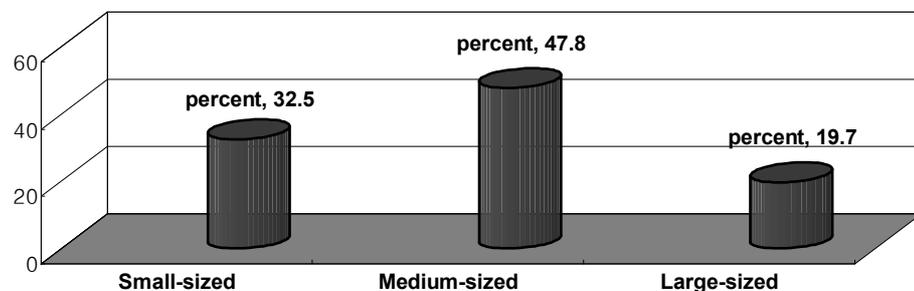
With regard to full time employees and annual sales, there are huge gaps between sample companies as reported in table 36. For example, minimum of full-time employees is just two and maximum of that is greater than forty-eight thousand. It is also notable that mean value (i.e., seven hundred and forty-four persons) is far greater than median value (i.e., ninety persons). However, as for years in operation, there are relatively small gaps between sample companies and mean value (i.e., seventeen years) is similar to median value (i.e., sixteen years).

*Table 36.. Descriptive statistics on general profile of sample companies*

	Minimum	Maximum	Mean	Median	Std. Deviation
No. of employees(persons)	2	48,421	744	90	4,081
Annual sales (mil KRW)	51	40,511,600	446,996	13,135	3,201,999
Years in operation (years)	1	48	17	16	10

Samples can be classified into three subgroups by the size of the company: (1) small-, (2) medium- and (3) large-sized company. According to the criterion from the ‘Framework Act on small and medium enterprises of Korea’ that stipulates the scope of SMEs (small and medium-sized enterprises), those that have less than 50 full-time employees are small-sized companies, those that have 50-299 full-time employees are medium-sized ones, and those that have same as or more than 300 full-time employees are large-sized ones in Korea. As reported in figure 19, medium-sized companies occupy the largest share of the samples (47.8%), followed by small-sized companies (32.5 %) and large-sized companies (19.7%).

*Figure 19. Distribution on the size of sample companies*



In addition, classified by the period of establishment, thirty percent of sample companies range from one to nine years in operation, forty percent of samples fall under from ten to twenty-four years, and twenty-nine percent of samples last longer than twenty-five years.

Concerning ownership structure, seventy percent of sample companies are standalone-type, sixteen percent of samples are partnership-type, and ten percent of samples are subsidiary-type. Four percent of sample companies fall under other types such as a company under tribunal control, a local office of foreign-company, and a mixed structure.

### **Correlation Between Ratio Measures about General Profiles**

As expected, there are significant correlations between variables of general profiles measured by ratio measures as reported in table 37. It is statistically significant that the greater No. of employees is and the larger annual sales is, the longer years in operation sample companies have. It is notable that the Pearson's correlation coefficient marks an extremely high value of 0.99 (between No. of employees and annual sales). All the sample companies belong to the Korean electronics industry in which most companies are identical at labour productivity. This characteristic of the Korean electronics industry seems to lead to such a high value of correlation coefficient.

*Table 37. Correlation coefficients between characteristics*

		No. of employees	Annual sales	Years in operation
No. of employees (N: 209)	Pearson Correlation Sig. (2-tailed)	1.000		
Annual Sales ( N: 209)	Pearson Correlation Sig. (2-tailed)	** .990 .000	1.000	
Years in operation ( N: 208)	Pearson Correlation Sig. (2-tailed)	** .272 .000	** .230 .001	1.000

\*\*Correlation is significant at the level of 0.01 (2-tailed)

### **5.3. Descriptive Statistics**

#### **5.3.1. Introduction**

This section consists of nine subsections: (1) attitude to e-commerce, (2) technologies used for e-commerce, (3) activities conducted via e-commerce, (4) penetration of e-commerce, (5) environmental uncertainty, (6) assets specificity, (7) trust, (8) dependence, and (9) buyer-supplier relationship.

In this section, descriptive statistics (e.g., mean value and standard deviation) of every item in the questionnaire will be investigated in order to identify the current state of e-commerce and buyer-supplier relationship. The results from the investigation into descriptive statistics will be discussed to extract some implications on the research.

Descriptive statistics of three subgroups will also be examined. However, comparisons of three groups will rely just on intuitive method (e.g., ranking between variables) in this section. The statistical test for the independence for three subgroups will be dealt with in the next section (5.4. ANOVA – Independence test).

### 5.3.2. Attitude to e-Commerce

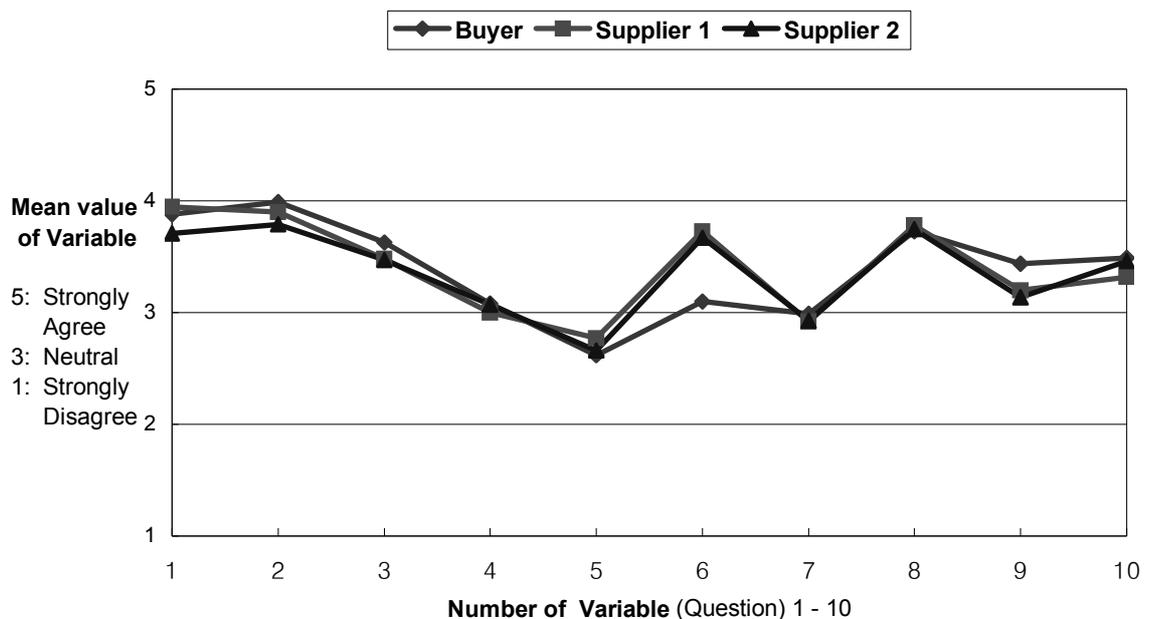
As seen in table 38, measured by five-point Likert scale, questions about firms' perception on e-commerce present greater than neutral scores (i.e., 3.0) from 3.53 (variable 3) to 3.84 (variable 1) to 3.89 (variable 2).

*Table 38. Responses on attitude to e-commerce statements*

Variable	Mean <sup>a</sup>				St. deviation			
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
(A) Basic perception on e-commerce								
1. E-commerce causes major change in way of working.	3.84	3.88	3.95	3.71	.73	.79	.67	.70
2. E-commerce gives new opportunities for growth.	3.89	3.99	3.90	3.79	.71	.77	.57	.75
3. E-commerce represents a high risk (reverse).	3.53	3.63	3.48	3.47	.80	.85	.81	.75
(B) Drivers of e-commerce adoption								
4. We adopt e-commerce on our own initiative.	3.05	3.08	3.00	3.07	.76	.84	.71	.71
5. We adopt e-commerce to keep up with our competitors.	2.67	2.62	2.77	2.66	.80	.86	.74	.80
6. Our partner demands to participate its network.	3.49	3.10	3.73	3.67	.96	.96	.84	.94
7. Government incentives help to engage in e-commerce.	2.95	2.99	2.92	2.93	.92	.96	.90	.92
(C) Management support								
8. Top management has a great interest in e-commerce.	3.75	3.73	3.78	3.75	.85	.94	.78	.83
9. Our staff have enough knowledge of e-commerce.	3.26	3.44	3.20	3.14	.82	.85	.70	.86
10. E-commerce is central to business strategy.	3.43	3.49	3.32	3.46	.78	.83	.77	.73

a. Every variable is measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 20. Means of three subgroups on attitude to e-commerce*



KOSDAQ (Korea securities dealers automated quotations, equivalent to NASDAQ in USA) Index marked 283.44 point, highest in its history, at 10<sup>th</sup> March 2000. After, so-called,

*dot.com* boom collapsed, it fell down to 51.59 at early July 2003, deadline of this survey. However, these results of the survey indicate that even though *dot.com* hype has passed in Korea, most companies still maintain an optimistic view on e-commerce.

As seen in figure 20 (the previous page), regarding drivers of e-commerce adoption, the sample companies show that they adopt e-commerce on the bases of active drivers (i.e., variable 4: its own initiative and variable 6: partner's demand) rather than passive drivers (i.e., variable 5: keeping up with competitors, variable 7: government incentives). Among four sorts of drivers, partner's demand is ranked as the highest, and followed by its own initiative, whereas keeping up competitors is ranked as the lowest. These findings suggest that most companies have adopted e-commerce to facilitate collaboration with their trading partners rather than to respond the pressure of competition. In addition, government incentives are neither appreciated nor depreciated by responding companies.

Like those on the perception of e-commerce, questionnaire items on management support (variable 8, 9, and 10) present greater than neutral score (i.e., 3.0). Among these, response on top management's interest (variable 8) is ranked as the highest, and followed by role in business strategy (variable 10) and staff's capability (variable 9). Entering into details of variable 10, nine percent of sample companies disagreed the statement of 'e-commerce is central to our business strategy', while forty-two percent of samples agreed the statement. One percent of them strongly disagreed, whereas six percent of them strongly agreed. Lastly, neutral score, neither agree nor disagree, accounted for forty-two percent of responses.

As seen in figure 20 (the previous page), an interesting aspect of the results is that only two variables out of ten showed a striking difference between three subgroups. With regard to the degree of partner's demand, supplier group (i.e., supplier 1's score is 3.73, and supplier 2's score is 3.67) presents higher score than buyer group (i.e., its score is 3.10) does, which is a statistically significant difference that will be described in the next section 5.4. (ANOVA). Conversely, regarding staff's knowledge of e-commerce in variable 9, buyer group marks higher score than supplier group does. These results may propose that buyer group initiate the development of e-commerce and supplier group follow it. However, overall scores of the respondents show that buyers and suppliers generally have similar and positive attitude to e-commerce.

### 5.3.3. Technologies used for e-Commerce

As reported in table 39 and figure 21, e-mail (variable 1) is the most widely used technology for e-commerce, followed by intranet (variable 2). There is no difference between three subgroups about the widest use of e-mail and secondly-widest use of intranet.

*Table 39. Responses on technologies for e-commerce statements*

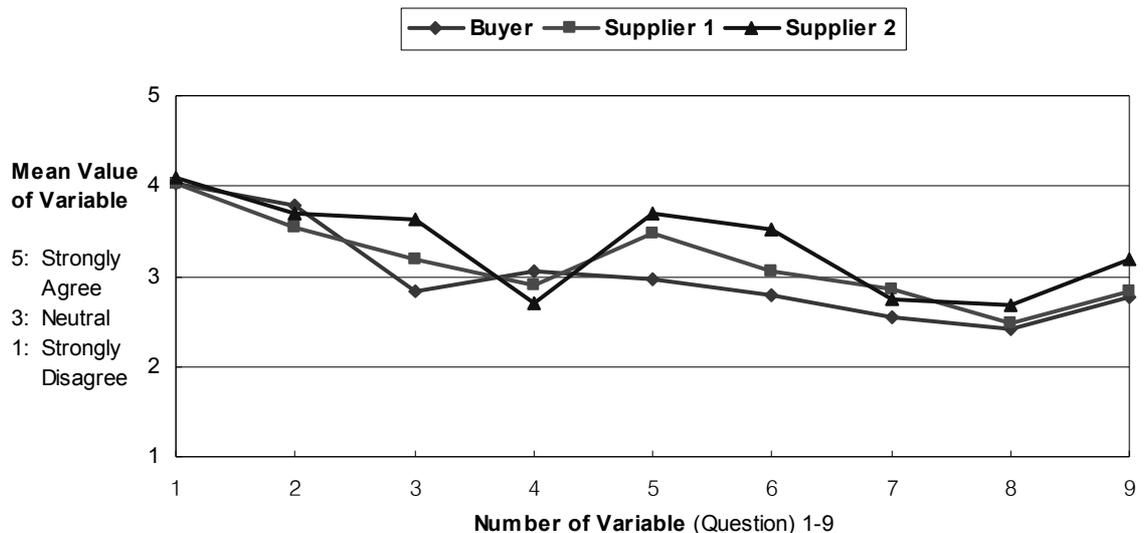
Variables for buyer (supplier) <sup>a,b</sup>	Mean <sup>c</sup>			St. deviation				
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
<b>(A) Network technology</b>								
1. E-mail is widely used for communication with the supplier (buyer).	4.05	4.03	4.03	4.09	.80	.91	.73	.75
2. Intranet is widely used for internal knowledge sharing.	3.69	3.79	3.55	3.70	1.06	1.16	1.01	.99
3. Extranet is widely used for communication with the supplier (buyer).	3.22	2.84	3.18	3.63	1.04	1.09	.96	.90
4. Our Internet website is widely used for trading with the supplier (buyer).	2.89	3.05	2.90	2.71	.94	.95	.93	.92
5. The partner's website is widely used for trading with the supplier (buyer).	3.38	2.97	3.48	3.69	.99	.97	.89	.95
<b>(B) Application technology</b>								
6. Private e-com. system is widely used for exchange with the supplier (buyer).	3.13	2.78	3.05	3.53	1.03	1.05	.99	.90
7. Public e-Marketplace system is adopted for trading with supplier (buyer).	2.70	2.55	2.85	2.74	.84	.88	.86	.78
8. SCM(or CRM) software is used to collaborate with the supplier (buyer).	2.52	2.41	2.47	2.68	.87	.92	.79	.88
9. ERP software is used to collaborate with the supplier (buyer).	2.94	2.77	2.83	3.19	1.03	1.12	.88	1.00

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 21. Means of three subgroups on technologies for e-commerce*



Responses on use of extranet (variable 3) and Internet websites (variable 4 and 5) mark lower scores than those of e-mail and intranet do, but present notable differences between buyer and supplier. Supplier group replies that it uses extranet and partner's (i.e., buyer's) website more than its own website, whereas buyer group answers that it uses its own website more than extranet and partner's (i.e., supplier's) website. These findings demonstrate that buyer's websites are used more frequently than supplier's websites are. This indicates that buyers lead the development of e-commerce in the Korean electronics industry.

As expected, the survey show that a private e-commerce system (variable 6) is used more widely than a public e-marketplace system (variable 7) is. It is also expected that application technologies such as SCM (supply chain management), CRM (customer relationship management) and ERP (enterprise resource planning) software are less widely used than network technologies such as e-mail, intranet, and extranet. Nonetheless, it is notable that variables on three out of four application technologies present smaller than neutral score. These findings may be a result of the fact that those application technologies are adopted on the basis of network technologies utilized.

It is also notable that with regard to responses on use of extranet and private e-commerce system, buyer subgroup has the lowest mean value and highest standard deviation among three subgroups, while supplier 2 subgroup has the highest mean value and lowest standard deviation. In case of use of private e-commerce system, mean value of buyer is 2.78, that of supplier 1 is 3.05, and that of supplier 2 is 3.53, whereas standard deviation of buyer is 1.05, that of supplier 1 is 0.99 and that of supplier 2 is 0.90. These need to be interpreted in the conjunction with the above finding about usage of websites. Even though buyer's websites are used more than supplier's websites are, supplier groups presents higher score than buyer group does as for mean value of the usage of private e-commerce system. These mixed findings suggest that a private e-commerce system is centered on transactions between a few large buyers and their numerous suppliers.

### 5.3.4. Activities conducted via e-Commerce

In the survey business activities conducted via electronic commerce between buyers and suppliers were split into three subsections: transaction preparation, transaction completion, and production support, as reported in table 40.

*Table 40. Responses on business activities via e-commerce statements*

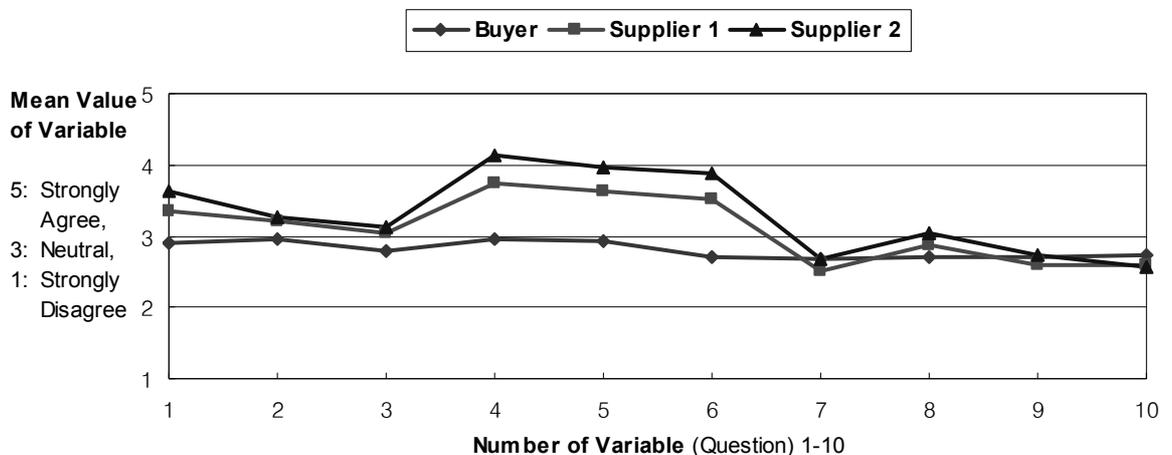
Variable for buyer (supplier) <sup>a,b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
<b>(A) Transaction Preparation - We use electronic network for</b>								
1. providing (receiving) information on procurement policy.	3.30	2.90	3.35	3.64	.89	.86	.82	.82
2. providing (receiving) data on products.	3.14	2.96	3.20	3.26	.82	.85	.84	.77
3. negotiating prices, quantities, and terms of products.	2.99	2.79	3.05	3.12	.90	.95	.91	.81
<b>(B) Transaction Completion – We use electronic network for</b>								
4. placing (receiving) orders for the supplier’s (buyer’s) products.	3.60	2.95	3.73	4.12	1.05	1.10	.88	.76
5. taking (confirming) delivery of products.	3.51	2.92	3.64	3.97	1.04	1.05	.94	.83
6. making (receiving) payments for products.	3.37	2.71	3.52	3.88	1.12	1.07	1.04	.90
<b>(C) Production Support – We use electronic network for</b>								
7. supporting the supplier’s (buyer’s) production.	2.63	2.68	2.50	2.68	.84	.86	.70	.91
8. supporting the supplier (buyer) when they develop new products.	2.88	2.70	2.87	3.05	.92	.93	.85	.93
9. collaborating with the supplier (buyer) for our own developing.	2.69	2.71	2.60	2.74	.87	.85	.78	.97
10. collaborating with the supplier (buyer) for conducting market research.	2.64	2.74	2.60	2.58	.88	.85	.84	.94

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 22. Means of three subgroups on business activities via e-commerce*



As reported in table 40 and figure 22 (the previous page), an overall aspect of responses on e-commerce activity statements is that responses on business activities for transaction (measured by variable 1, 2, 3, 4, 5, and 6) present higher scores than those for production support (measured by variable 7, 8, 9, and 10) do. Measured by five-point Likert scale, scores of variables for transaction-oriented statements in total samples range from 2.99 to 3.60, while those for production-supported statements range from 2.63 to 2.88. This finding indicates that e-commerce in electronics industry is currently at the stage of transaction implementation and has not reached to the stage of production support yet.

In addition, the survey shows that electronic network is more widely used for transaction completion (variable 4, 5, and 6) rather than transaction preparation (variable 1, 2, and 3) among transaction-oriented activities. Measured by five-point Likert scale, scores of variables for transaction preparation in total group range from 2.99 to 3.30, while those transaction completion range from 3.37 to 3.60. This result may suggest that electronic networks are used for implementing fixed form of activities (i.e., placing orders, taking delivery and making payments) more than non-fixed form of activities (i.e., providing or receiving information, or negotiating terms of products).

It is interesting that with regard to responses on transaction completion statements (variable 4,5 and 6.), three subgroups present remarkably different means and standard deviations, which are statistically significant difference that will be described in the next section 5.4. (ANOVA). It is also interesting that there is little difference between three subgroups as for usage of electronic network for production support (variable 6,7,8 and 9). This result is considered to be caused by the current state of the Korean electronics industry, and may be extended to other areas.

### 5.3.5. Penetration of e-Commerce

#### Penetration Measured by Likert Scale

As described before, penetration of e-commerce construct is measured by five-point Likert scale since all other constructs of the research model are measured by five-point Likert scale. As seen in table 41 and figure 23, most responses on e-commerce penetration statements are distributed around a neutral point, 3.0.

*Table 41. Responses on penetration of e-commerce statements*

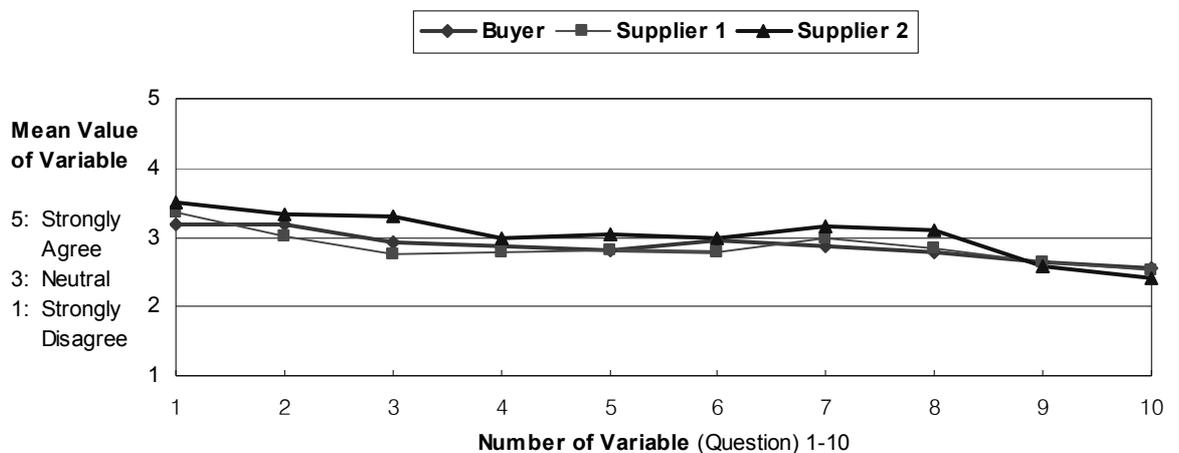
Variable for buyer (supplier) <sup>a, b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
1. The staff for the supplier (buyer) uses e-network longer than other staff	3.34	3.18	3.35	3.49	.84	.85	.75	.87
2. Our company use e-network longer than other buyer (supplier)	3.19	3.18	3.02	3.34	.85	.94	.81	.75
3. We adopted e-com. for the largest partner earlier than other partner	3.01	2.92	2.76	3.29	.85	.88	.67	.87
4. We adopted e-com. earlier than other buyer (supplier)	2.89	2.86	2.77	3.00	.79	.88	.72	.74
5. We invest in e-com. for the largest partner more than other partner	2.89	2.81	2.80	3.05	.81	.87	.77	.76
6. We invest in e-com. more than other buyer (supplier)	2.91	2.95	2.77	3.00	.82	.92	.76	.74
7. We purchase (sale) via proprietary e-com. from the largest partner more than other partner	3.01	2.88	2.98	3.17	.90	.91	.87	.91
8. We purchase (sale) via proprietary e-com. more than other buyer (supplier)	2.90	2.77	2.83	3.09	.80	.84	.80	.75
9. We purchase (sale) via non-proprietary e-com. from the largest partner more than other partner	2.62	2.63	2.63	2.59	.83	.82	.82	.85
10. We purchase (sale) via non-proprietary e-com. more than other buyer (supplier)	2.50	2.56	2.52	2.42	.76	.78	.67	.82

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The largest supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 23. Means of three subgroups on penetration of e-commerce*



Ten scores of variables range from 2.63 to 3.34. To some extent, this result may be affected by subjective perception of individual respondents because respondents were asked to compare state of their own companies with those of others. On the other hand, this finding may demonstrate that most companies consider themselves as neither a pioneer nor a laggard. In addition, it may indicate that most aspects of e-commerce go together in an individual company.

It is notable finding that most companies give negative responses on variables for usage of non-proprietary e-commerce system. Namely, variable 9 and 10 for trade via a non-proprietary e-commerce system mark 2.62 and 2.50 by each. This finding leads to the interpretation that non-proprietary e-commerce such as public e-marketplaces has not developed yet and most companies have not taken up a positive attitude to non-proprietary e-commerce in the Korean electronics industry.

### **Penetration Measured by Ratio Level Statistics**

In the survey, e-commerce penetration was investigated by two measures. The one is an ordinal (i.e., five-point Likert) scale for building a research construct as described above, the other is a ratio scale for an informative purpose, as reported in table 42.

*Table 42. Ratio statistics on penetration of e-commerce*

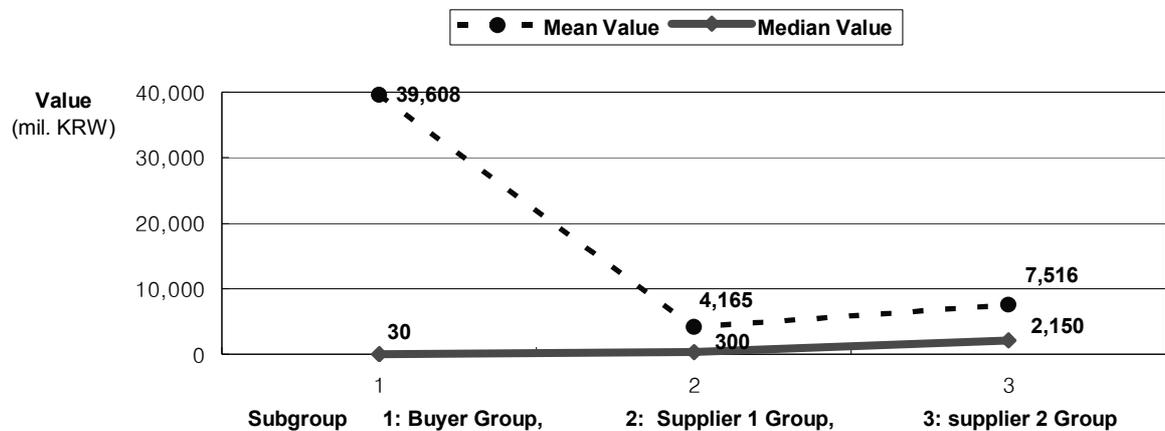
Item	No. of Cases	Mean				Median			
		Total	Buyer	Sup1	Sup2	Total	Buyer	Sup1	Sup2
The timing of e-com. adoption (years)	173	5.58	6.10	4.38	5.32	5.00	5.00	4.00	5.00
Hours using e-com. per person, week (hours)	191	8.33	8.48	7.82	8.25	5.00	6.00	5.00	5.00
Period of collaborating by e-com. (months)	173	42.70	39.98	31.88	43.97	36.00	36.00	27.00	36.00
Transaction via proprietary e-com. (mil KRW)	139	18,829	39,608	4,165	7,516	1,000	30	300	2,150
Transaction via non-proprietary e-com. (mil KRW)	126	1,366	2,463	670	736	0	0	0	0
Total	209								

Viewed in terms of mean value, a sample company adopted e-commerce system 5.58 years ago, does business using electronic network approximately for 8.33 hours per person per week, has collaborated with the largest partner via e-commerce for 42.70 months, has purchased (or, sold) from (or, to) the largest supplier (or, buyer) about KRW 18,829 million

(equivalent to GBP 10 million) for the last 12 months via proprietary e-commerce system, and has purchased (or, sold) from (or, to) the largest supplier (or, buyer) about KRW 1,336 million (equivalent to GBP 700 thousand) for the last 12 months via non-proprietary e-commerce system. It is notable that transaction volume of a proprietary commerce (i.e., KRW 18,829 million) is about fourteen times as large as that of a non-proprietary commerce (i.e., KRW 1,366 million).

It is interesting result that there is a gap between three subgroups as to transaction volume of e-commerce. It is more interesting, as seen in figure 24, there is a large gap between mean value and median value as to transaction volume, especially a huge gap in buyer subgroup. As for transaction volume via proprietary e-commerce of buyer group, mean value is KRW 39,608 million, but median value is KRW 30 million. As for transaction volume via non-proprietary e-commerce of buyer group, mean value is KRW 1,366 million, but median value is zero. These results indicate that e-commerce in the electronics industry is centered on a few large-sized companies.

*Figure 24. Means of three subgroups on trade volume of a proprietary e-commerce*



### 5.3.6. Environmental Uncertainty

It was expected that sample companies would generally give low level of scores to the environmental uncertainty statements since the survey was carried out in the Korean electronics industry, which has arrived at maturity stage.

*Table 43. Responses on environmental uncertainty statements*

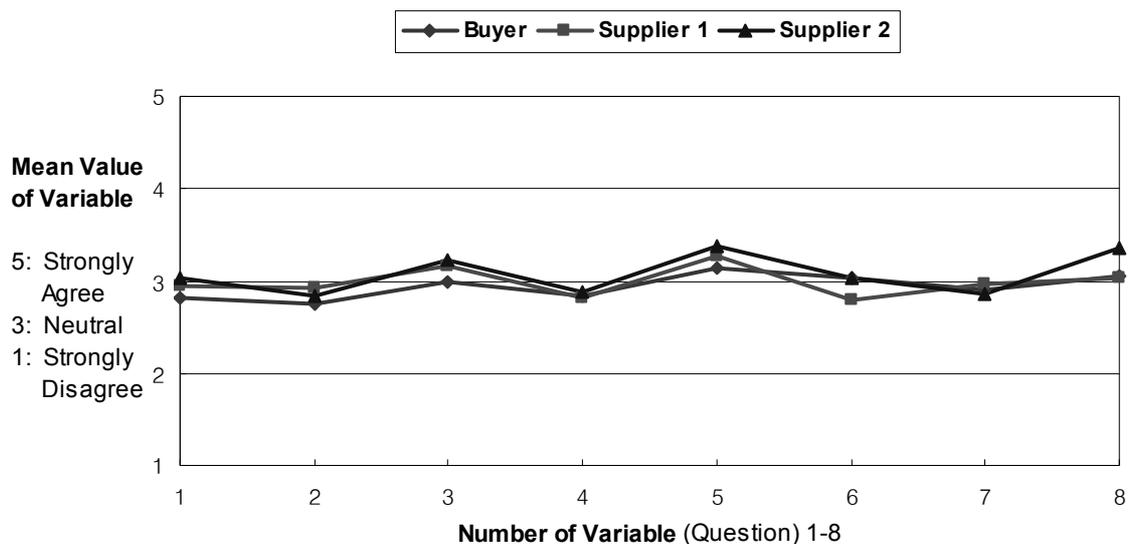
Variable for buyer (supplier) <sup>a, b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buyer	Sup1	Sup2	Total	Buyer	Sup1	Sup2
<b>(A) Market volatility</b>								
1. Prices of products of the supplier (buyer) are difficult to predict.	2.93	2.81	2.95	3.03	.83	.86	.72	.87
2. Design trends for products of the supplier (buyer) are not predictable.	2.83	2.75	2.93	2.83	.80	.83	.73	.83
3. Expected volumes for the supplier (buyer) are difficult to forecast.	3.12	2.99	3.17	3.22	.82	.85	.69	.88
4. Market for end products that use the supplier's (buyer's) is unstable.	2.85	2.83	2.82	2.88	.91	.88	.91	.95
<b>(B) Technological Dynamism</b>								
5. Products of the supplier (buyer) have a very high innovation rate.	3.26	3.14	3.27	3.38	.72	.69	.68	.76
6. Products of the supplier (buyer) have a short life cycle.	2.97	3.04	2.80	3.04	.80	.87	.65	.82
7. Technological development for products of the supplier (buyer) is difficult to predict.	2.90	2.90	2.97	2.86	.81	.81	.76	.84
8. Design for end product that use the supplier's (buyer's) products is frequently adjusted.	3.16	3.05	3.03	3.36	.74	.74	.73	.72

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 25. Means of three subgroups on environmental uncertainty*



However, as reported in table 43 and figure 25 (the previous page), an overall aspect of response is that sample companies regard market environment as neither uncertain nor certain. Namely, measured by five-point Likert scale, sample companies give nearly neutral point to the statements on market volatility (variable 1, 2, 3 and 4) and technological dynamism (variable 5, 6, 7 and 8). These results show that most aspects of environmental uncertainty go together in an individual sample company. It also indicates that sample companies take an ambivalent attitude toward market volatility and technological dynamism.

It is also notable that there is no statistically significant difference between means of three subgroups except mean of variable 8. As for design adjustment (variable 8), buyer's, supplier 1's and supplier 2' scores are 3.05, 3.03, and 3.36 respectively.

#### 5.3.7. Assets Specificity

In the survey, assets specificity was measured by three dimensions: human assets, physical assets and organizational procedure. Measured by five-point Likert scale, scores of ten variables in total group range from 2.87 to 3.69 as reported in table 44 and figure 26 (the next page). This suggests that assets of sample companies be considered to be somewhat specific to their relations with the partner.

Regarding human and physical assets specificity, sample companies present somewhat high scores. They give 3.69 point on the statement of personnel's knowledge specificity (variable 3), 3.31 point on significant investment specificity (variable 4), and 3.32 point on specific standard adaptation (variable 5). As for specific organization procedure, sample companies give almost neutral level of scores to most statements They mark 3.02 point on the statement of integrating procedure with the specific partner (variable 8), 2.87 point on operation method specificity (variable 9), and 2.96 point on purchasing procedure specificity (variable 10).

As outstanding in figure 26 (the next page), three subgroups show significant difference with regard to means of four, out of ten, variables: significant investment (variable 4), standard adaptation (variable 5), information system (variable 6) and integrating procedure (variable 8). In addition, throughout these four variables, supplier 2 subgroup presents the highest

mean among three subgroups, followed by supplier 1 subgroup and buyer subgroup. This finding demonstrates that supplier has generally had more specific assets than buyer has.

*Table 44. Responses on assets specificity statements*

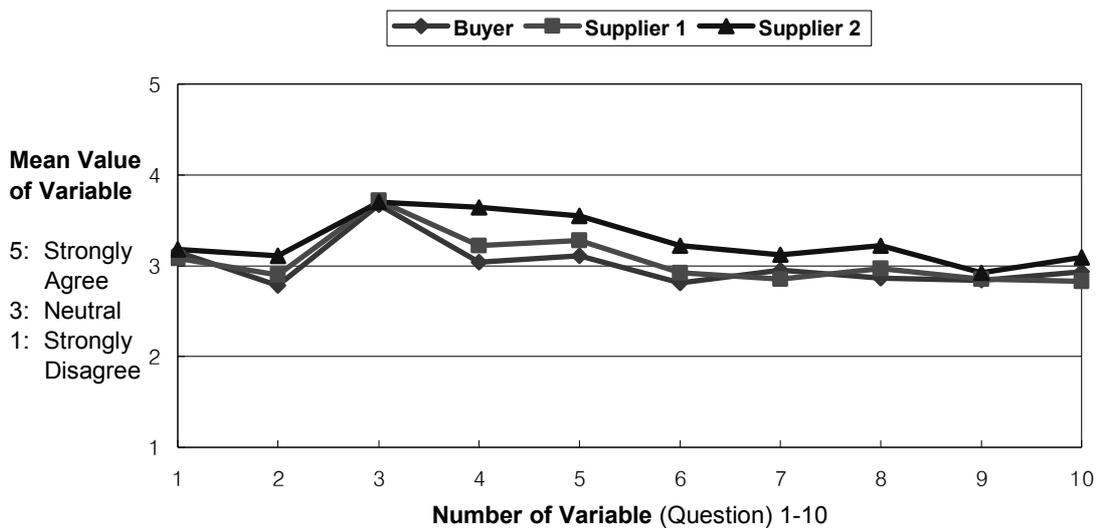
Variable for buyer (supplier) <sup>a, b</sup>	Mean <sup>c</sup>				St. deviation				
	Total	Buyer	Sup1	Sup2	Total	Buy	S.1	S.2	
<b>(A) Human Assets Specificity</b>									
1. A lot of time/money is committed to training of staff for the supplier (buyer).	3.14	3.15	3.08	3.18	.88	.93	.76	.92	
2. Just for the supplier (buyer), we have recruited new staff.	2.93	2.78	2.90	3.11	.84	.78	.85	.85	
3. The staff for the supplier (buyer) needs good knowledge of their product.	3.69	3.67	3.72	3.70	.85	.94	.78	.83	
<b>(B) Physical Assets Specificity</b>									
4. We made significant investment to meet demand of the supplier (buyer).	3.31	3.04	3.22	3.64	.84	.78	.80	.81	
5. We committed resources to adapt to standards of the supplier (buyer).	3.32	3.11	3.28	3.55	.86	.82	.88	.82	
6. We invested in information system dedicated to the supplier (buyer).	2.99	2.81	2.92	3.22	.90	.81	.92	.94	
7. Just for the supplier (buyer), we changed equipments and tools.	2.98	2.95	2.85	3.12	.87	.91	.75	.90	
<b>(C) Specific Organizational Procedure</b>									
8. Time/Money was spent for integrating our procedure with the supplier (buyer).	3.02	2.86	2.97	3.22	.86	.93	.82	.81	
9. Our knowledge on operation method is dedicated to the supplier (buyer).	2.87	2.84	2.85	2.92	.93	.88	.92	.99	
10. Just for the supplier (buyer), we have changed purchasing (selling) procedure.	2.96	2.93	2.83	3.09	.85	.87	.80	.85	

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 26. Means of three subgroups on assets specificity*



### 5.3.8. Trust

In the survey, trust was measured by three dimensions: honesty, benevolence and credibility.

*Table 45. Responses on trust statements*

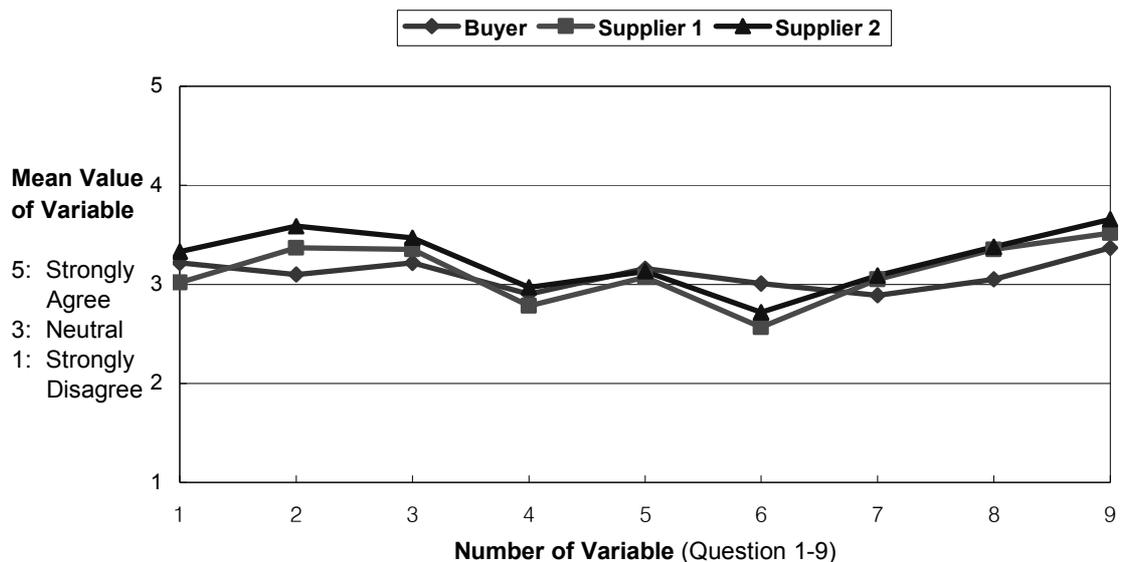
Variable for buyer (supplier) <sup>a,b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
<b>(A) Honesty</b>								
1. The staff of the supplier (buyer) are open to our company.	3.20	3.22	3.02	3.33	.75	.75	.67	.79
2. The staff of the supplier (buyer) are honest about the problem.	3.35	3.10	3.37	3.59	.73	.73	.68	.69
3. The staff of the supplier (buyer) have been frank with our company.	3.35	3.22	3.35	3.47	.71	.65	.79	.68
<b>(B) Benevolence</b>								
4. In important decisions, the supplier (buyer) concerns our welfare.	2.89	2.90	2.78	2.97	.79	.73	.80	.84
5. We feel that the staff of the supplier (buyer) are like friends.	3.12	3.16	3.07	3.13	.78	.70	.86	.80
6. The supplier (buyer) made sacrifices for us in the past.	2.78	3.01	2.57	2.72	.80	.75	.74	.84
<b>(C) Credibility</b>								
7. We find it unnecessary to be cautious with the supplier (buyer).	3.01	2.89	3.05	3.09	.79	.67	.85	.85
8. The supplier (buyer) keeps promises it makes to our company.	3.25	3.05	3.35	3.38	.74	.68	.77	.74
9. The supplier (buyer) does not make false claims.	3.52	3.37	3.52	3.66	.76	.69	.87	.72

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 27. Means of three subgroups on trust*



It was expected that a high level of trust would be confirmed by the survey since trust is usually most appreciated value in terms of Korean business culture. However, an overall

aspect of responses suggests that sample companies do not build a high level of trust against expectation even though seven out of nine variables present scores above a neutral point. Scores of nine variables range from 2.89 to 3.52 in total group, as reported in table 45 and figure 27 (the previous page).

Concerning honesty dimension of trust, sample companies present somewhat high level of scores: 3.20, 3.35 and 3.35 point on the statement of openness of the partner (variable 1), honest about the problem (variable 2), and frankness of the partner (variable 3) respectively. Sample companies give lower scores to benevolence dimension than honesty dimension: 2.89 point on the statement of concerning welfare (variable 4), 3.12 point on being like friends (variable 5), and 2.78 point on making sacrifices for the partner. As for credibility dimension of trust, like honesty dimension, sample companies show somewhat high level of scores: 3.01 point on the statement of being cautious (variable 7), 3.25 point on keeping promises (variable 8), and 3.52 point on not making false claims (variable 9). In sum, sample companies show somewhat positive attitude to the statements of honesty (i.e., openness, honesty, and frankness) and credibility (i.e., caution, promise, and claim). However, they relatively present somewhat negative attitude to the statements of benevolence (i.e., welfare, friendship, and sacrifice). These findings indicate that trust in the electronics industry is confined to the level of honesty and credibility, and has not developed into the level of benevolence.

It is notable that three subgroups show significant difference with regard to means of three variables: being honest about the problem (variable 2), making sacrifice for the partner (variable 6) and keeping promise (variable 8). It is interesting that buyer subgroup marks the lowest score on variable 2 and variable 8 while it marks the highest score on variable 6 among three subgroups. These results suggest that suppliers place more weights on trust in relationship than buyers do, and suppliers are more prone to make sacrifice for relation with their partner rather than buyers are.

### 5.3.9. Dependence

In the survey, dependence was measured by three dimensions: unavailability of alternative source, switching cost, and importance of the partner.

*Table 46. Responses on dependence statements*

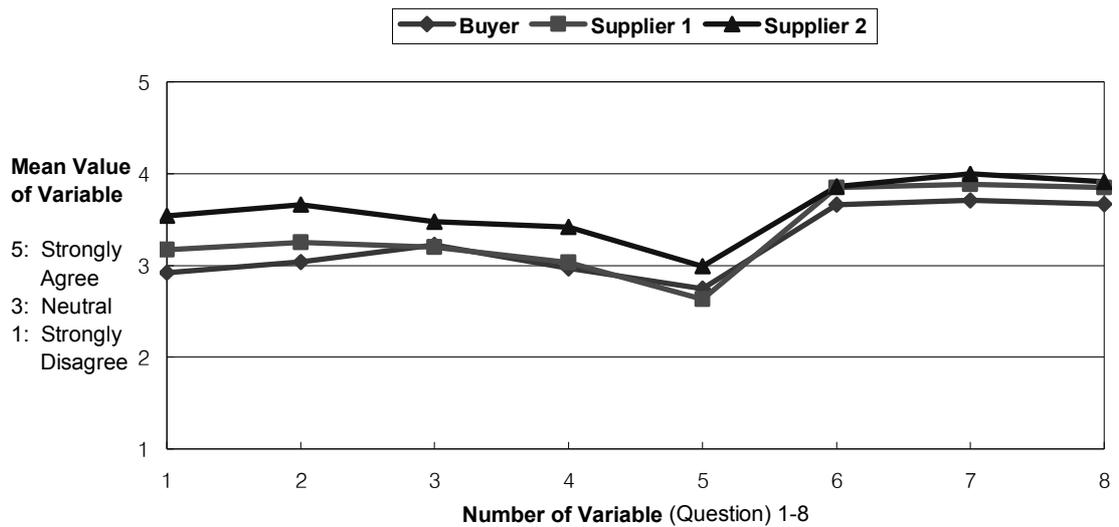
Variable for buyer (supplier) <sup>a, b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buye	Sup1	Sup2	Total	Buye	Sup1	Sup2
<b>(A) Unavailability of Alternative Source</b>								
1. To find a replacement for the supplier (buyer) is difficult.	3.22	2.92	3.17	3.54	.85	.77	.92	.75
2. To make up purchase volume from alternatives is difficult.	3.33	3.04	3.25	3.66	.83	.77	.83	.79
<b>(B) Switching Cost</b>								
3. It costs a lot for us to switch from the supplier (buyer) to another.	3.31	3.22	3.20	3.48	.81	.71	.84	.86
4. Switching from the supplier (buyer) would have negative effects on us.	3.15	2.97	3.03	3.42	.86	.78	.90	.85
5. Switching from the supplier (buyer) would lose a lot of investment.	2.80	2.75	2.63	2.99	.92	.81	.95	.97
<b>(C) Importance of the partner</b>								
6. Maintaining the supplier (buyer) is critical to profitability of ours.	3.78	3.66	3.85	3.86	.67	.65	.68	.66
7. The supplier (buyer) is currently important to our business.	3.87	3.71	3.88	4.00	.66	.63	.64	.69
8. The supplier (buyer) is crucial to our future performance.	3.81	3.67	3.85	3.91	.65	.62	.65	.67

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 28. Means of three subgroups on dependence*



As reported in table 46 and figure 28 (the previous page), an overall aspect of responses is that sample companies give somewhat high level of scores. Scores of eight variables that measure dependence range from 2.80 to 3.87, and seven out of eight variables present scores above a neutral point in total group.

As for unavailability of alternative dimension of dependence, sample companies mark 3.22 point on the statement of finding a replacement (variable 1), and 3.33 point on making up purchase volume (variable 2). With regard to switching cost dimension, sample companies mark 3.31 point on the statement of switching cost (variable 3), 3.15 point on negative effects of switching (variable 4), and 2.80 point on loss of investment (variable 5). Through five variables explained above, supplier 2 group presents the highest score among three groups, followed by supplier 1 group and buyer group. For example, regarding finding a replacement (variable 1), buyer's, supplier 1's, and supplier 2's scores are 2.92, 3.17, and 3.54 respectively. Concerning negative effects of switching (variable 5), the buyer's score is 2.97, supplier 1's is 3.03, and supplier 2's is 3.42.

With regard to importance of the partner dimension, sample companies mark 3.78 point on the statement of being critical to profitability (variable 6), 3.87 point on currently important to business (variable 7), and 3.81 point on crucial to future performance.

It is natural result that there is a remarkable difference between buyers and suppliers since buyers are usually more powerful than suppliers are in Korean manufacturing industries. However, it is interesting result that buyers as well as suppliers present high level of scores on the statements of dependence.

More interestingly, not only suppliers but also buyers present high scores on the statements of the importance of the partner rather than those of unavailability of alternative or switching cost. This finding suggests that sample companies place high stress on the relation with the existing (largest) partner even if there is an alternative source.

### 5.3.10. Buyer-Supplier Relationship

In the survey, buyer-supplier relationship was measured by four dimensions: solidarity, reciprocity, communication and continuity.

*Table 47. Responses on buyer-supplier relationship statements*

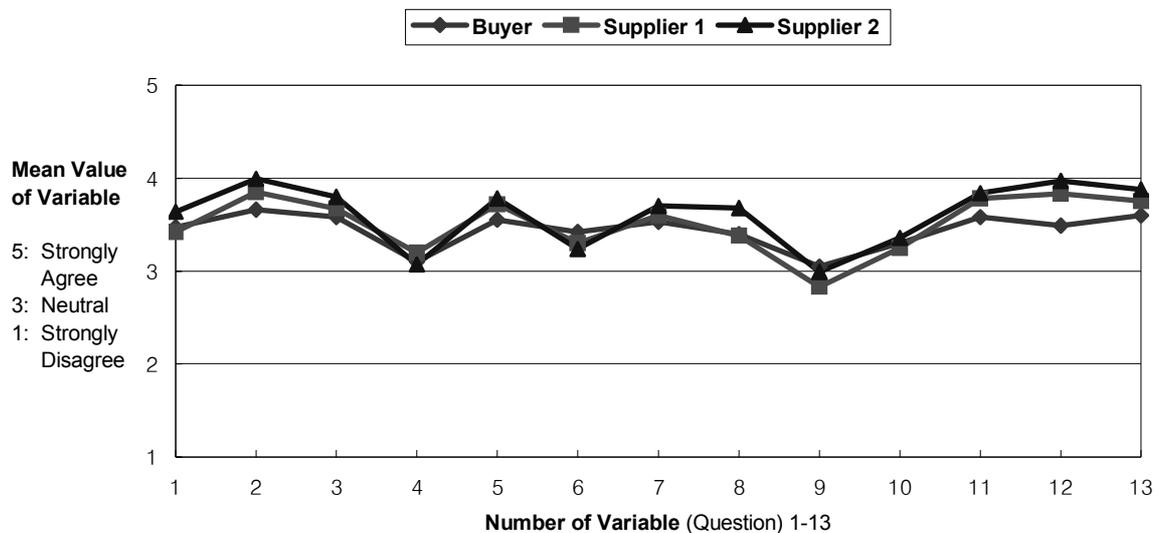
Variable for buyer (supplier) <sup>a, b</sup>	Mean <sup>c</sup>				St. deviation			
	Total	Buy	Sup1	Sup2	Tot.	Buy	S.1	S.2
(A) Solidarity								
1. Both the supplier (buyer) and we actively work together.	3.52	3.47	3.42	3.64	.78	.74	.85	.76
2. Both the supplier (buyer) and we should work together to be successful.	3.83	3.66	3.85	3.99	.74	.80	.70	.68
3. We plan to develop our cooperation with the supplier (buyer) further.	3.68	3.58	3.67	3.80	.72	.76	.75	.65
(B) Reciprocity								
4. Problems with the supplier (buyer) are joint responsibilities.	3.12	3.10	3.20	3.07	.85	.74	.93	.89
5. Conflicts are solved by working together rather than third party.	3.68	3.55	3.72	3.78	.76	.76	.82	.70
6. The supplier (buyer) and we will not use a strong bargaining position.	3.32	3.42	3.30	3.24	.86	.81	.85	.92
7. We made ongoing adjustment to cope with circumstances.	3.61	3.53	3.60	3.70	.69	.70	.69	.67
(C) Communication								
8. We have an excellent communication with the supplier (buyer).	3.50	3.40	3.38	3.68	.79	.79	.76	.78
9. We share proprietary information with the supplier (buyer).	2.97	3.05	2.83	2.99	.84	.88	.82	.83
10. We regularly exchange information about market condition.	3.31	3.30	3.25	3.36	.81	.81	.77	.86
(D) Continuity								
11. Both of us expect our relationships to last for a long time.	3.73	3.58	3.78	3.84	.73	.70	.69	.76
12. A long-term relationship with the supplier (buyer) is important to us.	3.76	3.49	3.83	3.97	.88	.90	.84	.83
13. We focus on long-term goals in relationship with the supplier (buyer).	3.75	3.60	3.75	3.88	.79	.85	.72	.76

a. Variables for supplier are the same as those for buyer except the direction of the statement.

b. The supplier (buyer) means the largest, in terms of transaction volume, supplier (buyer).

c. Measured by five-point Likert scale (1.Strongly Disagree, 3.Neutral, 5.Strongly Agree)

*Figure 29. Means of three subgroups on buyer-supplier relationship*



As reported in table 47 and figure 29 (the previous page), an overall aspect of response on buyer-supplier relationship is that sample companies gave high level of scores. Scores of thirteen variables range from 2.97 to 3.83. Twelve out of thirteen variables present scores above a neutral point, 3.0.

As for solidarity dimension, sample companies mark 3.52 point on the statement of actively working together (variable 1), 3.83 point on working together to be successful (variable 2), and 3.68 point on developing cooperation (variable 3). There is a moderate difference between three groups regarding three variables of solidarity dimension.

With regard to reciprocity dimension, sample companies mark 3.12 point on the statement of joint responsibilities (variable 4), 3.68 point on solving conflicts (variable 5), 3.32 point on overusing bargaining position (variable 6), and 3.61 point on ongoing adjustment (variable 7). It is notable that respondents give variables of solidarity dimension higher scores than those of reciprocity dimension.

Regarding communication dimension, sample companies mark 3.50 point on the statement of excellent communication (variable 8), 2.97 point on sharing proprietary information (variable 9) and 3.31 point on regularly exchanging information (variable 10). This result suggests that proprietary information be more exclusively treated even in the relationship with the strategically important partner.

As for continuity dimension, sample companies mark 3.73 point on the statement of expecting relationship to last, 3.76 point on a long-term relationship, 3.75 point on focusing on long-term relationship. This result shows that buyers and suppliers lay the highest stress on long-term relationship with their largest partner.

In sum, the findings of this survey indicate that most sample companies make much of relationships with their largest trading partner. On the one hand this result may be affected by the measures of this survey that focus on the relationships with the largest, in terms of transaction volume, partner. On the other hand it may be influenced by business culture of the Korean electronics industry that appreciates the relational context.

## **5.4. ANOVA – Independence Test**

### **5.4.1. Introduction – Amalgamation of three groups**

As explained in the previous section 4.3.2 (sampling method), this research took stratified sampling. Hence, samples of the survey were drawn from three separated subgroups: buyer, supplier 1, and supplier 2. These three subgroups need to be amalgamated for further analyses.

This study is basically aimed at examining the impact of e-commerce on buyer-supplier relationship. It means that this study principally focus on unilateral effect for e-commerce on buyer-supplier relationship, rather than comparison of three subgroups on the characteristics of e-commerce and buyer-supplier relationship. Viewed in terms of this objective of the research, it is necessary to amalgamate three subgroups into a whole one, rather than leave them separate.

In addition, sample size matters to multivariate analysis such as factor analysis, regression analysis or structural equation modelling. If samples in the survey were divided into three subgroups, a sample size of each subgroup would be reduced to a level of sixty or seventy. However, as for structural equation modelling technique which will be used to test the research model and hypotheses, a sample size of two hundred is recommended (Hair et al., 1998). Accordingly, three subgroups need to be combined for the sample size required.

In order to amalgamate three subgroups, values of research variables should not be significantly different for three subgroups. In other words, if there were no significant differences between three groups regarding values of research variables, all samples in the survey can be considered to be drawn from a single population (Nakayama, 2000).

In this context, ANOVA (analysis of variance) will be conducted to test the independence for three subgroups in the next section.

## 5.4.2. Logic of ANOVA

### **Independence Test**

The aim of analysis of variance (ANOVA) is to test whether differences in means for three subgroups (i.e., buyer, supplier 1, and supplier 2 subgroups) are statistically significant, or not. The total variance of a variable is partitioned into two components: the one is made by true random error (i.e., within group variability), and the other is made by differences between means of subgroups (Statsoft, 2003). The latter component of variance is tested for statistical significance. If significant, the researcher rejects the null hypothesis of no differences between means for three subgroups, and accepts the alternative hypothesis that means in the sample frame are different for three subgroups (Statsoft, 2003).

### **Dependent and Independent (Factor) variables**

The variables that are measured (i.e., eighty-seven questionnaire items in the survey) are called as dependent variables in this analysis. The variables that are controlled (i.e., belonging to subgroup) are called as factors or independent variables in this analysis.

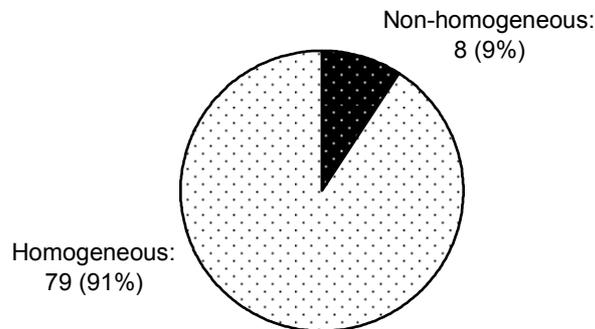
### **Checking the Assumptions**

At first, dependent variables should be normally distributed. Normality of all variables in the survey was checked by SPSS software. Through all variables, the points lie close the line in a Q-Q plot of SPSS software, which indicates the data in the survey meet the assumption of normality. Second, three subgroups should have approximately equal variance to the dependent variable. Homogeneity of variance can be checked by the Levene's test using SPSS software. This will be in detail discussed in the next section.

### 5.4.3. Levene Test for homogeneity of variances for three subgroups

If statistics of Levene's test is significant ( $p$  value associated with Levene's test is smaller than 0.05), variances of three subgroups are significantly different. It means that variances of three subgroups are not homogeneous. Conversely, statistics of Levene's test is not significant ( $p$  value is greater than 0.05), variances of three subgroups are not significantly different. It indicates that variances of three subgroups are homogeneous.

*Figure 30. Test for homogeneity of variance*



*Table 48. Significantly different variables in Levene's test*

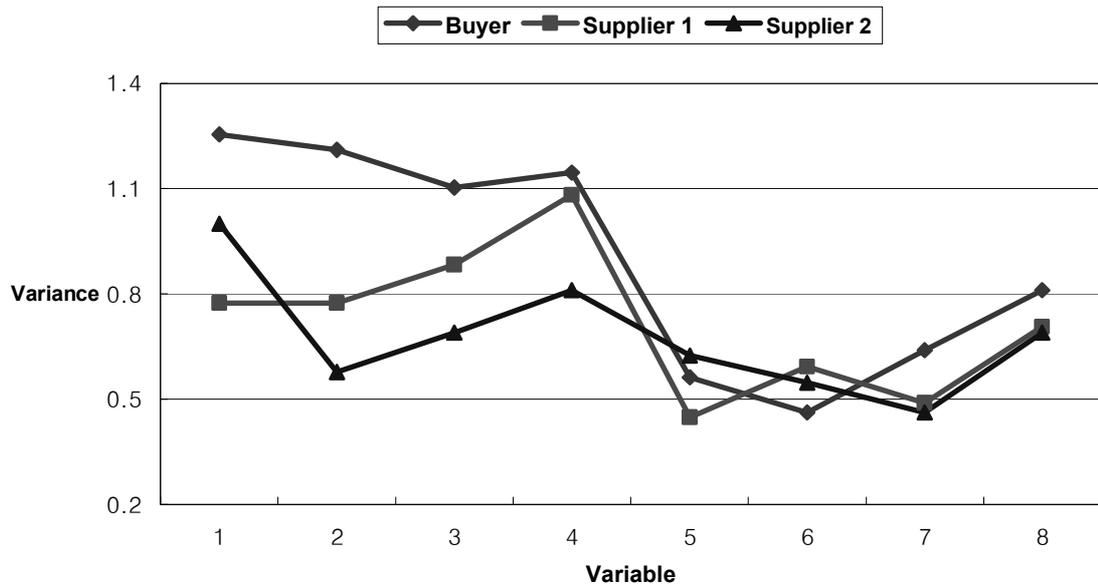
Dependent variables	Levene test		Variance			
	Statistics	Sig.	Buyer	Sup. 1	Sup. 2	Order
ERP software is used for collaborating with the partner.	3.18	*.043	1.25	.77	1.00	B>S2>S1
We use e-network for placing/receiving orders.	9.39	**0.000	1.21	.77	.58	B>S1>S2
We use e-network for taking/confirming delivery.	8.28	**0.000	1.10	.88	.69	B>S1>S2
We use e-network for making/receiving payment.	5.00	**0.008	1.14	1.08	.81	B>S1>S2
The staff of the partner are honest about the problem.	6.07	**0.003	.56	.45	.62	S2>B>S1
The partner keeps promises it makes to us.	3.95	*.021	.46	.59	.55	S1>S2>B
The partner and we should work together to succeed.	4.56	*.011	.64	.49	.46	B>S1>S2
Long-term relation with the partner is important to us.	3.07	*.048	.81	.71	.69	B>S1>S2

\*: significant at the level of 0.05, \*\*: significant at the level of 0.01

Using SPSS software, test for homogeneity of variance was conducted. SPSS produced the Levene's statistics and its significance. As reported in figure 30 and table 48, a total of eight

variables out of eighty-seven have  $p$  value smaller than 0.05, and the others have  $p$  value greater than 0.05. This result shows that ninety-one percent of variables meet the assumption of homogeneous variance between groups. However, variances of nine variables in the survey are significantly different for three subgroups.

*Figure 31. Variances of three subgroups as for significantly different variables*



In addition, as shown in table 48 (the previous page) and figure 31, there is a tendency in variances of significantly different variables. In six out of eight variables, variance of buyer group is greatest, followed by supplier 1, and supplier 2 subgroup. For example, with regard to variable of using e-network for placing orders, variances of buyer, supplier 1 and supplier 2 subgroups are 1.21, 0.77, and 0.58 respectively. This result indicates that supplier 2 subgroup is the most homogeneous for the characteristics of e-commerce and buyer-supplier relationship, followed by supplier 1 and buyer subgroup.

#### 5.4.4. ANOVA Test

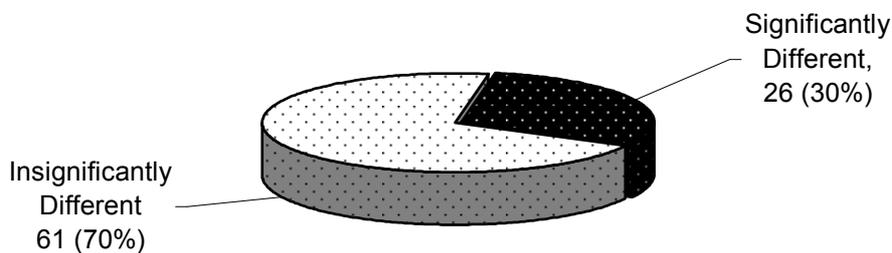
As explained in the introduction, analysis of variance (ANOVA) is employed to test the difference in means of three subgroups (i.e., buyer group, supplier 1 group, and supplier 2 group). Accordingly, a null and an alternate hypothesis for ANOVA are made up as follows;

*“Ho: There is no difference between means for three subgroups*

*HI: There is a difference between means for three subgroups”.*

If the test is significant ( $p$  value associated with ANOVA is smaller than 0.05), means of three groups are significantly different. This result might indicate that three subgroups are independent, and thereby they are not appropriate to amalgamate. Conversely, if the test is not significant ( $p$  value is greater than 0.05), three subgroups may not be independent and thus adequate to amalgamate.

Figure 32. Results of ANOVA



Using SPSS software, ANOVA was conducted. SPSS produced the statistics and its significance. As reported in figure 32 and table 49 (the next page), a total of twenty-six<sup>10</sup> (thirty percent) variables out of eighty-seven had  $p$  value below 0.05, and the others (seventy percent) had  $p$  value above 0.05. This result shows that thirty percent of variables do not meet the premise required for amalgamating three subgroups into one.

In addition, as seen in table 49 (the next page) and figure 33 (the next page), there is a consistent trend in means for significantly different variables. In most (i.e., twenty out of twenty-six) variables, means of supplier 2 group are the greatest, followed by those of supplier 1 group and those of buyer group. This result may indicate that supplier 2 subgroup is the most active as to implementation of e-commerce and relationships with the trading partner, followed by supplier 1 subgroup and buyer subgroup.

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<sup>10</sup> All variables that do not meet the assumption of homogeneity of variance (Levene's test) belong to this section of graph since means of them are also significantly different.

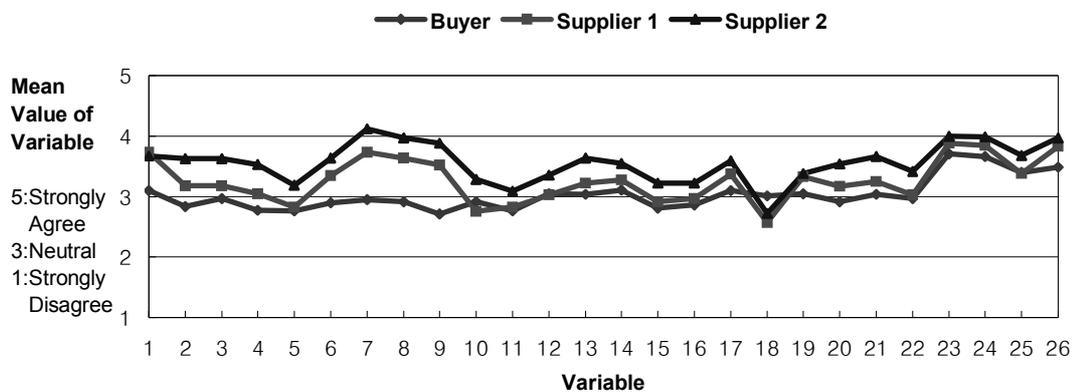
*Table 49. Results of ANOVA as for significantly different variables*

Dependent variables	ANOVA		Mean			Order
	F stat.	Sig.	Buye.	Sup.1	Sup.2	
1. The partner demands to participate its network.	10.10	** .00	3.10	3.73	3.67	S1>S2>B
2. Extranet is used for communication with the partner.	12.06	** .00	2.84	3.18	3.63	S2>S1>B
3. The partner's website is used for trading with the partner.	11.27	** .00	2.97	3.18	3.63	S2>S1>B
4. Private e-commerce system is used for data exchange.	10.91	** .00	2.78	3.05	3.53	S2>S1>B
5. ERP software is used for collaborating with the partner.	3.57	* .03	2.77	2.83	3.19	S2>S1>B
6. We use e-network for providing information.	14.61	** .00	2.90	3.35	3.64	S2>S1>B
7. We use e-network for placing/receiving orders.	30.64	** .00	2.95	3.73	4.12	S2>S1>B
8. We use e-network for taking/confirming delivery.	24.08	** .00	2.92	3.64	3.97	S2>S1>B
9. We use e-network for making/receiving payments.	25.82	** .00	2.71	3.52	3.88	S2>S1>B
10. We adopt e-commerce for the partner than other partner.	7.42	** .00	2.92	2.76	3.29	S2>B>S1
11. We purchase via proprietary e-com. from the partner than other partner.	3.40	* .04	2.77	2.83	3.09	S2>S1>B
12. Design for end products is frequently adjusted.	4.32	* .01	3.05	3.03	3.36	S2>B>S1
13. We invested to meet demand of the partner.	11.13	** .00	3.04	3.22	3.64	S2>S1>B
14. We committed resources to adapt to standards of the partner.	5.03	* .01	3.11	3.28	3.55	S2>S1>B
15. We invest in information system dedicated to the partner.	4.29	* .02	2.81	2.92	3.22	S2>S1>B
16. Time/Money was spent for integrating procedures with the partner.	3.47	* .03	2.86	2.97	3.22	S2>S1>B
17. Staff of the partner are honest about the problem.	9.21	** .00	3.10	3.37	3.59	S2>S1>B
18. The partner made sacrifices for us in the past.	5.64	* .01	3.01	2.57	2.72	B>S2>S1
19. The partner keeps promises it makes to us.	4.18	* .02	3.05	3.33	3.38	S2>S1>B
20. To find a replacement for the partner is difficult.	10.99	** .00	2.92	3.17	3.54	S2>S1>B
21. To make up purchase volume from alternative is difficult.	11.35	** .00	3.04	3.25	3.66	S2>S1>B
22. Switching from the partner would have negative effects.	6.11	** .00	2.97	3.03	3.42	S2>S1>B
23. The partner is currently important to us.	3.59	* .03	3.71	3.88	4.00	S2>S1>B
24. The partner and we should work together to succeed.	3.76	* .03	3.66	3.85	3.99	S2>S1>B
25. We have an excellent communication with the partner.	3.40	* .04	3.40	3.38	3.68	S2>B>S1
26. Long-term relationship with the partner is important.	6.18	** .00	3.49	3.83	3.97	S2>S1>B

The partner means the largest, in terms of transaction volume, partner.

\*: significant at the level of 0.05, \*\*: significant at the level of 0.01

*Figure 33. Means of three groups as for significantly different variables*



## **5.5. Factor Analysis**

### **5.5.1. Introduction**

Factor Analysis is an interdependence technique in which a large set of variables are considered simultaneously in terms of their bivariate relationships (Hair et al., 1998). Main applications of factor analytic techniques are to discover underlying patterns or relationships in a large number of variables and to reduce these variables to smaller set of factors or new variables (Blaikie, 2003; Statsoft, 2003). Accordingly, factor analysis can be used as a data reduction or structure detection method for further analysis such as regression analysis.

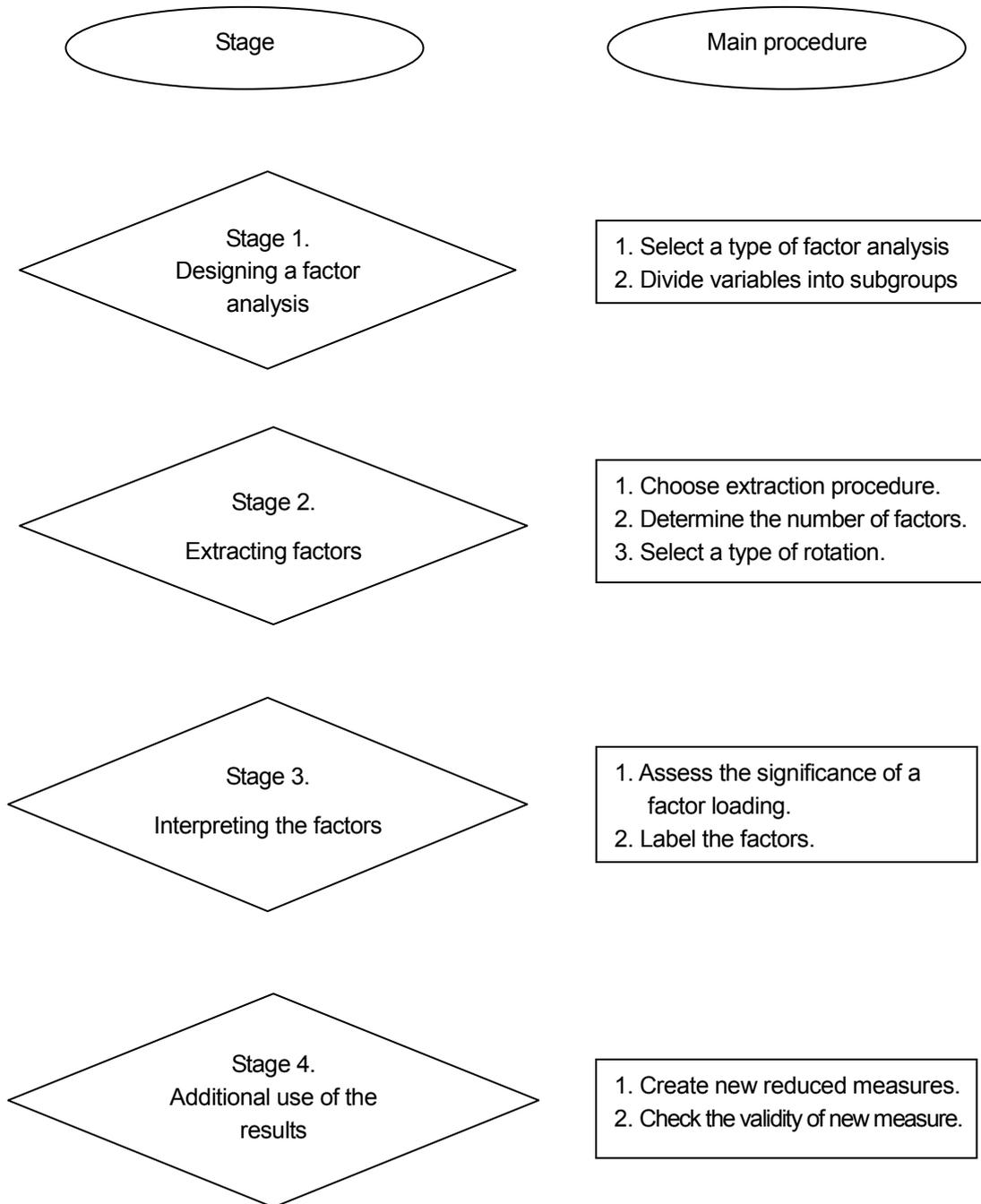
Factor analysis can be used for both an exploratory and a confirmatory research. This does not mean, however, that factor analysis technique can be applied without any theoretical background and with just hoping that some meanings will come (Hech, 1998). Conversely, although a set of items are grounded on theory, if they are derived from a variety of sources and some items are modified, factor analytic technique needs to be applied (Beatty et al., 2001).

This is because major aspects of construct validity such as dimensionality and internal consistency may be changed according to the research context. A set of items, whose dimensionality had already confirmed by the prior research, may no longer have dimensionality when they are applied to other research. In this context, the questionnaire items of this survey, even though they were directly borrowed from or developed from prior researches, will be applied to factor analysis.

In this section, factor analyses will be conducted on two kinds of data sets. At first, the questionnaire items that did not go through the independent test, discussed in the former section 5.4. (ANOVA), will be excluded from the first-wave of factor analysis. Second, all items in the survey will be included in the second-wave of factor analysis. Then, two forms of data structure derived from each factor analysis will be compared.

As illustrated in figure 34, factor analysis will be conducted through step by step process.

*Figure 34. Flow of factor analysis*



Adapted from Hair et al. (1998: 94)

## 5.5.2. Methods for Extracting Factors

### **Extraction Procedure**

Principal component analysis, maximum likelihood estimation and principal axis factoring are widely used methods to extract factors. Principal component analysis is viewed as appropriate to reduce the data, but it is not adequate to detect underlying structures (Kim et al., 2001). Maximum likelihood (ML) estimation usually provides a wide range of indexes for the goodness of fit, however it has a strict assumption of multivariate normality (Heck, 1998; Fabrigar et al., 1999). Principal axis factoring has no distributional assumption and is appropriate to investigate underlying structures, while it provides more limited range of the goodness-of-fit indexes than ML estimation does.

### **Number of Factors**

An optimal number of factors can be determined on the basis of several criteria. The first criterion is variance, which is to examine the proportion of variance contributed by a set of factors. A solution that accounts for eighty percent of variance is practically preferred, but it is a reasonable solution that accounts for fifty percent to eighty percent of variance (Hech, 1998). The second is Kaiser-eigenvalue, which is called as 'eigenvalue greater than one rule'. Used alone, this criterion may over- or under-estimate the number of factors (Hech, 1998). The third is Cattell's scree test, which is a visual representation of descending eigenvalue. The fourth is chi-square test, which tests the number of factors retained in the model. It is recommended that multiple criteria should be employed to determine the number of factors (Fabrigar et al., 1999). More importantly, a good solution should be sensible in terms of theoretical background (Hech, 1998).

### **Type of Rotation**

*Orthogonal rotation* approach has an advantage of simplicity, however it has the unrealistic assumption that factors should be uncorrelated. Varimax is the most widely used rotation method for orthogonal approach. Even though factors are intercorrelated, *oblique rotation* approach such as Promax, can be used (Heck, 1998). According to Fabrigar et al. (1999), an

oblique rotation produces a better estimate and a simple structure than an orthogonal rotation does when latent variables are correlated.

### **Significance of Factor Loading**

There are several criteria for assessing significance of factor loading. A commonly used statistic for this purpose is *Kaiser-Meyer-Olkin (KMO)*, which measures the sampling adequacy of the items. KMO measure varies from 0.0 to 1.0. A value of 0.70 or more is generally considered as sufficiently high, while a value below 0.50 is unsatisfactory (Blaikie, 2003).

The second criterion is a convergent validity for which each item needs to load strongly on only one factor. In other words, a largest factor loading of each item should be 0.45 or above (Blaikie, 2003).

The third criterion is a discriminant validity for which each item needs to load weakly on the other factors. Namely a second-largest factor loading of each item should remain below the 0.34.

The last one is reliability for which *Cronbach's alpha* of each factor needs to be 0.6 or above (Hair et al., 1998).

### 5.5.3. Factor Analysis 1 – Reflecting the Results of ANOVA

#### **Grouping**

Fifty-seven items that passed through the independence test (or ANOVA) are regrouped into two subgroups based on the research model. The one consists of the items on ‘e-commerce’ (i.e., twenty-five questionnaire items), and the other is composed of the items on ‘relationship’ (i.e., thirty-two questionnaire items).

#### **Factor Analysis with Items on e-Commerce**

In the survey, there were thirty-five<sup>11</sup> questionnaire items under four dimensions of e-commerce. However, as the results of ANOVA, means of ten items were significantly different for three subgroups. Accordingly, ten items could not be amalgamated into a whole group. So, they were excluded from this analysis that requires a whole group as an analysis unit.

Principal component analysis is not appropriate since this analysis aims at detecting underlying structure of data. Maximum likelihood estimation is not appropriate either since the data of the study do not meet multivariate normality. Data for twenty-five items in the survey are entered into a principal axis factoring analysis. SPSS software produces Kaiser-Meyer-Olkin measure of sampling adequacy (KMO). A value of KMO is 0.871, which shows that the set of items is a suitable selection.

The second step is to determine the number of factors to be extracted. First, Cattell’s scree test, seen in figure 35 (the next page), produces a cut-off point at five, which suggest four or five factor solution. Second, Kaiser-eigenvalue criterion, eigenvalue greater than one, suggests seven factor solution, which is different from those of Cattell’s scree test. Third, the proportion of variance criterion confirms four, five and seven factor models because all of them account for more than fifty percent of total variance as reported in table 50 (the next page).

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<sup>11</sup> In the survey, there were ten items on attitude to e-commerce. However, four items were designated to be excluded from this analysis because they were not appropriate to measure the attitude to e-commerce, as mentioned in the section 4.5.3. (Results of Pilot test)

Figure 35. Cattell's scree test on 25 items on e-commerce

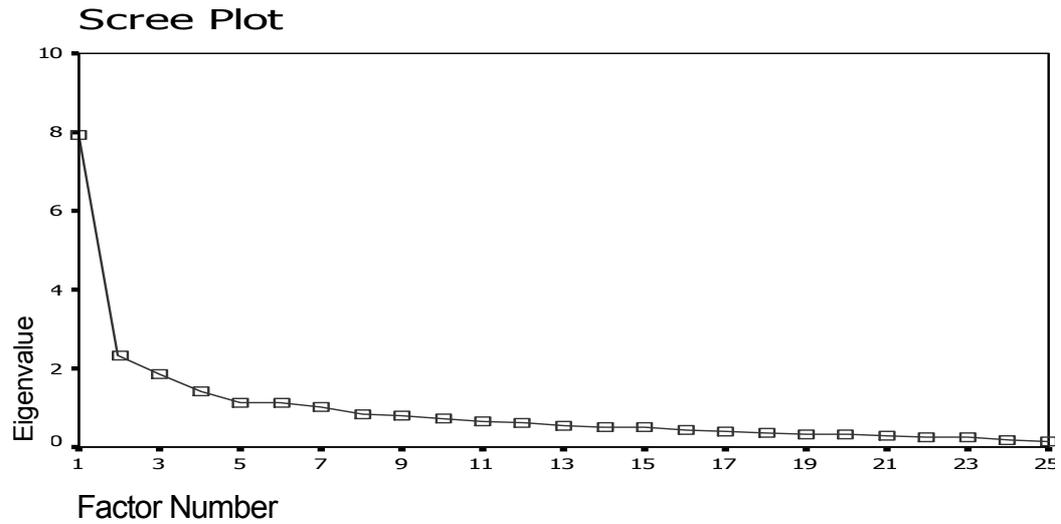


Table 50. Total variance explained on 25 items on e-commerce

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.925	31.701	31.701	7.520	30.081	30.081
2	2.315	9.261	40.961	1.896	7.585	37.667
3	1.866	7.464	48.426	1.498	5.992	43.659
4	1.433	5.731	54.156	1.075	4.298	47.957
5	1.123	4.492	58.649	.639	2.557	50.514
6	1.110	4.439	63.088	.621	2.486	53.000
7	<b>1.015</b>	<b>4.061</b>	<b>67.149</b>	.419	1.675	54.675
8	.854	3.416	70.565			
9	.784	3.137	73.702			
		<Omitted>				
25	.143	.573	100.000			

Extraction Method: Principal Axis Factoring.

The third step is to compare these three factor models by examining factor matrix and interpreting the meaning of factor loading. A *factor loading* is a measure of how much an item contributes to a particular factor. A common recommendation for factor loading threshold is 0.30 and above (Blaikie, 2003). However, in this analysis, each item should load on its factor greater than 0.45 for a convergent validity, and load on the other factors less than 0.34 for a discriminant validity. To identify factor matrix, three models need to be rotated because initial solutions are not clear. Promax (Kappa: 6) rotation instead of more

commonly used Varimax rotation is employed because Promax rotation can be used even if factors are intercorrelated.

*Table 51.<sup>12</sup>. Comparison of pattern matrix on 25 items on e-commerce*

	4-factor model				5-factor model				
	Factor 1	2	3	4	Factor 1	2	3	4	5
Item 1	<b>.84</b>	-.02	-.09	-.10	.01	<b>.80</b>	-.03	-.08	-.01
Item 2	<b>.87</b>	-.02	-.13	-.05	.06	<b>.90</b>	.00	-.02	-.20
Item 3	<b>.60</b>	-.10	.06	-.05	-.07	<b>.57</b>	.08	-.05	.02
Item 4	<b>.75</b>	.03	.05	-.08	.03	<b>.69</b>	.05	-.07	.09
Item 5	<b>.61</b>	-.01	-.04	.19	-.04	<b>.51</b>	-.08	.18	.18
Item 6	<b>.71</b>	-.02	.13	.06	.01	<b>.67</b>	.13	.07	.06
Item 7	.10	.15	.04	.03	.11	.06	-.02	.02	.14
Item 8	.35	.03	.04	.17	-.11	.16	-.18	.12	<b>.55</b>
Item 9	.21	.26	-.08	.13	.19	.13	-.13	.12	.18
Item 10	-.09	.23	.29	.17	.20	-.10	.20	.17	.14
Item 11	.00	.35	.14	.12	.33	.01	.12	.13	.04
Item 12	.12	<b>.59</b>	.00	-.08	<b>.48</b>	.03	-.12	-.10	.31
Item 13	.01	<b>.66</b>	-.03	-.08	<b>.60</b>	.01	-.05	-.07	.10
Item 14	-.14	<b>.74</b>	.05	-.09	<b>.84</b>	.01	.20	-.04	-.34
Item 15	-.02	<b>.71</b>	.11	-.23	<b>.75</b>	.08	.18	-.20	-.16
Item 16	-.02	<b>.88</b>	-.18	.07	<b>.80</b>	-.02	-.16	.08	.07
Item 17	-.07	<b>.81</b>	-.15	.21	<b>.71</b>	-.10	-.17	.20	.14
Item 18	.09	.27	<b>.47</b>	-.17	.10	-.10	.14	-.28	<b>.78</b>
Item 19	.15	.09	<b>.49</b>	.04	-.09	-.05	.16	-.04	<b>.76</b>
Item 20	.01	-.05	<b>.82</b>	-.04	-.02	.04	<b>.65</b>	-.02	.18
Item 21	-.13	-.08	<b>.97</b>	.08	.00	-.04	<b>.88</b>	.13	.02
Item 22	.05	.00	<b>.71</b>	.08	-.02	.02	<b>.50</b>	.08	.31
Item 23	-.03	-.09	<b>.60</b>	-.04	.00	.08	<b>.60</b>	.01	-.13
Item 24	-.10	-.11	.11	<b>.83</b>	-.08	-.10	.12	<b>.84</b>	-.06
Item 25	.01	-.03	-.08	<b>.91</b>	.01	.02	.02	<b>.94</b>	-.16
Eigenvalue	7.925	2.315	1.866	1.433	7.925	2.315	1.866	1.433	1.123
Cum. Variance (%)	31.701	40.961	48.426	54.156	31.701	40.961	48.426	54.156	58.649

Rotation converged in 5 iterations.

Rotation converged in 6 iterations.

Extraction Method: Principal Axis Factoring, Rotation Method: Promax with Kaiser Normalization.

<sup>12</sup> Seven factor model is omitted in this table because it is very difficult to interpret.

The last step is to examine that the results of the factor analysis are plausible in terms of theoretical background. From this point of view, a four factor model is not only clear but also plausible to interpret, seen in table 51 ( the previous page), while five and seven factor models have somewhat difficulties in interpreting the meaning of factors.

Accordingly, the items on e-commerce would be composed of four factors and their items, and each factor can be named as the following;

**Factor 1. < Attitude to e-commerce: 6 items>:**

(1) E-commerce causes major change in way of working., (2) E-commerce gives new opportunities for growth., (3) E-commerce represents a high risk., (4) Top management has a great interest in e-commerce., (5) Our staff have enough knowledge of e-commerce., and (6) E-commerce is central to business strategy.

**Factor 2. <Usage of e-network: 6 items>**

(12) E-network for providing (receiving) data on product, (13) E-network for negotiating prices, quantities, and terms of products, (14) E-network for supporting the largest partner's production, (15) E-network for supporting the largest partner, (16) E-network for collaborating with the largest partner for their own developing, and (17) E-network for collaborating with the largest partner for conducting market research

**Factor 3. <Putting in e-Commerce; 6 items >:**

(18) Hours using e-network for the largest partner, (19) Hours using e-network, (20) Period of using e-commerce for the largest partner, (21) Period of using e-commerce, (24) Investment on e-commerce for the largest partner, and (25) Investment on e-commerce

**Factor 4. <Non-Proprietary e-Commerce: 2 items>:**

(28) Trade via a non-proprietary e-commerce with the largest partner, (29) Trade via a non-proprietary e-commerce with all partners

## Factor Analysis with Five (excluded) Items on e-Commerce

In the previous analysis, five items were excluded because they do not have a factor loading greater than 0.45. However, five items is too large to ignore for further analysis. It needs to consider running a factor analysis on excluded items. Before doing this, Cronbach's alpha coefficient and item-to-total correlation coefficients need to be examined. As reported in table 52, the alpha coefficient is somewhat disappointing. Two items, item 7 and item 8, have a correlation coefficient less than 0.30. This suggests that two items need to be eliminated.

*Table 52. Cronbach's alpha and item- to-total statistics on five excluded items*

Corrected Item	Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Item 7	.1886	.0427	.5519
Item 8	.2414	.0774	.5404
Item 9	.3824	.1695	.4430
Item 10	.3727	.2043	.4544
Item 11	.3787	.2451	.4489
Reliability Coefficients	5 items, Alpha = .5457,	Standardized item alpha = .5497	

Factor Analysis was run on three items with two items re-excluded. KMO index is 0.617, which is, if not sufficiently high, not unsatisfactory for factor analysis (Blaikie, 2003). As reported in table 53, one-factor can be a solution since there is only one factor that has an eigenvalue of greater than 1.0. The proportion of variance criterion also confirms one-factor solution as this factor accounts for 56.4% of total variance.

*Table 53. Total variance explained on five excluded items*

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.693	56.443	56.443	1.101	36.706	36.706
2	.751	25.038	81.481			
3	.556	18.519	100.000			

Extraction Method: Principal Axis Factoring.

This factor can be named as *Infrastructure of e-commerce* and consists of three items, as seen in table 54. (1) Internet website is used for trading with the partner, (2) Private e-commerce system is used for data exchange, and (3) SCM software is used to collaborate with the partner.

*Table 54. Pattern matrix on five excluded items*

	Factor 1
Item 9	.460
Item 10	.563
Item 11	.757

Extraction Method: Principal Axis Factoring.

## Factor analysis with the Items on Relationship

In the survey, there were forty-eight items on relationships. However, as the results of ANOVA test, means of sixteen items were significantly different for three subgroups. Accordingly, sixteen items could not be used in amalgamation into a whole group, and were excluded from further analysis that requires a whole group as an analysis unit.

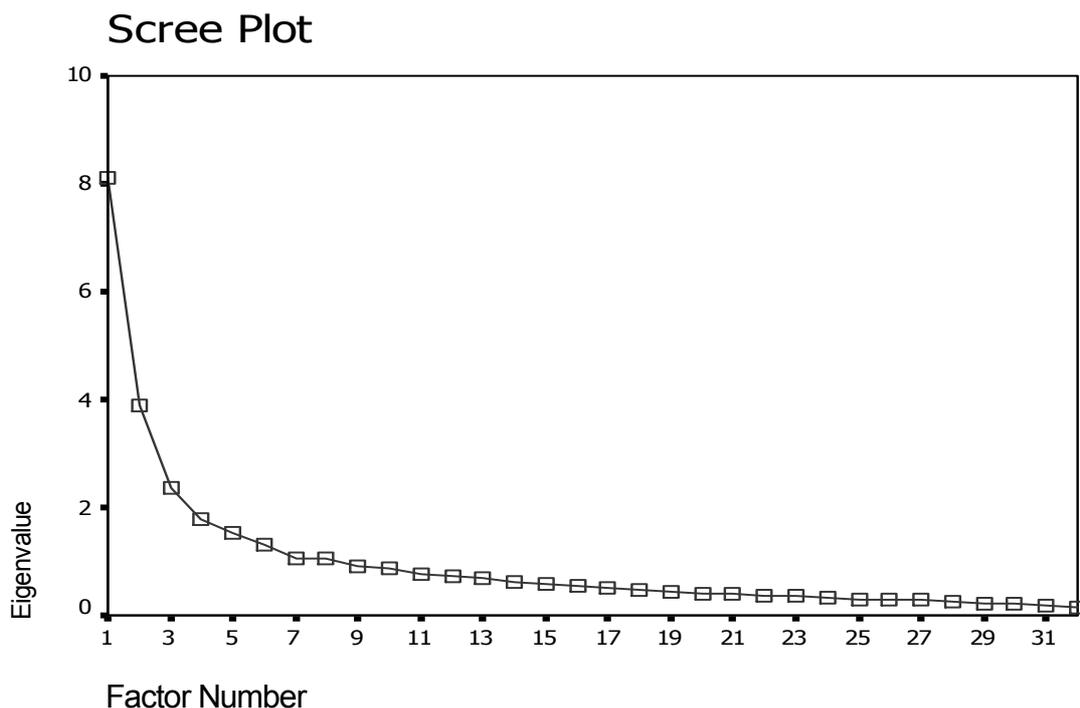
Data for thirty-two items in the survey are entered into a principal axis factoring analysis. A value of KMO measure is 0.851 as reported in table 55, which indicates that the set of items is a suitable selection for factor analysis.

*Table 55. KMO measure on 32 items on relationships*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.851
Bartlett's Test of Sphericity	Approx. Chi-Square	3110.308
	df	496
	Sig.	.000

The next step is to determine the number of factors to be extracted. First, Cattell's scree test, as seen in figure 36, produces a cut-off point at seven, which suggests six or seven factor model.

*Figure 36. Cattell's scree test on 32 items on relationships*



Second, Kaiser-eigenvalue criterion, eigenvalue greater than one, suggests a eight factor solution, which is different from that of Cattell's scree test. Third, four or greater than four factor models can be confirmed by the proportion of variance criterion since they account for above fifty percent of total variance as reported in table 56.

*Table 56. Total variance explained on 32 items on relationships*

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.112	25.351	25.351	7.714	24.106	24.106
2	3.873	12.104	37.455	3.433	10.728	34.834
3	2.372	7.414	44.868	1.917	5.991	40.825
<b>4</b>	<b>1.795</b>	<b>5.609</b>	<b>50.478</b>	1.354	4.232	45.057
5	1.536	4.798	55.276	1.082	3.382	48.439
6	1.300	4.061	59.337	.854	2.668	51.107
7	1.065	3.327	62.665	.710	2.220	53.327
<b>8</b>	<b>1.044</b>	<b>3.262</b>	<b>65.927</b>	.621	1.939	55.266
9	.924	2.889	68.815			
		Omitted				
32	.152	.474	100.000			

Extraction Method: Principal Axis Factoring.

The next step is to compare several factor models by examining factor matrix and interpreting the meaning of factor loading. For this purpose, factor matrixes of three models (i.e. six, seven and eight factor models) need to be rotated because the initial solutions are not clear. Promax (Kappa: 6) is employed because it is more appropriate method when factors are intercorrelated.

Then, the results of the factor analysis are examined in terms of theory. From the perspective of theory, as reported in table 57 and table 58<sup>13</sup> (the next page), six factor model is the clearest to interpret among three kinds (i.e., six, seven and eight) of factor models.

*Table 57. Comparison of several factor models*

	Factors
4-factor model	Uncertainty, Assets Specificity, Trust, Relationship
5-factor model	Uncertainty, Assets Specificity, Trust, Dependence, Relationship
6-factor model	Uncertainty, Assets Specificity, Trust, Dependence 1, Dependence 2, Relationship
7-factor model	Uncertainty, Assets Specificity, Trust, Dependence 1, Dependence 2, Relationship 1, Relationship 2
8-factor model	Uncertainty 1, Uncertainty 2, Assets Specificity, Trust, Dependence 1, Dependence 2, Relationship 1, Relationship 2

<sup>13</sup> Seven factor model is omitted in this table (table 57) because it is very difficult to interpret

*Table 58. Comparison of pattern matrix on 32 items on relationships*

	6-factor model						8-factor model							
	1	2	3	4	5	6	1	2	3	4	5	6	7	8
Item 1	-.13	<b>.76</b>	.00	.12	.11	-.04	-.06	<b>.92</b>	.03	.04	.08	-.05	.08	-.18
Item 2	-.12	<b>.80</b>	.04	.10	-.03	-.06	-.05	<b>.84</b>	.07	.03	-.06	-.06	.01	-.04
Item 3	.14	<b>.67</b>	-.10	.00	.07	-.08	.18	<b>.63</b>	-.09	-.03	.06	-.05	-.02	.05
Item 4	.06	<b>.57</b>	-.03	-.09	-.09	.17	.00	<b>.45</b>	-.04	-.11	-.11	.10	.13	.21
Item 5	.06	<b>.58</b>	.05	.03	.09	-.11	-.04	.30	.00	.08	.11	-.14	-.02	<b>.49</b>
Item 6	.11	<b>.53</b>	.08	-.10	-.13	.11	-.02	.11	.02	.02	-.11	.12	-.10	<b>.79</b>
Item 7	.07	<b>.65</b>	.06	-.11	-.01	.08	.06	<b>.47</b>	.04	-.08	.02	.08	-.05	.28
Item 8	-.04	-.02	<b>.75</b>	.10	.05	-.10	-.05	-.01	<b>.75</b>	.08	.03	-.10	.02	-.01
Item 9	-.01	.04	<b>.49</b>	.07	.05	-.01	-.07	-.09	<b>.47</b>	.09	.06	-.03	.01	.20
Item 10	.23	-.11	<b>.60</b>	-.12	.09	-.31	.20	-.14	<b>.60</b>	-.10	.09	-.27	-.09	.02
Item 11	-.09	-.04	<b>.81</b>	.06	-.13	.12	-.08	-.03	<b>.81</b>	.05	-.13	.09	.04	.00
Item 12	-.05	.10	<b>.52</b>	-.07	.00	.11	.13	.12	<b>.55</b>	-.04	.05	.19	-.26	-.08
Item 13	-.04	.07	<b>.70</b>	-.14	-.08	.13	-.05	.11	<b>.72</b>	-.17	-.11	.08	.09	-.05
Item 14	.00	-.02	.05	<b>.61</b>	.07	.12	.02	-.01	.05	<b>.57</b>	.08	.12	.09	-.03
Item 15	-.07	-.03	-.04	<b>.75</b>	-.12	.07	.00	-.01	-.04	<b>.72</b>	-.08	.12	-.01	-.04
Item 16	.11	-.06	-.01	<b>.71</b>	-.14	-.10	.10	-.10	-.02	<b>.70</b>	-.11	-.06	.02	.07
Item 17	-.06	.08	-.06	<b>.68</b>	.11	-.13	-.09	.04	-.06	<b>.64</b>	.11	-.11	.08	.06
Item 18	-.04	.03	.13	.35	.21	-.04	-.08	.04	.14	.30	.18	-.06	.13	-.02
Item 19	.02	-.03	.10	-.06	.16	<b>.54</b>	.02	-.07	.08	-.03	.20	<b>.48</b>	.07	.07
Item 20	-.08	.01	.02	-.04	.01	<b>.70</b>	-.03	-.04	.00	.02	.06	<b>.72</b>	.01	.07
Item 21	-.07	.03	-.06	.02	<b>.78</b>	.06	-.05	.02	-.08	.04	<b>.80</b>	.08	-.03	-.03
Item 22	.02	.01	.00	-.07	<b>.89</b>	.03	.04	.02	-.01	-.04	<b>.90</b>	.07	-.03	-.07
Item 23	<b>.77</b>	-.06	.05	-.02	-.03	.03	<b>.70</b>	-.05	.06	-.01	.00	.05	.07	-.03
Item 24	<b>.71</b>	-.10	.02	-.12	.06	.17	<b>.45</b>	-.13	.02	-.15	.02	.08	.41	.08
Item 25	<b>.75</b>	.06	-.08	.06	-.05	-.11	<b>.88</b>	-.02	-.10	.14	.05	.02	-.31	.05
Item 26	<b>.87</b>	-.02	-.07	-.15	.11	-.08	<b>.67</b>	-.04	-.06	-.15	.09	-.10	.23	.02
Item 27	<b>.91</b>	.06	-.03	-.09	-.09	-.16	<b>.97</b>	.07	-.02	-.05	-.04	-.06	-.17	-.06
Item 28	<b>.88</b>	.08	.01	-.09	.03	.00	<b>.75</b>	.09	.03	-.09	.03	.00	.17	-.02
Item 29	<b>.59</b>	.09	.03	.18	-.16	.03	<b>.60</b>	.11	.04	.18	-.13	.08	.01	-.05
Item 30	<b>.63</b>	.02	.03	.21	-.05	-.02	<b>.50</b>	.01	.03	.19	-.05	-.03	.20	.03
Item 31	<b>.51</b>	-.03	-.04	.17	.08	.23	.11	.06	-.04	.04	-.05	.04	<b>.87</b>	-.06
Item 32	.42	-.06	.02	.22	.11	.14	.07	.02	.04	.10	.01	-.02	<b>.72</b>	-.05
Eigenvalue	8.112	3.873	2.372	1.795	1.536	1.300	8.11	3.87	2.37	1.79	1.53	1.30	1.06	1.04
Cum.Variance(%)	25.351	37.455	44.868	50.478	55.276	59.337	25.3	37.4	44.8	50.4	55.2	59.3	62.6	65.9

Rotation converged in 6 iterations

Rotation converged in 7 iterations.

Extraction Method: Principal Axis Factoring, Rotation Method: Promax with Kaiser Normalization.

Accordingly, the items on relationship would be composed of six factors and their items, and each factor can be named as the following;

**Factor 1. <Collaborative Relationship, 9 items>:** (23) Both the largest partner and we actively work together., (24) We plan to develop cooperation with the largest partner., (25) Problems with the largest partner are joint responsibilities., (26) Conflicts are solved by working together., (27) Both of us will not use a strong bargaining position., (28) We made ongoing adjustment to cope with circumstances., (29) We have an excellent communication with the largest partner., (30) We share proprietary information with the largest partner., and (31) We regularly exchange information about market condition.

**Factor 2. <Environmental Uncertainty, 7 items>:** (1) Prices for product of the largest partner are difficult to predict., (2) Design trends are unpredictable., (3) Expected volumes for the largest partner are unpredictable., (4) Market for end products is unstable., (5) Products have a high innovation rate., (6) Products have a short life cycle., and (7) Technological development for products is difficult to predict.

**Factor 3. <Assets Specificity, 6 items>:** (8) Time/money is committed to training of staff for the largest partner., (9) Just for the largest partner, we have recruited new staff., (10) We need good knowledge of the largest partner's product., (11) Just for the largest partner, we change equipments., (12) Our knowledge on operation method is dedicated to the largest partner., and (13) Just for the largest partner, we have changed trading procedure.

**Factor 4. <Trust, 4 items>:** (14) Staff of the largest partner have been frank with us., (15) The largest partner concerns our welfare when making decision., (16) We feel that the largest partner is like a friend., and (17) It is unnecessary to be cautious with the largest partner.

**Factor 5. <Importance of the Partner, 2 items>:** (21) Maintaining the largest partner is critical to profitability of ours., (22) The largest partner is crucial to our future performance.

**Factor 6. <Unavailability of Alternative, 2 items>:** (19) It costs a lot to switch the partner., and (20) Switching from the partner would lose a lot of investment.

## Data Structure found by Factor Analysis

Factor analysis found the underlying structure of the data in the survey as explained in the previous section. In the survey, it was assumed that there were nine constructs and their eighty-three items. However, as the results of the independence test and factor analysis, the set of data have been changed into eleven factors and their fifty-three items.

As reported in table 59, the items on e-commerce are regrouped into five factors: (1) attitude to e-commerce, (2) usage of e-network, (3) putting in e-commerce, and (4) non-proprietary e-commerce and (5) infrastructure of e-commerce. The items on relationship are regrouped into six factors: (1) collaborative relationship, (2) environmental uncertainty, (3) assets specificity, (4) trust, (5) unavailability of alternative, and (6) importance of the partner.

In addition, the complex set of data comprised of fifty-three variables can be reduced into eleven factors (i.e., factor score, or new summated scale), which are easy to manage and can be used for further analysis such as regression analysis.

*Table 59. Comparison of data structure between before and after factor analysis*

	Before Factor Analysis (A Result of ANOVA)	After Factor Analysis (A Result of Factor Analysis)
e-Commerce	<ul style="list-style-type: none"> <li>- Attitude to e-commerce (6 items)</li> <li>- Technology dimension (5 items)</li> <li>- Activity dimension (6 items)</li> <li>- Penetration dimension (8 items)</li> </ul>	<ul style="list-style-type: none"> <li>- Attitude to e-commerce (6 items)</li> <li>- Usage of e-network (6 items)</li> <li>- Putting in e-commerce (6 items)</li> <li>- Non-proprietary e-commerce (2 items)</li> <li>- Infrastructure of e-commerce (3 items)</li> </ul>
Relationship	<ul style="list-style-type: none"> <li>- Environmental uncertainty (7 items)</li> <li>- Assets specificity (6 items)</li> <li>- Trust (5 items)</li> <li>- Dependence (4 items)</li> <li>- B-S relationships (10 items)</li> </ul>	<ul style="list-style-type: none"> <li>- Environmental uncertainty (7 items)</li> <li>- Assets specificity (6 items)</li> <li>- Trust (4 items)</li> <li>- Unavailability of alternative (2 items)</li> <li>- Importance of the partner (2 items)</li> <li>- Collaborative relationship (9 items)</li> </ul>

#### 5.5.4. Factor Analysis 2 - Disregarding the Results of ANOVA Test

##### Grouping

As referred in the section 5.4.4 (ANOVA Test), it was unavoidable that thirty percent of questionnaire items in the survey were excluded for amalgamating three subgroups into a whole one. However, it is a question how much the elimination of some items affected the original structure of data. In this context, factor analysis would be run on all items in the survey in order to detect the data structure of original data.

For factor analysis, the questionnaire items in the survey were regrouped into four groups based on the research model: attitude to e-commerce (group 1, 6 items), utilization of e-commerce (group 2, 29 items), determinants of buyer-supplier relationship (groups 3, 35 items), and buyer-supplier relationship (group 4, 13 items).

##### Analysis with the Items on Attitude to e-Commerce

Data for six items<sup>14</sup> in the survey was entered into a principal axis factoring analysis. A value of KMO measure is 0.862, which indicates the set of data is suitable for factor analysis. Next, in order to determine the number of factors, Cattell's scree test was conducted. SPSS software produces a cut-off point at two on Cattell's scree plot, which suggests one factor model. The Kaiser-eigenvalue criterion also confirmed one-factor model. One-factor model is plausible in terms of theory. This factor consists of six items as seen in table 60, and can be named as *Attitude to e-commerce*.

*Table 60. Factor matrix on attitude to e-commerce*

Item 1. E-commerce causes major change in way of working.	.727
Item 2. E-commerce gives new opportunities for growth.	.780
Item 3. E-commerce represents a high risk (reverse).	.552
Item 4. Top management has a great interest in e-commerce.	.767
Item 5. Our staff have enough knowledge of e-commerce.	.657
Item 6. E-commerce is central to business strategy.	.792

Extraction Method: Principal Axis Factoring, 1 factor is extracted. The solution cannot be rotated.

<sup>14</sup> As mentioned before, four items in the survey were excluded for this analysis because they are not appropriate to measure attitude to e-commerce.

## **Analysis with the Items on Utilization of e-Commerce**

Data for twenty-nine items in the survey were entered into a principal axis factoring analysis. Principal component analysis was not applied because this analysis aims at detecting underlying structure of data, and maximum likelihood estimation was excluded because the data did not meet the multivariate normality.

A value of KMO measure is 0.876, which show that the set of items is suitable. Next, Cattell's Scree test produces a cut-off point at four, which suggests three or four factor model. Kaiser-eigenvalue criterion suggests seven factor solution, which is different from the result of Cattell's scree test. The proportion of variance criterion denies three factor model, and proposes four or greater than four factor model.

The next step is to compare potential models by examining factor matrix and interpreting the meaning of factor loading. For this purpose, factor matrixes of two models were rotated using Promax (Kappa: 4) method. As reported in table 61 (the next page), seven factor model is very difficult to interpret because there are no high loading items on two factors. Four factor model is not only clear to interpret but also plausible from a theoretical view. Four factor model is a final solution. Accordingly, utilization of e-commerce would be composed of four factors, and each factor can be named as the following;

**Factor 1. < Transaction-Oriented e-Commerce; 6 items >** : (3) Extranet for communication with the largest partner, (5) Partner's website for trading, (6) Private e-commerce system for data exchange, (13) E-network for placing (receiving) orders, (14) E-network for taking (sending) delivery of products, and (15) E-network for making(receiving) payments.

**Factor 2. < Putting in e-Commerce; 5 items >** : (21) Hours using e-network, (22) Period of using e-commerce for the largest partner, (23) Period of using e-commerce, (24) Investment on e-commerce for the largest partner, and (25) Investment on e-commerce

**Factor 3. < Production-supported e-Commerce: 5 items >** (11) E-network for providing (receiving) data product, (16) E-network for supporting the largest partner's production, (17) E-network for supporting the largest partner's new products development, (18) E-network for collaborating with the largest partner for their own developing, (19) E-network for collaborating with the largest partner for conducting market research

**Factor 4. <Non-Proprietary e-Commerce: 2 items>**: (28) Trade via a non-proprietary e-commerce with the largest partner, (29) Trade via a non-proprietary e-commerce with all partners

*Table 61. Comparison of pattern matrix on utilization of e-commerce*

Items	4 Factor model				7 Factor model						
	1	2	3	4	1	2	3	4	5	6	7
1	.17	.08	.14	-.01	.30	-.05	.01	-.15	.00	.10	.30
2	-.28	.36	.28	.07	-.09	.20	-.02	-.08	-.14	.13	<b>.60</b>
3	<b>.58</b>	.12	-.08	.09	.49	.09	-.22	.20	.04	.04	.11
4	-.02	-.07	.29	.29	-.16	-.03	.06	.52	-.12	.05	.13
5	<b>.60</b>	-.11	.05	.17	.41	-.17	-.11	.32	.16	.03	.09
6	<b>.55</b>	.02	.06	.14	.25	-.09	.00	.34	.34	-.06	.00
7	.36	.01	.07	.36	.05	-.02	-.01	.48	.22	.09	-.01
8	.29	-.12	.24	.35	.01	.06	.09	<b>.80</b>	-.15	.05	-.21
9	.37	-.01	.15	.17	.20	.09	-.01	.49	-.08	-.01	-.03
10	.47	.03	.34	-.14	<b>.59</b>	-.04	.11	-.02	-.08	-.02	.28
11	.03	.06	<b>.66</b>	-.09	.20	.08	.36	.11	-.32	-.04	.32
12	.35	-.18	.56	.01	.37	-.22	.37	.13	-.02	.01	.17
13	<b>.85</b>	.04	.02	-.17	<b>.92</b>	.05	.06	-.17	.05	.03	-.06
14	<b>.84</b>	.00	.05	-.11	<b>.83</b>	.01	.08	-.07	.08	.01	-.08
15	<b>.75</b>	.00	-.06	-.06	<b>.73</b>	.09	-.06	.06	-.03	.02	-.13
16	.14	-.03	<b>.55</b>	.02	.04	.11	<b>.70</b>	.18	-.03	-.06	-.30
17	.21	.07	<b>.57</b>	-.16	.24	.14	<b>.62</b>	-.03	-.06	-.10	-.09
18	-.13	.09	<b>.80</b>	.03	-.09	-.04	<b>.81</b>	-.09	.11	.04	.17
19	-.18	.06	<b>.73</b>	.18	-.23	-.07	<b>.78</b>	.01	.20	.11	.12
20	.11	.41	.29	-.08	.00	.24	.02	.22	.11	-.21	.39
21	-.11	<b>.60</b>	.21	.05	-.16	.43	-.01	.13	.08	-.04	.42
22	.12	<b>.81</b>	-.04	-.13	.20	<b>.64</b>	-.10	-.18	.08	-.01	.30
23	.14	<b>.73</b>	-.01	-.03	.12	<b>.70</b>	.01	-.02	.03	.00	.07
24	.15	<b>.72</b>	-.07	.16	-.01	<b>.76</b>	.04	.13	.12	.09	-.11
25	-.11	<b>.77</b>	.11	.05	-.11	<b>.75</b>	.09	.05	-.04	.04	.13
26	.37	.39	-.23	.08	.10	.16	.04	-.18	<b>.73</b>	.04	-.13
27	.40	.34	-.14	.08	.05	.06	.06	-.04	<b>.81</b>	-.05	-.07
28	.03	.07	-.07	<b>.71</b>	.14	.07	-.07	.06	-.06	<b>.79</b>	.09
29	-.08	.05	.02	<b>.78</b>	-.04	.01	.08	.07	.04	<b>.78</b>	.08
Eigenvalue	9.282	2.761	2.126	1.405							
Variance (%)	32.006	9.522	7.333	4.845							

Extraction Method: Principal Axis Factoring.

Rotation Method: Promax with Kaiser Normalization, Rotation converged in 9 iterations.

## **Factor Analysis with the Items on Determinants of Buyer-Supplier Relationships**

Data for the thirty-five items in the survey were entered into a principal axis factoring analysis. A value of KMO measure is 0.824, which indicates that the set of data is appropriate for factor analysis. Cattell's scree test produces a cut-off point at six, which suggests five or six factor model. Kaiser-eigenvalue criterion suggests eight factor solution, which is different from that of Cattell's scree test. Proportion of variance criterion confirms greater than three factor models because they account for above fifty percent of total variance.

The next step is to compare the results of three sorts of models by examining factor matrix and interpreting the meaning of factor loading. Same as the above, Promax (Kappa: 5) is employed for rotation. Both seven and eight factor model is very difficult to interpret because they have the factors that have no high loading variables. Five factor model is not only clear to interpret but also plausible from a theoretical point of view as reported in table 62 (the next page). Accordingly, determinants of buyer-supplier relationship would be composed of five factors, and each factor can be named as the following;

**Factor 1. <Assets Specificity, 7 items>:** (9) Time/money is committed to training of staff for the largest partner., (12) We invested to meet demand of the largest partner., (13) We committed resources to adapt standards of the largest partner., (14) We invest in information system dedicated to the largest partner., (15) Just for the largest partner, we change equipments., (16) Time/money was spent for integrating procedure., (18) Just for the largest partner, we have changed trading procedure.

**Factor 2. <Trust, 7 items>:** (19) Staff of the largest partner are open to us., (20) Staff of the largest partner are honest about problem., (21) Staff of the largest partner have been frank with us., (22) The largest partner concerns our welfare when making decision., (23) We feel that the largest partner is like a friend.,(25) It is unnecessary to be cautious with the largest partner., and (26) The largest partner keeps promises it makes to us.

**Factor 3. <Environmental Uncertainty, 7 items>:** (1) Prices for product of the largest partner are difficult to predict., (2) Design trends are unpredictable., (3) Expected volumes for the largest partner are unpredictable., (4) Market for end products is unstable., (5) Products have a high innovation rate., (6) Products have a short life cycle., and (7) Technological development for product is difficult to predict.

**Factor 4. <Unavailability of Alternative, 5 items>:** (28) To find a replacement for the largest partner is difficult., (29) To make up purchase volume from alternative is difficult., (30) It costs a lot to switch the partner., (31) Switching from the largest partner would have negative effects., and (32) Switching from the partner would lose a lot of investment.

**Factor 5. <Importance of the partner, 3 items>:** (33) Maintaining the largest partner is critical to profitability., (34) The largest partner is currently is important to us., and (35) The largest partner is crucial to future performance.

*Table 62. Pattern matrix on determinants of buyer-supplier relationship*

Items	Factor 1	2	3	4	5
1. Prices for product of the largest partner are difficult to predict.	.00	.06	<b>.73</b>	-.08	.05
2. Design trends are unpredictable.	-.01	.03	<b>.76</b>	-.12	-.04
3. Expected volumes for the largest partner are unpredictable.	-.21	.12	<b>.69</b>	.03	.10
4. Market for end products is unstable.	-.08	.00	<b>.61</b>	.05	-.09
5. Products have a high innovation rate.	.08	.01	<b>.59</b>	-.09	.12
6. Products have a short life cycle.	.10	-.05	<b>.58</b>	.03	-.09
7. Technological development for products is difficult to predict.	.04	-.04	<b>.68</b>	.06	-.02
8. Design for the end product is frequently adjusted.	.21	-.17	.39	.16	.10
9. Time/money is committed to training of staff for the largest partner.	<b>.63</b>	.18	-.05	-.14	.10
10. Just for the largest partner, we have recruited new staff.	.47	.09	.00	.03	.07
11. Staff for the largest partner need good knowledge of their product.	.47	.01	-.13	-.12	.24
12. We invested to meet demand of the largest partner.	<b>.65</b>	-.02	.05	-.01	.09
13. We committed resources to adapt standards of the largest partner.	<b>.74</b>	.00	-.12	-.02	.18
14. We invest in information system dedicated to the largest partner.	<b>.87</b>	-.12	.07	.00	-.12
15. Just for the largest partner, we change equipments.	<b>.75</b>	.07	-.10	.04	-.09
16. Time/money was spent for integrating procedure.	<b>.73</b>	.04	.08	.04	-.14
17. Our knowledge on operation method is dedicated to the largest partner.	.40	-.01	.06	.22	-.02
18. Just for the largest partner, we have changed trading procedure.	<b>.76</b>	-.12	.02	.06	-.13
19. Staff of the largest partner are open to us.	.21	<b>.63</b>	.07	-.05	-.08
20. Staff of the largest partner are honest about problem.	-.04	<b>.58</b>	-.02	.06	.07
21. Staff of the largest partner have been frank with us.	-.03	<b>.76</b>	-.01	.12	.02
22. The largest partner concerns our welfare when making decision.	-.10	<b>.72</b>	-.06	.01	-.10
23. We feel that the largest partner is like a friend.	.03	<b>.66</b>	-.09	-.08	-.10
24. The largest partner made sacrifice for us in the past.	-.03	.46	.04	.05	-.14
25. It is unnecessary to be cautious with the largest partner.	-.01	<b>.60</b>	.04	-.06	.06
26. The largest partner keeps promises it makes to us.	.02	<b>.65</b>	.12	.01	.08
27. The partner does not make false claims.	.08	.38	.01	.08	.15
28. To find a replacement for the largest partner is difficult.	-.04	.06	-.09	<b>.66</b>	.04
29. To make up purchase volume from alternative is difficult.	-.03	.04	-.01	<b>.71</b>	.12
30. It costs a lot to switch the partner.	-.01	.02	-.04	<b>.78</b>	.02
31. Switching from the largest partner would have negative effects.	.04	-.03	.02	<b>.73</b>	-.04
32. Switching from the partner would lose a lot of investment.	.08	.00	.02	<b>.50</b>	-.10
33. Maintaining the largest partner is critical to profitability.	-.05	.00	.05	.00	<b>.77</b>
34. The largest partner is currently is important to us.	-.05	-.11	-.03	.05	<b>.91</b>
35. The largest partner is crucial to future performance.	.05	.00	.03	-.04	<b>.84</b>
Eigenvalue	7.480	4.381	2.851	2.456	1.732
Variance (%)	21.370	12.517	8.145	7.017	4.949

Extraction Method: Principal Axis Factoring.

Rotation Method: Promax with Kaiser Normalization, Rotation converged in 6 iterations.

## Analysis with the Items on Buyer-Supplier Relationship

Data for buyer-supplier relationship in the survey were entered into a principal axis factoring analysis. A value of KMO measure is 0.922, which is highly sufficient for factor analysis. Cattell's Scree test produces a cut-off point at two, which suggests one or two factor models. Kaiser-Eigen value criterion proposes two factor solution. The proportion of variance criterion confirms one or two factor models because both of them account for above fifty percent of total variance.

The next step is to compare the results of two models by examining factor matrix and interpreting the meaning of factor loading. Promax (Kappa: 4) is employed for rotation. Both one and two factor models are possible to interpret, however one factor model is more plausible than two factor model is as reported in table 63.

Accordingly, this factor can be named as *buyer-supplier relationship*.

*Table 63. Comparison of pattern matrix on buyer-supplier relationship*

Items	1 factor model	2 factor model	
		1	2
1. Both the largest partner and we actively work together.	<b>.79</b>	<b>.63</b>	.23
2. Both the largest partner and we should work together to be successful.	<b>.80</b>	.36	.52
3. We plan to develop cooperation with the largest partner.	<b>.76</b>	.35	.50
4. Problems with the largest partner are joint responsibilities.	<b>.63</b>	.79	-.10
5. Conflicts are solved by working together.	<b>.76</b>	<b>.56</b>	.27
6. Both of us will not use a strong bargaining position.	<b>.69</b>	<b>.84</b>	-.09
7. We made ongoing adjustment to cope with circumstances.	<b>.84</b>	<b>.75</b>	.16
8. We have an excellent communication with the largest partner.	<b>.79</b>	<b>.69</b>	.17
9. We share proprietary information with the largest partner.	<b>.61</b>	<b>.61</b>	.05
10. We regularly exchange information about market condition.	<b>.73</b>	.48	.32
11. Both of us expect our relationships to last for a long time.	<b>.77</b>	.08	<b>.81</b>
12. A long-term relationship with the largest partner is important to us.	<b>.66</b>	.00	<b>.77</b>
13. We focus on long-term goal in relationship with the largest partner.	<b>.72</b>	-.12	<b>.97</b>
Eigenvalue	7.529	7.529	1.271
Variance (%)	57.915	57.915	1.271

Extraction Method: Principal Axis Factoring

## Data Structure found by Factor Analysis

Factor analysis found the underlying structure of the data in the survey as summarized in table 64. It was assumed that there were nine constructs and their eighty-three questionnaire items in the survey. As a result of factor analysis, the set of data in the survey are reclassified into eleven factors as reported in table 64.

In the survey, data that measured the utilization of e-commerce was assumed to be comprised of three dimensions; (1) technology dimension, (2) activity dimension, and (3) intensity dimension. Notably, after factor analysis, the data structure is converted into four factors; (1) transaction-oriented e-commerce, (2) putting in e-commerce, (3) production-supported e-commerce, and (4) non-proprietary e-commerce. It is also notable that dependence construct in the survey is divided into two factors; (1) unavailability of alternative factor, and (2) importance of the partner factor.

In brief, the complex sets of eight-three variables are reduced into eleven factors.

*Table 64. Change of data structure as a result of factor analysis*

	In the Survey	Results of Factor Analysis
Attitude to e-Commerce	- Attitude to e-commerce (6 items)	- Attitude to e-commerce(6 items)
Utilization of e-Commerce	- Technology dimension (9 items) - Activity dimension (10 items) - Intensity dimension (10 items)	- Transaction-oriented e-commerce (6 items) - Putting in e-commerce (5 items) - Production-supported e-com.(5 items) - Non-proprietary e-commerce (2 items)
Determinants of Buyer-Supplier relationship	- Environmental uncertainty (8 items) - Assets specificity (10 items) - Trust (9 items) - Dependence (8 items)	- Environmental Uncertainty (7 items) - Assets specificity (7 items) - Trust (7 items) - Unavailability of alternative (5 items) - Importance of the partner (3 items)
Buyer-Supplier Relationship	- Buyer-supplier relationship (13 items)	- Buyer-supplier relationship (13 items)

### 5.5.5. Comparison of two sorts of Factor Analysis

In the survey, sample frame was made up of three subgroups: buyer, supplier 1 and supplier 2 subgroups. The questionnaire to test the research hypotheses was comprised of eighty-three items. In order to amalgamate three subgroups into a single whole group, ANOVA (i.e., the independent test) was employed, which showed that thirty percent of original items were significantly different for three subgroups. Factor analysis was conducted on the items that passed through the independence test, which is called as ‘factor analysis reflecting the results of ANOVA’. Subsequently, another factor analysis was done on the items that originally were in the survey, which is called as ‘factor analysis disregarding the results of ANOVA’.

As summarized in table 65 (the next page), total items of the research are split into small three or four groups for factor analysis. The items were divided based on the consideration of sample size, the number of questionnaire items, and the coverage of research model. In other words, questionnaire deals with somewhat different research areas (i.e., e-commerce, and buyer-supplier relationship), which leads to the split of the questionnaire. Factor analysis was conducted on each section of the questionnaire. In ‘factor analysis reflecting the results of ANOVA’, fifty-seven items were originally employed, four items were excluded, so fifty-three items were remained. In ‘factor analysis disregarding the results of ANOVA’, eighty-three items were originally entered, seventeen items were excluded, so sixty-six items were remained.

With regard to data structure (i.e., factors and their items), two sorts of factor analysis result in similar factor structure. Both of factor analyses extract eleven factors. However, there are notable differences for two factor structures. Above all, as reported in table 65 (the next page), ‘usage of e-network’ factor and ‘infrastructure of e-commerce’ factor were extracted from the factor analysis reflecting ANOVA, whereas ‘transaction-oriented e-commerce’ factor and ‘production-supported e-commerce’ factor were extracted by the factor analysis disregarding ANOVA.

In addition, there are differences in the composition of each similar factor for two factor structures. For example, trust factor in ‘factor analysis reflecting ANOVA’ consists of four

items, whereas trust factor in ‘factor analysis disregarding ANOVA’ does seven items. Lastly, the results of ‘factor analysis reflecting ANOVA’ will be employed for additional analysis. Those ‘disregarding ANOVA’ will not be used because they are not appropriate for further analysis in that they had some items that did not pass through the independent test.

*Table 65. Comparison of two sorts of factor analysis*

	Factor Analysis reflecting ANOVA	Factor Analysis disregarding ANOVA
	<i>3 SubGroups</i>	<i>4 SubGroups</i>
Grouping of Items for FA	1) All the items on e-commerce 2) The items excluded from e-commerce 3) All the items on relationship	1) Items on attitude to e-commerce 2) Items on utilization of e-commerce 3) Items on determinants of B-S relationship 4) Items on B-S relationship
Items employed & excluded	- 57 items initially employed for FA - 4 items eliminated from factor analysis - 53 items used for further analysis	- 83 items initially employed for FA - 17 items eliminated from factor analysis - 66 items used for further analysis
	<i>11 factors 53 items</i>	<i>11 factors 66 items</i>
Data Structure found by FA	- Attitude to e-commerce (6 items) - Putting in e-commerce (6 items) - Non-proprietary e-commerce (2 items) - Usage of e-network (6 items) - Infrastructure of e-commerce (3 items) - Environmental uncertainty (7 items) - Assets specificity (6 items) - Trust (4 items) - Unavailability of alternative (2 items) - Importance of the partner (2 items) - Collaborative relationship (9 items)	- Attitude to e-commerce (6 items) - Putting in e-commerce (5 items) - Non-proprietary e-commerce (2 items) - Transaction-oriented e-commerce (6 items) - Production-supported e-commerce (5 items) - Environmental uncertainty (7 items) - Assets specificity (7 items) - Trust (7 items) - Unavailability of alternative (5 items) - Importance of the partner (3 items) - Buyer-Supplier relationship (13 items)
Additional Use	<i>Appropriate</i>	<i>Inappropriate</i>

## 5.6. New Reduced Measure

### 5.6.1. Creation of Reduced Measure

The underlying data structure of questionnaire items in the survey was found by interpreting factor matrix as explained in the previous section 5.5.3. (factor analysis 1). It is time to produce new variable that is appropriate for further analysis. The new variable can be created by employing some forms of data reduction method.

Three kinds of method are generally used for data reduction: (1) selecting surrogate variable, (2) creating summated scale, and (3) computing factor score. The first method is to choose the variable that has the highest factor loading on each factor, which is called as a *surrogate variable*. This method is very simple and easy to use, however it may mislead the results by selecting only a single variable to represent a probably more complex result (Hair et al., 1998). The second option is to create a *summated scale*, which is made by combining several variables highly loaded on a factor. The average score of those variables is usually employed as a representative of that factor. This method has advantages to reduce a measurement error by using multiple variables and to represent multiple aspects of a factor in a single measure (Hair et al., 1998). The third method is to compute *factor score*, which conceptually indicates each item's relative loading on a factor.

A remarkable difference between a summated scale and a factor score is that the summated scale is formed by only selected (e.g., high-loaded on one factor and low-loaded on the others) variables, whereas the factor score is computed by all the variables regardless of the degree of loading on that factor. The factor score is not easily replicated across the studies because it is derived from a complex set of factor matrix (Hair et al., 1998).

Accordingly, this research takes the summated scale as a data reduction method for further analysis because it can reduce a measurement error, represent multiple aspects of a factor and is easy to replicate. Fifty-three of variables in the research are reduced into eleven set of summated scales as seen in table 66 (the next page). In addition, for further analysis, it is necessary to examine the validity and reliability of the new reduced measures, which will be discussed in next section.

Table 66. Creation of new summate scales<sup>15</sup>

Name of Factor (No. of items)	Selected Items for Consisting of a Factor	Summate Scale*
Usage of e-network (6 items)	E-network for providing (receiving) data on product E-network for negotiating prices, quantities, and terms of products E-network for supporting the largest partner's production E-network for supporting the largest partner E-network for collaborating with the largest partner for their own developing E-network for collaborating with the largest partner for conducting market research	$\sum \text{value of selected items} / 6$
Putting in e-Com. (6 items)	Hours using e-network for the largest partner Hours using e-network Period of using e-commerce for the largest partner Period of using e-commerce Investment on e-commerce for the largest partner Investment on e-commerce	$\sum \text{value of selected items} / 6$
Non-proprietary e-Com. (2 items)	Trade via a non-proprietary e-commerce with the largest partner Trade via a non-proprietary e-commerce with all partners	$\sum \text{value of selected items} / 2$
Infrastructure of e-Com. (3 items)	Our Internet website for trading with the largest partner. Private e-com. system for exchange with the largest partner. SCM (or CRM) software used to collaborate with the largest partner.	$\sum \text{value of selected items} / 3$
Environmental uncertainty (7 items)	Prices for product of the largest partner are difficult to predict. Design trends are unpredictable. Expected volumes for the largest partner are unpredictable. Market for end products is unstable. Products have a high innovation rate. Products have a short life cycle. Technological development for products is difficult to predict.	$\sum \text{value of selected items} / 7$
Assets Specificity (6 items)	Time/money is committed to training of staff for the largest partner. Just for the largest partner, we have recruited new staff. We need good knowledge of the largest partner's product. Just for the largest partner, we change equipments. Our knowledge on operation method is dedicated to the largest partner. Just for the largest partner, we have changed trading procedure.	$\sum \text{value of selected items} / 6$
Trust (4 items)	Staff of the largest partner have been frank with us. The largest partner concerns our welfare when making decision. We feel that the largest partner is like a friend. It is unnecessary to be cautious with the largest partner.	$\sum \text{value of selected items} / 4$
Importance of the Partner (2 items)	Maintaining the largest partner is critical to profitability of ours. The largest partner is crucial to our future performance.	$\sum \text{value of selected items} / 2$
Unavailability of Alternative(2 items)	It costs a lot to switch the partner. Switching from the partner would lose a lot of investment.	$\sum \text{value of selected items} / 2$
Collaborative Relationship (9 items)	Both the largest partner and we actively work together. We plan to develop cooperation with the largest partner. Problems with the largest partner are joint responsibilities. Conflicts are solved by working together. Both of us will not use a strong bargaining position. We made ongoing adjustment to cope with circumstances. We have an excellent communication with the largest partner. We share proprietary information with the largest partner. We regularly exchange information about market condition.	$\sum \text{value of selected items} / 9$

\*It is an arithmetic mean. Namely, a summate scale =  $\sum_{i=1}^n \text{value of items} / \text{the number of items}$

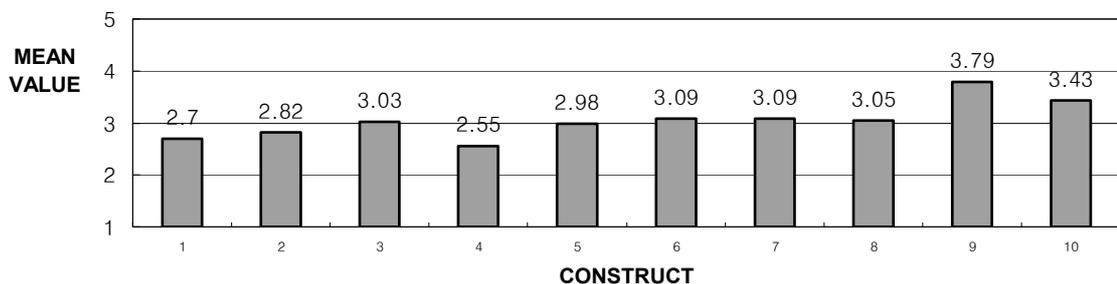
<sup>15</sup> Attitude to e-commerce factor is omitted in this table because it will be excluded from the final research model, which will be explained in the section 5.7. (Revising the research model).

## 5.6.2. Descriptive Statistics of the Reduced Measures

As seen in figure 37, an overall aspect of new summate scales is that they are distributed around a neutral point, 3.0. As a simple addition of scores measured by five-point Likert scale, environmental uncertainty (construct 5 in figure 37), putting in e-commerce (construct 3), unavailability of alternative (construct 8) and assets specificity (construct 6) mark 2.98, 3.03, 3.05, and 3.09 point, respectively. These results suggest that the summate scales show the tendency to converge into a neutral point compared to original data in the survey. For example, ten variables that comprises assets specificity in the survey range from 2.80 point to 3.87 point, while a summate scale of assets specificity presents 3.09 point.

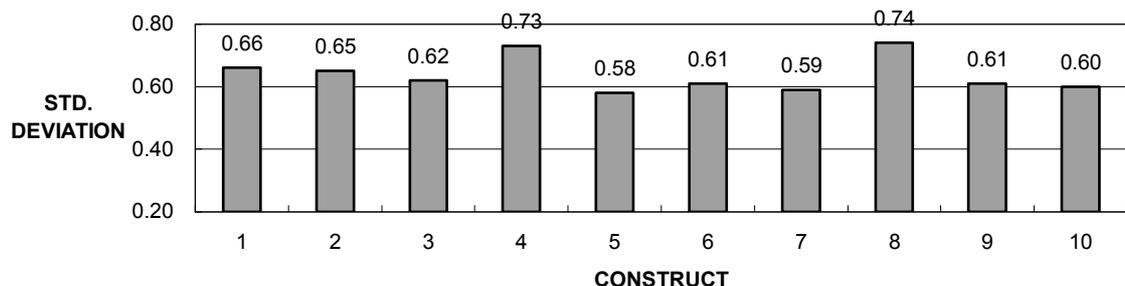
It is also notable that two summate scales that are newly created by factor analysis present exceptionally high or low values. Non-proprietary e-commerce (construct 4) marks 2.55 point, whereas importance of the partner (construct 9) marks 3.79 point.

*Figure 37. Mean values of the summate scales*



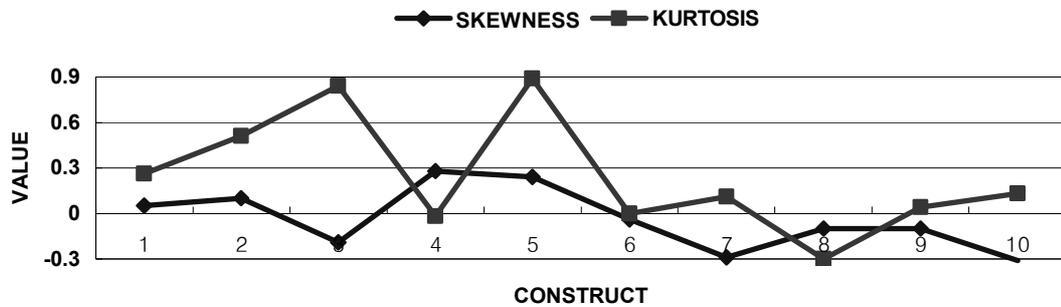
Interestingly, all constructs are homogeneous as far as standard deviation is concerned. As shown in figure 38, standard deviations of all constructs range 0.58 to 0.73.

*Figure 38. Standard deviation of the summate scales*



With regard to distribution of dispersion, it is notable that skewness values range from -0.31 to 0.28, whereas kurtosis values range from -0.30 to 0.89, as seen in figure 39. This result indicates that non-normality is not severely problematic in the reduced measures.

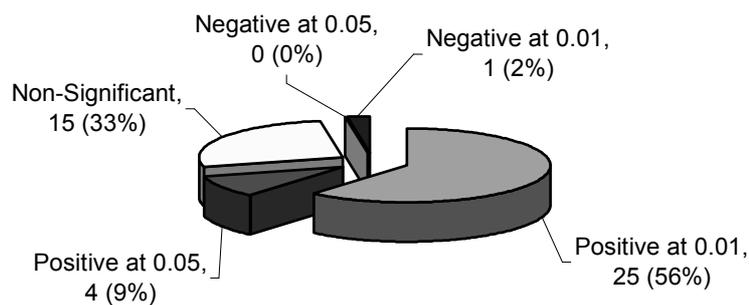
*Figure 39. Dispersion (skewness and kurtosis) of the summate scales*



### 5.6.3. Correlation Between the Reduced Measures

As seen in figure 40, among forty-five (Pearson's) correlation coefficients of the summate scales, thirty (equivalent to sixty-seven percent of all) coefficients are significant, whereas fifteen coefficients (thirty-three percent) are not significant. This high percentage of significant coefficients indicates that there may be significant relationships between research constructs.

*Figure 40. Overall distribution of correlation coefficients of the summate scales*



In the context of the research model, correlation coefficients can be divided into three categories; (1) coefficients of independent (i.e., e-commerce related) constructs, (2) coefficients of dependent (i.e., relationship related) constructs, and (3) coefficients between independent (i.e., e-commerce related) constructs and dependent (i.e., relationship) constructs.

As reported in table 67, it is notable that all the correlation coefficients of e-commerce related constructs are significantly positive at the level of 0.01. Namely, they range from 0.351 to 0.488. This finding explains an underlying structure between e-commerce related constructs. At the same time, this shows that the introduction of second-order (or high level) construct that comprises e-commerce related constructs needs to be considered in the model.

*Table 67. Classifying correlation coefficients*

Category	Positively Correlated		Non-Significant	Negative Correlated		Sum
	$\alpha = 0.01$	$\alpha = 0.05$		$\alpha = 0.05$	$\alpha = 0.01$	
Among e-commerce constructs (C1-C4)	6	0	0	0	0	6
Among relationship constructs (C5-C10)	9	0	5	0	1	15
Between e-commerce and relation constructs	10	4	10	0	0	24
Of all constructs	25	4	15	0	1	45

Out of fifteen correlation coefficients of relationship related constructs, nine (sixty-percent of this category) coefficients are significantly positive at the level of 0.01, five coefficients are not significant, and one coefficient is significantly negative at the level of 0.01. As reported in table 68 (the next page), to some extent, this result might be distorted by environmental uncertainty construct. Namely, four out of five non-significant coefficients are derived from the correlations with environmental uncertainty. This result suggests that environmental uncertainty be hypothesized as a moderating variable rather than a mediating variable in the model since environmental uncertainty is almost non-significantly interacted with the other constructs.

With regard to the third category (i.e., coefficients between e-commerce related constructs and relationship related constructs), fourteen (fifty-nine percent of this category) coefficients are significantly positive at the level of 0.05, while ten (forty-one percent of this category) coefficients are non-significant. It is highly possible that this category of correlations will indicate causal relationship between e-commerce and buyer-supplier relationship because the former is defined as an independent variable, and the latter is a dependent variable in the research model.

However, even though fifty-nine percent of correlations are found as significant, however, it is too early to conclude the existence of causality without further analysis (e.g., regression analysis) that assumes causal relationship between constructs.

*Table 68. Descriptive statistic and correlation coefficients of the reduced measures*

Construct		Descriptive Statistics				(Pearson's) Correlation between Constructs									
Name	No.of Items	Mean	St.D.	Skew	Kurt	C 1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	C 9	C 10
C 1. Infrastructure of e-commerce	3	2.70	.66	.05	.26	1.000									
C 2. Usage of e-network	6	2.82	.65	.10	.51	** .488	1.000								
C 3. Putting in e-commerce	6	3.03	.62	-.19	.84	** .452	** .487	1.000							
C 4. Non-proprietary e-commerce	2	2.55	.73	.28	-.02	** .385	** .351	** .415	1.000						
C 5. Environmental uncertainty	7	2.98	.58	.24	.89	.047	.016	.046	.008	1.000					
C 6. Assets specificity	6	3.09	.61	-.04	-.00	** .257	** .263	** .309	* .171	.056	1.000				
C 7. Trust	4	3.09	.59	-.29	.11	** .246	** .252	** .196	* .156	** -.191	** .301	1.000			
C 8. Unavailability of alternative	2	3.05	.74	-.10	-.30	.038	* .142	-.019	-.069	.053	** .183	.133	1.000		
C 9. Importance of the partner	2	3.79	.61	-.10	.04	* .157	.106	** .199	.036	.029	** .333	** .189	** .300	1.000	
C10. Collaborative relationship	9	3.43	.60	-.31	.13	** .301	** .226	** .291	.128	.060	** .391	** .455	** .321	** .329	1.000

\* Correlation coefficient is significant at the level of 0.05 (2-tailed), \*\* Correlation coefficient is significant at the level of 0.01 (2-tailed).

#### 5.6.4. Reliability and Validity of the Reduced Measures

As referred to in the previous section, new reduced measures, which were simple addition of selected variables, will be examined in terms of reliability and validity.

##### **Reliability**

The questionnaire items that reflects the same construct are expected to yield similar results in the survey. It is a concept of reliability to check the consistency of two items that measure the same thing (Blaikie, 2003). Reliability is defined as a ratio of variances in the true scores over variances in the observed scores (Black, 1999). *Cronbach's alpha* is the most widely used indicator of internal consistency reliability (Hair et al., 1998).

Cronbach's coefficient alpha ( $\alpha$ ) is calculated as follows (Black, 1999);

$$\alpha = \frac{N}{N-1} * \left[ 1 - \frac{\sum_{i=1}^N S_i^2}{S_x^2} \right], \text{ where } N \text{ is the number of questions, } S_i^2 \text{ is the variance of individual questions and } S_x^2 \text{ is the variance of the whole test.}$$

This coefficient ranges between 0 and 1, with a high value indicating a high level of consistency among the items. Intuitively, the value of alpha increases as the number of items increases. As the average inter-item correlation increase, Cronbach's alpha also increases. It is a alpha of 0.60 that is a widely accepted cut-off for an exploratory study in social science, and a alpha of 0.80 for a confirmatory study (Hair et al., 1998; Kim et al., 2001).

Reliability tests using Cronbach's alpha were conducted for each construct that was found in factor analysis in the previous section. As reported in table 69 (the next page), all constructs have a Cronbach's alpha of greater than 0.60., and six out of ten have a alpha of greater than 0.80. Viewed in terms of an exploratory aspect of this research, the alphas of this research are acceptable. Additionally, alphas do not rise when any item is deleted except one construct. Even in this exceptional construct (i.e., putting in e-commerce), the alpha is increased too slightly to eliminate any item. In sum, Cronbach's alphas show that the research items have the reliability.

*Table 69. Cronbach's alphas on the research constructs*

Construct	Alpha when all items are tested		Largest alpha when any item is removed	
	No. of items	Cronbach's $\alpha$	No. of items left	Cronbach's $\alpha$
Usage of e-network	6	.8406		Same as the left
Putting in e-commerce	6	.8473	5	.8547
Non-proprietary e-commerce	2	.8343		Same as the left
Infrastructure of e-commerce	3	.6113		Same as the left
Collaborative relationship	9	.9150		Same as the left
Environmental Uncertainty	7	.8398		Same as the left
Assets specificity	6	.7921		Same as the left
Trust	4	.7654		Same as the left
Importance of the partner	2	.8244		Same as the left
Unavailability of alternative	2	.6221		Same as the left

### **Content Validity**

Content validity is the extent to which the items represent the concept being measured. This type of validity subjectively assesses the correspondence between individual items and experts' judgements (Hair et al., 1998).

In order to establish a content validity, research constructs in this study were operationalized on the basis of the literature review and the questionnaire items were developed or drawn from the previous studies. Additionally, experts in both the academic and the practical validated the questionnaire items through the pilot test.

It was the results of ANOVA and factor analysis that exclude almost a-third of original items<sup>16</sup> of the survey from forming summative scales. This might affect the content validity of the research constructs. However, the content validity is still valid because the items of each construct were selected on the basis of a theoretical consideration in the factor analysis.

<sup>16</sup> As mentioned in the section of 5.5.4., the items were reduced from eight-three at the time of the survey to fifty three at the result of factor analysis.

## **Construct Validity**

Construct validity refers to the extent to which various items operate in a consistent manner; namely highly correlated between items that measure the same construct, and lowly correlated between items that are supposed to be distinct (Sekaran, 2000; Neuman, 2003). The former refers to as convergent validity, while the latter mentions discriminant validity.

In this study, it was assumed that each item be loaded strongly on only one factor, above 0.45 for convergent validity, and weakly loaded on the other factors, below 0.34 for discriminant validity. The items with factor loading below 0.45 on all the factors, or above 0.34 on more than one factors were considered to be eliminated from the research model. As described in the section of 5.5.3. (Factor analysis 1), the first factor analysis was conducted to extract constructs on e-commerce, the second analysis was done on the data excluded from the first factor analysis, and the third analysis was done to derive the constructs on relationships. Through these analyses, the criteria set for convergent and discriminant validity had been kept. In brief, the pattern matrixes of factor analyses indicated that research constructs met the assumption of construct validity.

## **Criterion Validity**

Criterion validity consists of a concurrent validity and a predictive validity. The former refers to the extent to which an item in the research is associated with a preexisting indicator, and the latter is related to predicting future events that are logically related to a construct (Neuman, 2003). The degree of criterion validity tends to depend on the extent of the correspondence between a test and a criterion (Carmines and Zeller, 1979).

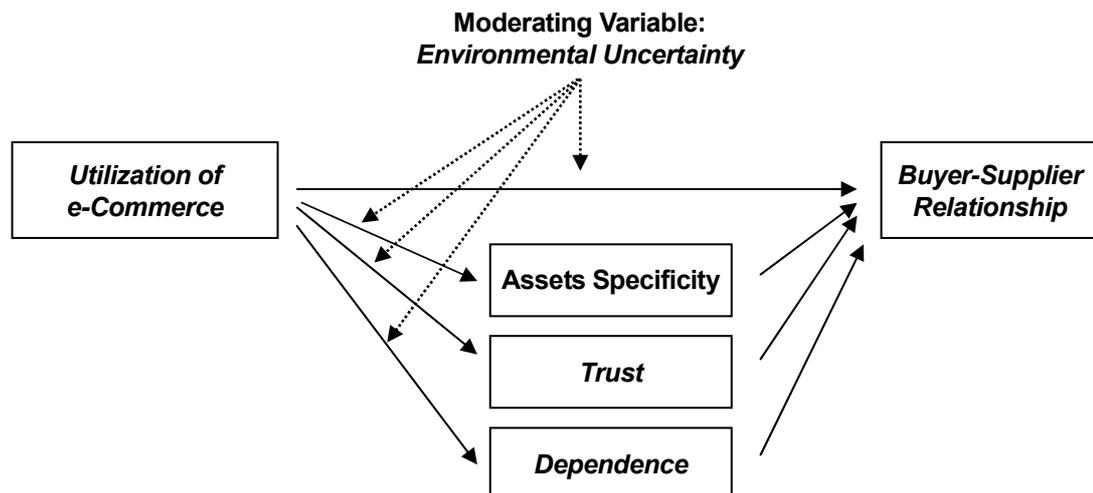
It is probable that items of this study have a predictive validity because every item measuring research constructs was developed based on the theoretical background. It is not possible to assess concurrent validity of this study because the researcher can not draw the preexisting indicator that measured the e-commerce and buyer-supplier relationship in the context of Korean electronics industry. However, it is not unusual that criterion validation procedure cannot be applied in the social science research because relevant criterion variables simply do not exist (Carmines and Zeller, 1979).

## 5.7. Revising the Research Model

### 5.7.1. The Original Conceptual Model

As described in the section 3.2. (hypotheses of the research), the original research model was conceptualized as multi-paths framework as illustrated in figure 41. All hypotheses were expressed in terms of relationships between constructs that were operationalized on the basis of the literature review. For example, an integrated hypothesis was proposed as the following; *utilization of e-commerce* will facilitates a *collaborative relationship* between buyer and supplier both directly and via *assets specificity, trust* and *dependence*.

*Figure 41. The original conceptual model*



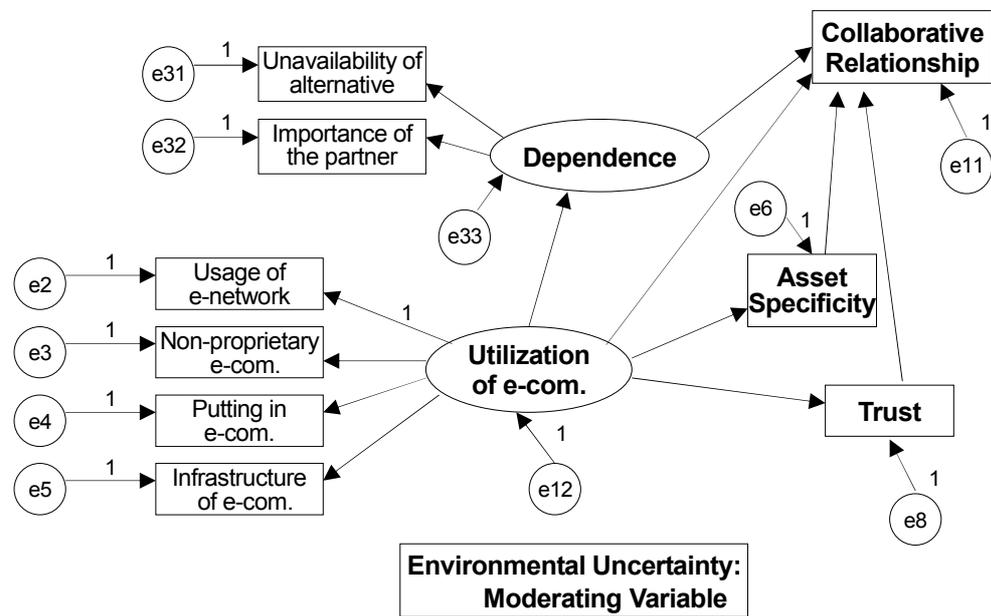
It was initially assumed that there were nine constructs and eighty-three items in the research model. However, as explained in the section 5.5. (Factor analysis), data structure of this research was changed through the independence test and the factor analysis. Nine constructs and eighty-three items in the initial model were modified into eleven constructs and fifty-three items. Furthermore, attitude to e-commerce construct needs to be excluded from the research model<sup>17</sup> because causal paths from attitude to e-commerce to utilization of e-commerce come under the redundancy of the model (see the appendix 2). Consequently, the complex set of data in the survey are condensed into ten set of summated scales, which can be easily managed and used for further analysis.

<sup>17</sup> Revision processes of the research model are precisely explained in the appendix 2.

### 5.7.2. The Revised Research Model

In response to the change of data structure, it is necessary to revise the research framework. Accordingly, the original conceptual model in figure 41 (the previous page) is applied to the reduced set of data, which brings the revised conceptual model as illustrated in figure 42. This figure is delineated in terms of a structural equation modelling technique using AMOS Graphic.

*Figure 42. The revised conceptual model*



\* 'Utilization of e-commerce' construct in the revised model consists of 'usage of e-network', 'putting-in e-commerce', 'non-proprietary e-commerce' and 'infrastructure of e-commerce' factor.

\*\* 'Dependence' construct in the revised model is comprised of 'importance of the partner' and 'unavailability of alternative' factor.

\*\*\* 'Environmental uncertainty' construct, 'assets specificity' construct, 'trust' construct, and 'collaborative relationship' construct in the revised model are made up of only one factor.

Viewed in terms of the role in the research framework, ten constructs<sup>18</sup> are divided into four categories as reported in table 70. At first, utilization of e-commerce comprised of usage of e-network, putting in e-commerce, non-proprietary e-commerce and infrastructure of e-commerce comes under an independent variable. Second, each of assets specificity, trust, and dependence falls under a mediating variable. Third, collaborative relationship becomes a dependent variable. Lastly, environmental uncertainty is established as a moderating variable.

*Table 70. Overall role of constructs in the final research model*

Initial Data -In the Survey	Modified Data Structure - Results of ANOVA and factor analysis	Roles of the Constructs - In the Revised Model
	- Attitude to e-commerce (6 items)	- (Excluded from the final model)
e-Commerce (39 items)	- Usage of e-network (6 items) - Putting in e-commerce (6 items) - Non-proprietary e-commerce (2 items) - Infrastructure of e-commerce (3 items)	<i>Independent Variable</i> -Utilization of e-commerce (4 factors merged)
	- Environmental uncertainty (7 items)	<i>Moderating Variable</i> -Environmental uncertainty
Buyer-Supplier Relationship (48 items)	- Assets specificity (6 items) - Trust (4 items) - Unavailability of alternative (2 items) - Importance of the partner (2 items)	<i>Mediating Variables</i> - Assets specificity - Trust - Dependence (2 factors merged)
	- Collaborative relationship (9 items)	<i>Dependent Variable</i> - Collaborative relationship

<sup>18</sup> As mentioned before, 'Attitude to e-commerce' factor was excluded from the final model.

## 5.8. Summary of Data Analyses

(1) The final samples have some missing values, even if not critical, and thereby this study will employ mean substitution (MS) for multivariate analysis instead of deleting cases. There is no significant difference between early and late respondents, which indicates that non-response bias does not appear and the sample represents the sample frame. Small-sized companies amount for 32.5% of the sample, medium-sized companies do 47.8%, and large-sized companies do 19.7%.

(2) Results of the survey say that most companies in electronics industry still maintain an optimistic view on e-commerce even though dot.com hype has passed in Korea. E-mail is most widely used technology for e-commerce, followed by intranet. Concerning use of private e-commerce, buyer subgroup has the lowest mean and highest st.deviation among three subgroups, which suggests that private e-commerce is centered on transactions between a few big buyers and their numerous suppliers. Electronic network is more heavily used for transaction oriented activities, especially transaction-completed, than for production supported ones. Most responses on e-commerce intensity statements are distributed around a neutral score, which indicates that most companies regard themselves as neither a pioneer nor a leggard.

(3) Sample companies generally recognize market environment as neutral and they present less confidence in technological dynamism than market volatility. Assets are considered somewhat specific to their partners and suppliers have committed more specific investment than buyers have. Human and physical specificities are stronger than procedural specificity. Sample companies do not give trust as a high score as expected. Trust is confined to the level of honesty and credibility, but has not developed into the level of benevolence yet. It is interesting that buyers as well as suppliers present high scores on the statement about dependence and lay a high stress on the importance of the partner rather than unavailability of alternative source. An overall aspect of this survey on buyer-supplier relationships is that most sample companies make much of relationships with their largest trading partner.

(4) Eight questionnaire items (9 %) do not meet the assumption of homogeneous variance for three subgroups. In six out of eight items, variances of buyer subgroup are greatest, followed by supplier 1 and supplier 2. More importantly, independent (ANOVA) test shows

that twenty-six questionnaire items (30%) out of eighty-seven do not meet the premise, equality in means, for amalgamating three subgroups. In twenty out of twenty-six items, means of supplier 2 subgroup are the greatest, followed by those of supplier 1, and those of buyer.

(5) A factor analysis is conducted on the items that passed through the independence test, which found eleven factors that are named as attitude to e-commerce, usage of e-network, putting in e-commerce, non-proprietary e-commerce, infrastructure of e-commerce, collaborative relationship, environmental uncertainty, assets specificity, trust, unavailability of alternative, and importance of the partner. Subsequently, another factor analysis is done on the items that originally were in the survey. Two sorts of factor analysis result in similar data structure, however the latter will not be used for further analysis because it has some items that did not pass through the independence test.

(6) The summated scales are created as new reduced measures using the results of factor analysis. Accordingly, the eighty-three set of data in the survey are reduced to eleven set of summated scales, which are easy to manage for further analysis. With regard to mean value, most summated scales are distributed around a neutral point with some exceptions. Among forty-five correlation coefficients of the summated scales, thirty (67 %) coefficients are significant, whereas fifteen are not significant. In terms of the reliability and the validity, the summated scales are considered to be satisfactory.

(7) Through ANOVA and factor analysis, complex set of data are condensed into eleven set of the summated scales. Among these, attitude to e-commerce construct is excluded from the final research model. In response to the modified situation, the research model has been revised: 'utilization of e-commerce' that consist of 'usage of e-network', 'putting in e-commerce', 'non-proprietary e-commerce' and 'infrastructure of e-commerce' comes under an independent variable., Second, each of assets specificity, trust, and dependence falls under a mediating variables., Third, collaborative relationship becomes a dependent variable., Lastly, environmental uncertainty is established as a moderating variable.

## **CHAPTER 6. RESULTS AND DISCUSSION**

### **6.1. Introduction**

As described in chapter 5, the complex set of data in the survey were reduced to ten set of the summate scales. The research model had been revised in response to the new summate scales. It is time to test the research hypotheses using the reduced measures in the context of the revised research model, and to interpret the results of hypotheses-testing for both academic and practical terms.

In this chapter, at first, statistical methods will be discussed to select an appropriate technique for the test.

Then, research hypotheses will be tested and the results will be interpreted in the sequence of (1) direct path from utilization of e-commerce to collaborative relationship, (2) assets specificity as a mediator, (3) trust as a mediator, (4) dependence as a mediator, (5) the integrated (multi-path full) model, and (6) environmental uncertainty as a moderator.

Finally, the validity of this research will be discussed in terms of internal validity, external validity, construct validity and statistical validity.

This chapter consists of three subsections: (1) results of testing the research model, (2) interpretation of the results, and (3) review on the validity of the research.

## 6.2. Results of Testing the Research Model

### 6.2.1. Statistical Method to Test the Model

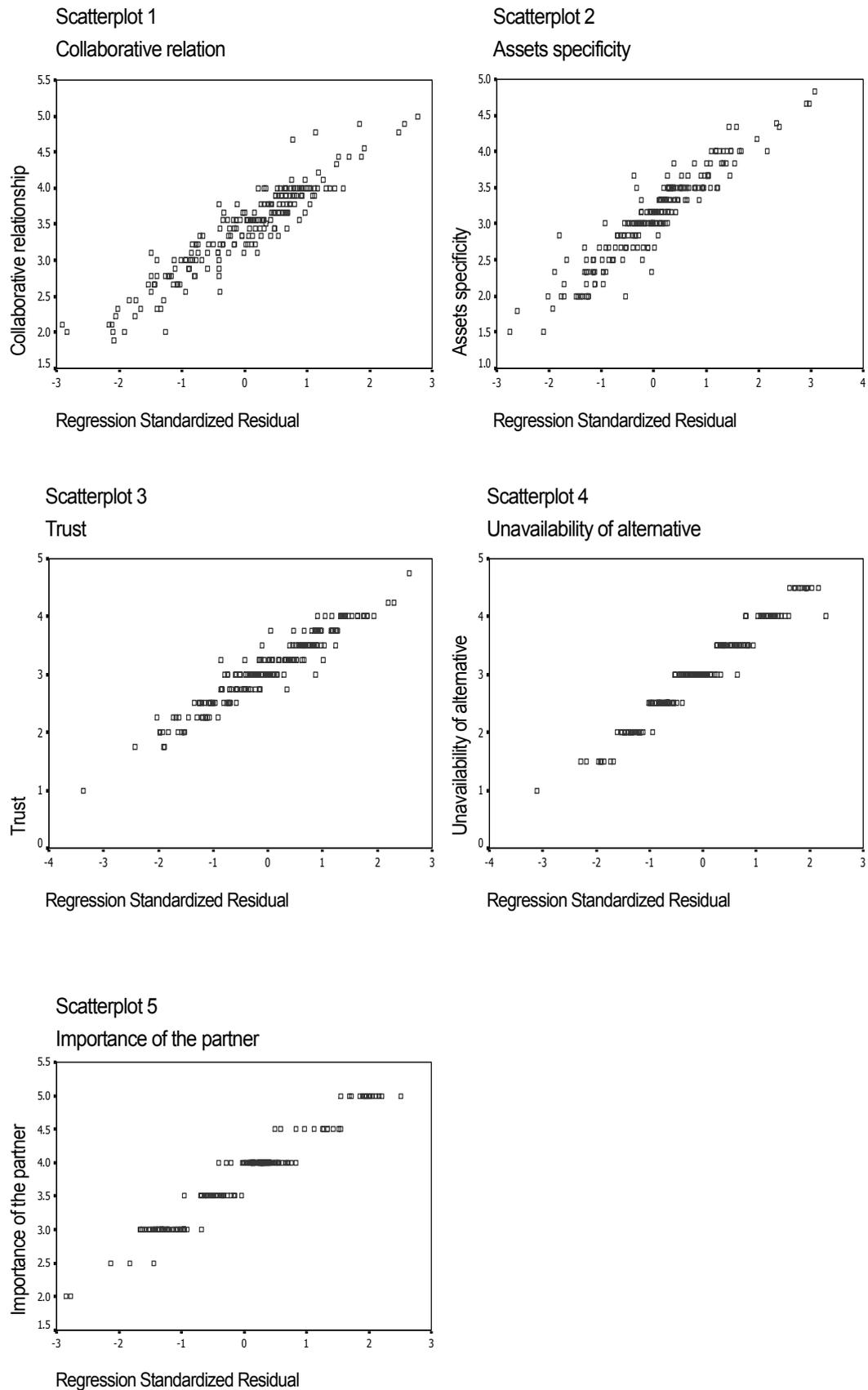
The final model of this research consists of a set of variables (i.e., independent, independent & dependent, and dependent variables) and has to consider a series of relationships between variables simultaneously. However, traditional statistical techniques such as multiple regression, multivariate analysis of variance (MANOVA), and canonical correlation analysis cannot be used for this research. These techniques share one common limitation that each one can examine only a single relationship at a time (Hair et al., 1998).

Structural equation modelling (SEM) is the single comprehensive technique to examine a series of dependence relationships simultaneously. SEM is particularly useful for one dependent variable which becomes an independent variable in subsequent dependence relationship (Hair et al., 1998). Accordingly, SEM is a suitable technique to test the hypotheses of this study. Specifically, AMOS (analysis of moment structure) Graphic 4.0 package software is used for this research. AMOS provides easy specification, view and modification to the research model with simple drawing tools, while allowing assessment of model fit, adjustment and test returns (Teo and Choo, 2001).

SEM requires four assumptions: independent observations, random sampling of respondents, the linearity of relationships and multivariate normality (Hair et al., 1998). As described in Chapter 4 (Methodology), every observation of this study was independently conducted and samples of respondents were randomly extracted. To check the linearity of relationships, as illustrated in figure 43 (the next page), graphical analyses of residuals are produced by SPSS software. They indicate that all dependent variables in the final model (i.e., assets specificity, trust, unavailability of alternative, importance of the partner and collaborative relationship) meet the assumption of the linearity of relationship.

All dependent variables in the final model had either a skewness value or a kurtosis value that are smaller than +1.00, or greater than -1.00. This indicates that univariate nonnormality is not statistically significant. However, AMOS reported that joint multivariate kurtosis in the data exceeds 10.0, and its associated critical ratio is greater than 1.96. This indicates that the data in the survey may critically violate the multivariate normality assumption (Kline, 1998).

Figure 43. Graphical analysis of residuals



The default estimation procedure of AMOS is the maximum likelihood estimation (MLE). While the MLE is the most common estimation procedure, the application of MLE procedure demands that the data should satisfy the criterion of multivariate normality (Bryne, 2001). Violation of multivariate normality assumption brings about a result that chi-square value of MLE becomes excessively large and standard errors may be underestimated (Bryne, 2001). Consequently, the spuriously high value of chi-square value results in inappropriate and nonreplicable modifications to otherwise theoretically adequate models. In addition, the underestimated standard error leads to the result that regression paths and factor/error covariances will be statistically significant although they may not be in the population.

This research will employ a *bootstrap* procedure to handle a presence of multivariate nonnormal data in SEM (Bryne, 2001). In order to correct a nonnormality in the data, *Bollen-Stine bootstrapped p-value* produced by a bootstrap procedure rather than usual maximum likelihood based *p-value* will be used to assess overall model fit. The bootstrap parameter estimate will also be produced as for each parameter (e.g., regression or pass coefficient) in the model.

Several fit statistics will be employed to assess the fitness of the models; the first index is the significance of chi-square (*p-value*), the second is the goodness-of-fit index (GFI), the third is the adjusted-goodness-of-fit index (AGFI), and the last is the root mean square error of approximation (RMSEA). Standard cut-offs of the above indices to accept the fitness of the model are established as reported in table 71. If the null hypothesis that ‘the (hypothesized) specified model structure fits the data’ is significantly correct, the Bollen-Stine *p-value* should be greater than 0.05, the GFI should be 0.90 or above, the AGFI should be 0.80 or above, and the RMSEA should be smaller than 0.10.

*Table 71. Fit index and cut-off point*

Fit index	Cut-off point	Author (suggest cut-off)
Significance of chi-square ( <i>Bollen-Stine p-value</i> )	> 0.05	-
Goodness-of-fit index (GFI)	≥ 0.90	Jöreskog and Sörbom (1982)
Adjusted-goodness-of-fit index (AGFI)	≥ 0.80	Jöreskog and Sörbom (1982)
Root mean square error of approximation (RMSEA)	< 0.10	Noh (2002)

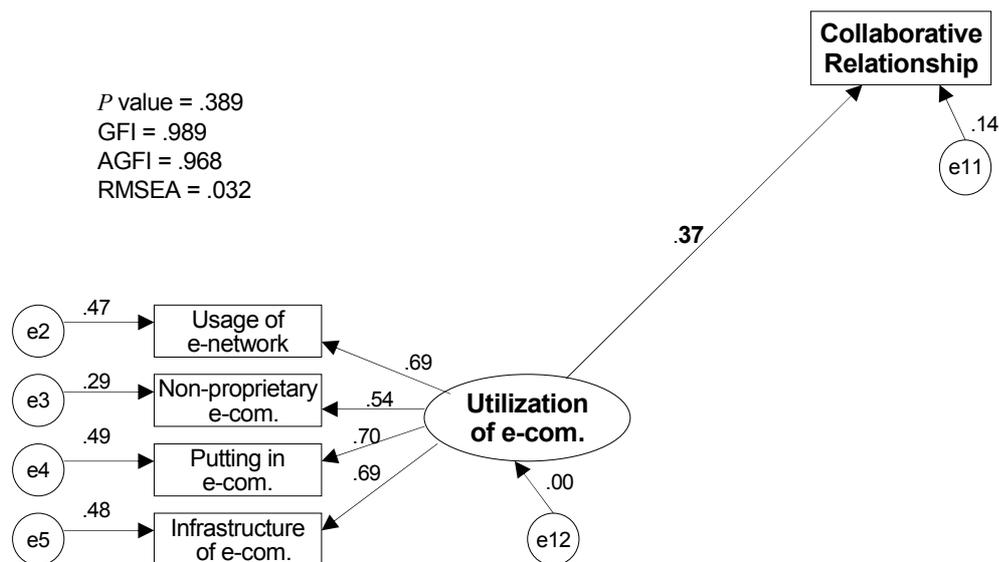
## 6.2.2. Test the Partial Model

### 6.2.2.1. Test hypothesis 1; Direct path from e-Commerce to B-S Relationship

As described in the section 3.2.2. (Direct path from e-commerce to buyer-supplier relationship), hypothesis 1 is that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier in the Korean electronics industry’. Hypothesis 1 was tested by structural equation modelling technique using AMOS Graphic 4.0. with maximum likelihood estimation (MLE) method with a bootstrap procedure.

As reported in figure 44, the hypothesized model 1 can be accepted as being a good fit with the data. The null hypothesis that ‘the hypothesized model 1 fits the data’ can be accepted because the Bollen-Stine p-value is 0.389, which is greater than the cut-off point, 0.05. Moreover, the fit indices for an assessment of fitness such as GFI, AGFI and RMSEA are also satisfactory. Namely, GFI is 0.989, AGFI is 0.968, and RMSEA is 0.032. With regard to a causal path in the model, the regression weight for utilization of e-commerce to collaborative relationship is 0.371 as seen in figure 44.

*Figure 44. Direct path from utilization of e-commerce to collaborative relationship*



#### Bootstrapped Parameter Estimate

Standardized (Beta) Weight	Mean	Bias(=Boot-ML)
Util. of e-Com → Coll. Relationship	0.371	- 0.003

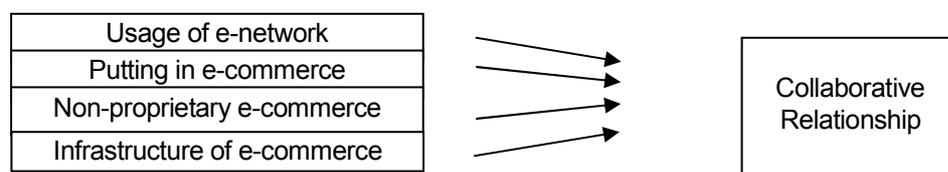
This result shows that hypothesis 1 is supported by the data in the survey, and indicates there is a significant causal relationship between e-commerce and collaborative relationship. In practical terms, this means that more use of e-commerce for business with the buyer (supplier) leads to a more collaboration with the buyer (supplier). For example, EDI (electronic data interchange) will facilitate the exchange of information between final assemblers and their suppliers, which will result in enhanced collaboration in areas of production delivery and R&D in the electronics industry.

In addition to the impact of the second-order construct (i.e., utilization of e-commerce) that comprises four first-order constructs (usage of e-network, putting in e-commerce, non-proprietary e-commerce, and infrastructure of e-commerce), the impacts of these first-order constructs on collaborative relationship are also of concern to the research. SPSS was employed for this analysis instead of AMOS. As reported in table 72, SPSS software produces coefficients of determination ( $R^2$ ) and partial regression coefficients ( $\beta$ ). The partial regression coefficients for first-order constructs range from -0.050 to 0.209. It is notable that partial regression coefficient for the first-order constructs in regression analysis is not as large as the regression weight of the second-order construct in SEM. In addition, the partial coefficient for non-proprietary e-commerce is -0.050. This suggests there is little probability that non-proprietary e-commerce could weaken collaborative relationships between trading partners.

*Table 72. Regression analysis for the effects of e-commerce on collaborative relationship*

Regression between factors	Coefficient of determination; $R^2$	Partial Regression coefficient; $\beta$ (probability)
Utilization of e-commerce (4 variables) → Collaborative relationship (1 variables)	.124	
Usage of e-network → Collaborative Relationship		.047 (.559)
Putting in e-com. → Collaborative Relationship		*.194 (.017)
Non-proprietary e-com. → Collaborative Relationship		-.050 (.504)
Infrastructure of e-com. → Collaborative Relationship		** .209 (.009)

\*Regression is significant at the level of 0.05., \*\*Regression is significant at the level of 0.01.

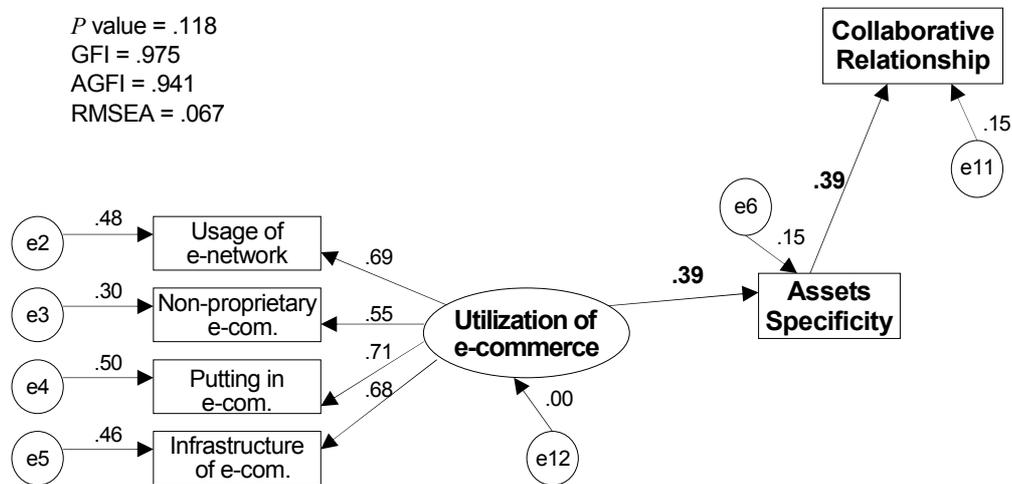


### 6.2.2.2. Test Hypothesis 2: Assets Specificity as a Mediator

As described in the section 3.2.3. (Assets specificity as a mediator between e-commerce and B-S relationship), hypothesis 2 is that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of assets specificity in the Korean electronics industry’. Hypothesis 2 was tested by structural equation modelling technique using AMOS Graphic 4.0. with maximum likelihood estimation method with a bootstrap procedure.

As reported in figure 45, structural path from utilization of e-commerce to collaborative relationship via assets specificity can be accepted as being a good fit with the data. The null hypothesis that ‘the specified model fits the data’ can be accepted because the Bollen-Stine p-value is 0.118, which is greater than the cut-off point, 0.05. Moreover, the fit indices for assessment such as GFI, AGFI and RMSEA are also satisfactory.

*Figure 45. Structural path from util. of e-commerce to coll. relationship via assets specificity*

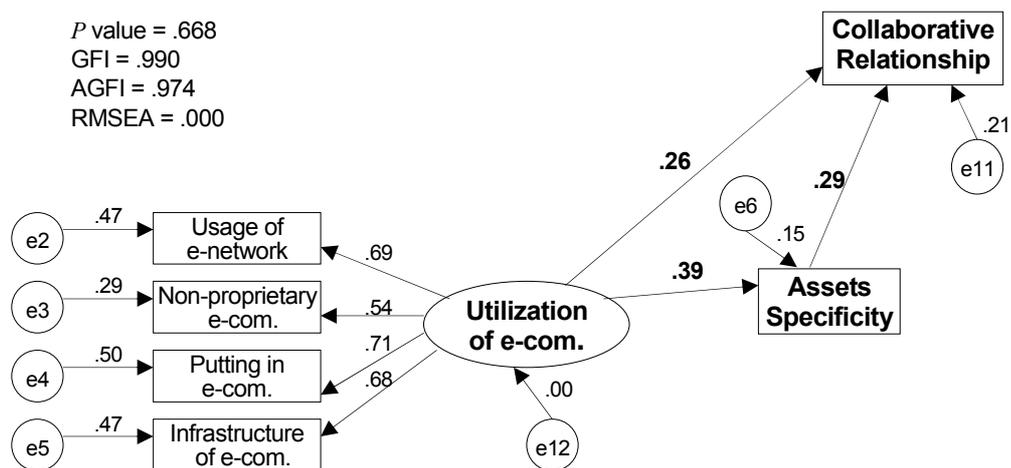


#### Bootstrapped Parameter Estimate

Standardized (Beta) Weight	Mean	Bias(=Boot-ML)
Util. of e-Com → Assets Specificity	0.389	0.001
Assets Specificity → Coll. Relationship	0.391	0.006

The hypothesized model 2 that asset specificity is a mediator between utilization of e-commerce and collaborative relationship, as reported in figure 46 (the next page), can also be accepted as being a good fit with the data. The null hypothesis that ‘the hypothesized model 2 fits the data’ can be accepted because the Bollen-Stine p-value is 0.668, which is greater than the cut-off point, 0.05. Moreover, the fit indices for assessment are also satisfactory. Namely, GFI is 0.990, AGFI is 0.974, and RMSEA is 0.000. All of three regression weights for causal paths in the model are significant. Namely, the (standardized) regression weight for utilization of e-commerce to assets specificity is 0.39, that for assets specificity to collaborative relationship is 0.29, and that for utilization of e-commerce to collaborative relationship is 0.26.

*Figure 46. Assets specificity as a mediator between util. of e-com. and coll. relationship*



**Bootstrapped Parameter Estimate**

Standardized (Beta) Weight	Mean	Bias(=Boot-ML)
Util. of e-Com. → Assets Specificity	0.387	-0.002
Assets Specificity → Coll. Relationship	0.289	-0.001
Util. of e-Com. → Coll. Relationship	0.260	0.000

These results suggest that hypothesis 2 is supported by the data in the survey, and indicate that assets specificity significantly mediates the impacts of utilization of e-commerce on collaborative relationship. In practical terms, this means that more use of e-commerce requires significant specific assets to buyers (suppliers), which, in turn, leads to a more collaboration with their partners. For example, electronic interconnection with major

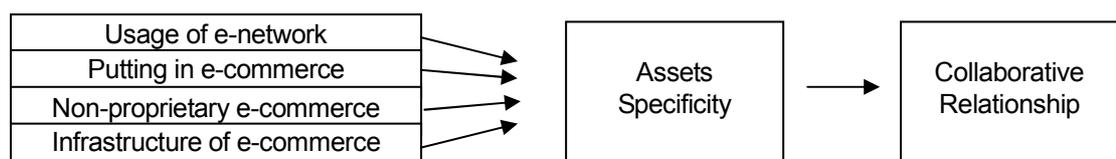
manufacturer brings a supplier to investments that are dedicated to a manufacturer, which, in turn, support the cooperation between the manufacturer and the supplier in the electronics industry. In addition to the impact of the second-order construct (i.e., utilization of e-commerce), the impacts of the first-order constructs on assets specificity are also of interest to the research. Rather than the structural equation modelling technique, a linear regression analysis technique is appropriate for this purpose because the model has just one dependent variable. SPSS software was employed for this analysis instead of AMOS software.

SPSS software produced coefficients of determination ( $R^2$ ) and partial regressions coefficients ( $\beta$ ) as reported in table 73. The partial regression coefficients for the first-order constructs range from 0.006 to 0.204. It is interesting that the (partial) regression coefficients for the first-order construct in regression analysis are not as large as the regression weight for the second-order construct in SEM. It is notable that the partial coefficient for putting in e-commerce is significant at the level of 0.05. In addition, the partial coefficient for non-proprietary e-commerce is 0.006, which may be interpreted that even non-proprietary e-commerce does not decrease assets specificity between trading partners.

*Table 73. Regression analysis for the effects of util. of e-commerce on assets specificity*

Regression between factors	Coefficient of determination; $R^2$	Partial Regression coefficient; $\beta$ (probability)
Utilization of e-Com (4 variables) → Assets Specificity (1 variable)	.121	
Usage of e-network → Assets Specificity		.108 (.183)
Putting in e-com. → Assets Specificity		*.204 (.012)
Non-proprietary e-com. → Assets Specificity		.006 (.934)
Infrastructure of e-com. → Assets Specificity		.110 (.169)
Assets Specificity (1 variable) → Collaborative Relationship (1 variable)	.153	** .391 (.000)

\*Regression is significant at the level of 0.05., \*\*Regression is significant at the level of 0.01.

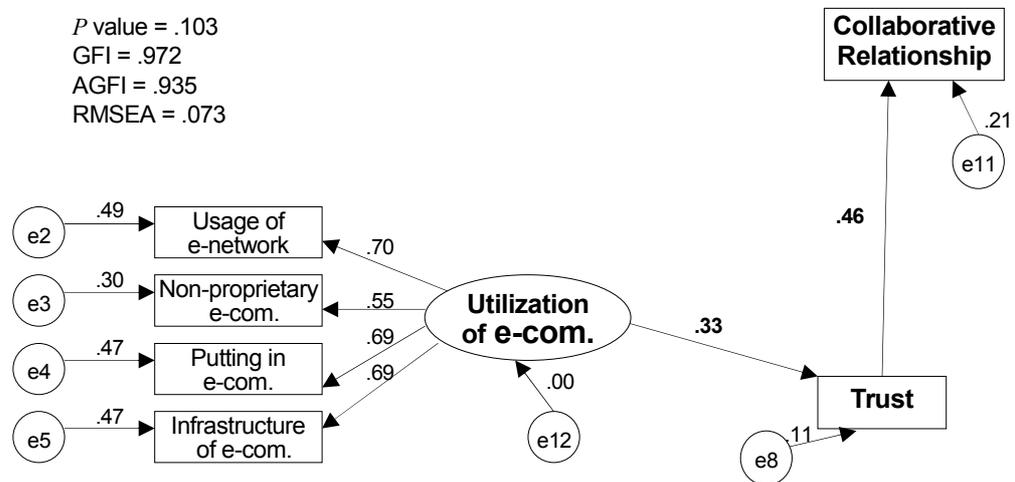


### 6.2.2.3. Test Hypothesis 3: Trust as a Mediator

As described in the section 3.2.4. (Trust as a mediator between e-commerce and B-S relationship), hypothesis 3 is that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of trust in the Korean electronics industry’. Hypothesis 3 was tested by structural equation modelling technique using AMOS Graphic 4.0. with a maximum likelihood estimation method a bootstrap procedure.

Structural path from utilization of e-commerce to collaborative relationship via trust can be accepted as a good fit with the data, as reported in figure 47. The null hypothesis that ‘the specified model fits the data’ can be accepted because the Bollen-Stine p-value is 0.103, which is greater than the cut-off point, 0.05. Moreover, the fit indices for assessment such as GFI, AGFI and RMSEA are also satisfactory.

*Figure 47. Structural path from util. of e-commerce to coll. relationship via trust*

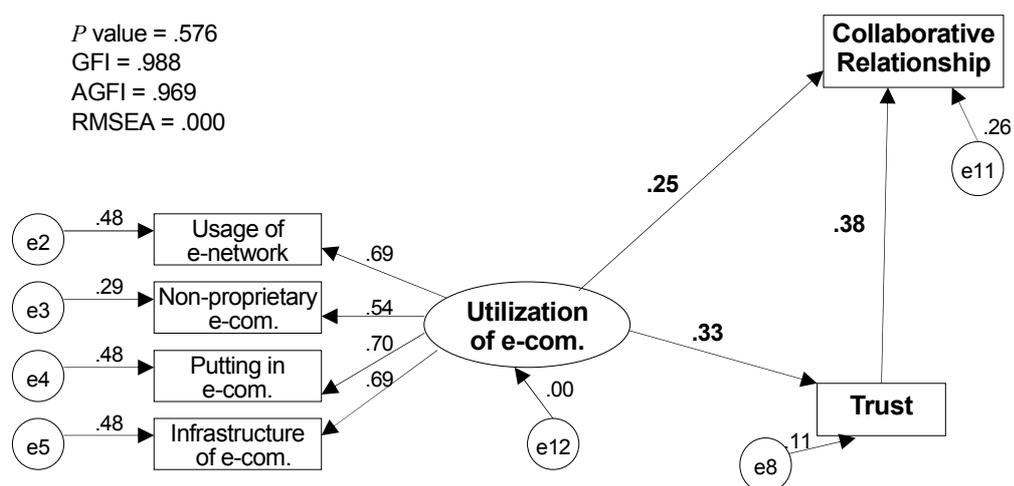


#### Bootstrapped Parameter Estimate

Standardized (Beta) Weight	Mean	Bias(=Boot-ML)
Util. of e-Com. → Trust	0.328	0.000
Trust → Coll. Relationship	0.457	0.001

The hypothesized model 3 that trust is a mediator between utilization of e-commerce and collaborative relationship, as reported in figure 48 (the next page), can also be accepted as a good fit with the data. The null hypothesis that ‘the hypothesized model 3 fits the data’ can be accepted because the Bollen-Stine p-value is 0.576, which is greater than the cut-off point, 0.05. Moreover, the fit indices for assessment such as GFI, AGFI and RMSEA are also satisfactory. Namely, GFI is 0.988, AGFI is 0.969, and RMSEA is 0.000. All of three regression weights for causal paths in the model are significant. Namely, the standardized regression weight for utilization of e-commerce to trust is 0.328, that for trust to collaborative relationship is 0.375, and that for utilization of e-commerce to collaborative relationship is 0.249.

*Figure 48. Trust as a mediator between util. of e-commerce and collaborative relationship*



Bootstrapped Parameter Estimate

Standardized (Beta) Weight	Mean	Bias (=Boot-ML)
<i>Util. of e-Com. → Trust</i>	0.328	0.000
<i>Trust → Coll. Relationship</i>	0.375	-0.002
<i>Util. of e-Com. → Coll. Relationship</i>	0.249	-0.000

These results suggest that hypothesis 3 is supported by the data in the survey, and indicate that trust significantly mediates the impacts of utilization of e-commerce on collaborative relationship. In practical terms, this means that more use of e-commerce builds trust between buyer and supplier, which, in turn, leads to a more collaboration. For example, a supplier

(buyer) who has well-equipped information system gains credibility from a buyer (supplier) , which will facilitate the buyer (supplier) to collaborate with the supplier (buyer).

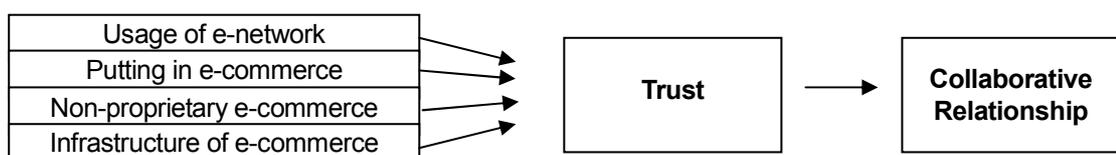
In addition to the impact of the second-order construct (i.e., utilization of e-commerce), the impacts of the first-order constructs on trust are also of interest to the research. For this purpose SPSS software was employed instead of AMOS software.

As reported in table 74, SPSS software produced coefficients of determination ( $R^2$ ) and partial regression coefficients ( $\beta$ ). The partial regression coefficients for the first-order constructs range from 0.030 to 0.150. As found in the analysis of assets specificity as a mediator, it is notable that the (partial) coefficients for the impacts of the first-order constructs on trust in regression analysis are not as large as the regression weight of second-order construct in SEM. The partial coefficients for usage of e-network and infrastructure of e-commerce are significant at the level of 0.05. In addition, the partial coefficient for non-proprietary e-commerce is 0.030, which indicates that non-proprietary e-commerce may enhance a trusting relationship between trading partners, even if it is not significant.

*Table 74. Regression analysis for the effect of e-commerce on trust*

Regression between variables	Coefficient of determination; $R^2$	Partial Regression coefficient; $\beta$ (probability)
Utilization of e-commerce (4 variables) → Trust (1 variable)	.086	
Usage of e-network → Trust		*.150 (.070)
Putting in e-commerce → Trust		.048 (.558)
Non-proprietary e-commerce → Trust		.030 (.693)
Infrastructure of e-commerce → Trust		*.139 (.089)
Trust (1 variable) → Collaborative relationship (1 variable)	.207	** .455 (.000)

\*Regression is significant at the level of 0.05., \*\*Regression is significant at the level of 0.01.

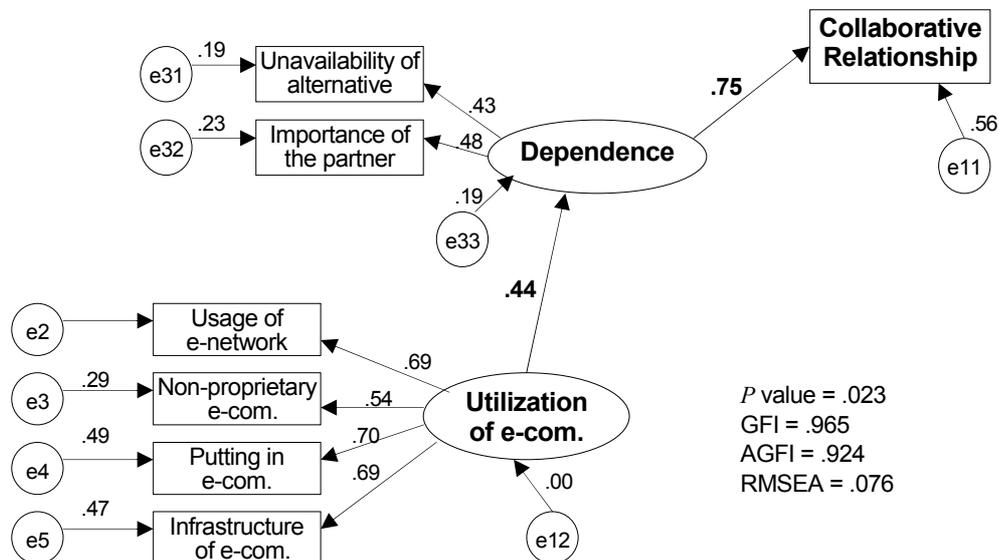


#### 6.2.2.4. Test Hypothesis 4: Dependence as a Mediator

As described in the section 3.2.5. (Dependence as a mediator between e-commerce and B-S relationship), hypothesis 4 is that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of dependence in the Korean electronics industry’. Hypothesis 4 was tested by structural equation modelling.

Against the expectation, structural path from e-commerce to collaborative relationship via dependence can not be accepted due to its bad fit with the data. As shown in figure 49, the fit indices for assessment such as GFI, AGFI and RMSEA are satisfactory, however, the null hypothesis that ‘the specified model fits the data’ can not be accepted because the Bollen-Stine p-value is 0.023, which is below the cut-off point, 0.05.

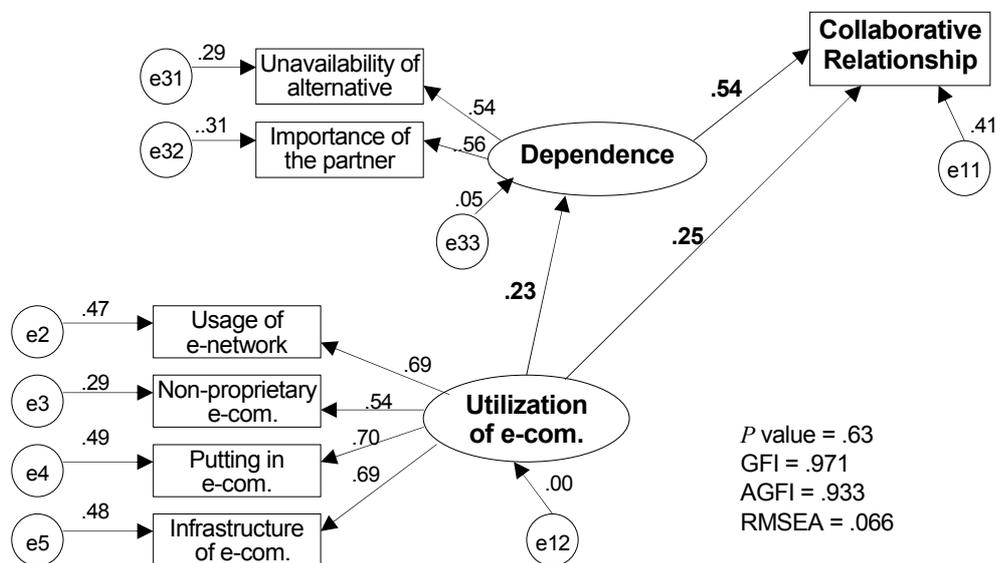
*Figure 49. Structural path from util. of e-commerce to coll. relationship via dependence*



The modification indices of AMOS software proposed that a fitness of the model might be improved if the covariances between usage of e-network construct and unavailability of alternative construct were introduced. However, since the former construct is defined as a independent and the latter is a dependent variable in the model, the addition of the covariances may make a theoretical problem in the model. Accordingly, the proposal of AMOS software should be carefully considered. Apart from a structural path from utilization

of e-commerce to collaborative relationship via dependence, the hypothesized model 4, in which dependence is defined as a mediator between utilization of e-commerce and collaborative relationship, can be accepted as being a good fit with the data. The null hypothesis that ‘the hypothesized model 4 fits the data’ can be accepted because the Bollen-Stine p-value is 0.063, which is greater than the cut-off point, 0.05. Moreover, the fit indices for assessment such as GFI, AGFI and RMSEA are also satisfactory as seen in figure 50. Standardized regression weights for causal paths in the model are significant. They are 0.232, 0.538 and 0.246, respectively.

*Figure 50. Dependence as a mediator between util. of e-commerce and coll. relationship*



Bootstrapped Parameter Estimate

Standardized (Beta) Weight	Mean	Bias (=Boot-ML)
Util. of e-Com. → Dependence	0.232	-0.003
Dependence → Coll. Relationship	0.538	0.003
Util. of e-Com. → Coll. Relationship	0.246	-0.002

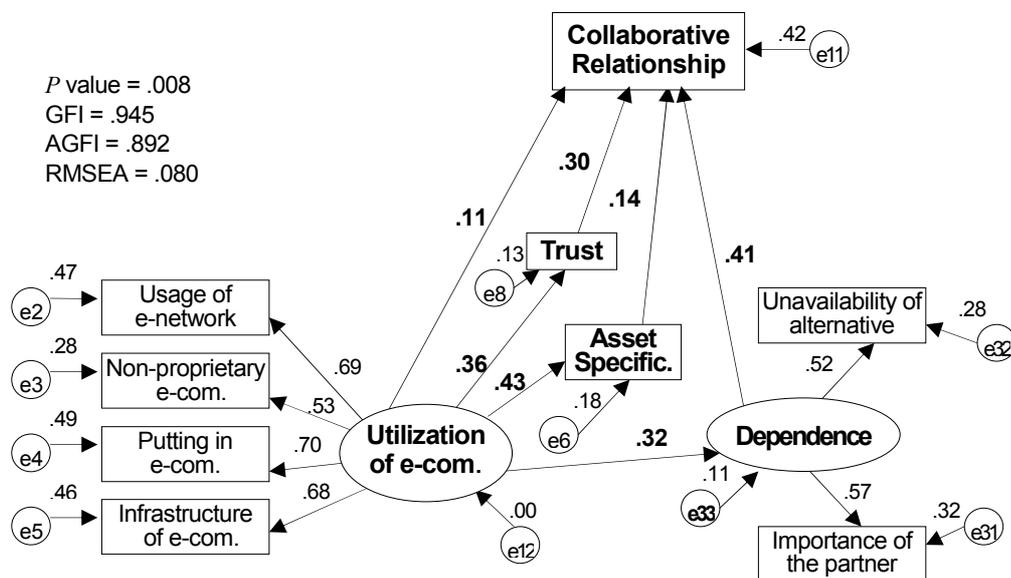
Even though a structural path from utilization of e-commerce to collaborative relationship via dependence (figure 49, the previous page) was not accepted, all of three paths in this model are significant as shown in figure 50. Accordingly, it can be concluded that hypothesis 4 is supported by the data in the survey. In practical terms, this means that more use of e-commerce forms interfirm dependence between trading parties, which, in turn, leads to a more cooperation.

### 6.2.3. Test the Integrated Full Model

As described in the section 3.2.6. (Integrated full model), hypothesis 5 is that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence in the Korean electronics industry’. Hypothesis 5 was tested by structural equation modelling technique using AMOS Graphic 4.0. with maximum likelihood estimation method with a bootstrap procedure.

Against the expectation, as seen in figure 51, the integrated full model<sup>19</sup> made by hypothesis 5 should be rejected as being a bad fit with the data. Though the fit indices for assessment such as GFI, AGFI and RMSEA are satisfactory, the null hypothesis that ‘the integrated full model made by hypothesis 5 fits the data’ can not be accepted because the Bollen-Stine p-value is 0.008, which is far below the cut-off point, 0.05.

*Figure 51. Test of the original integrated model*

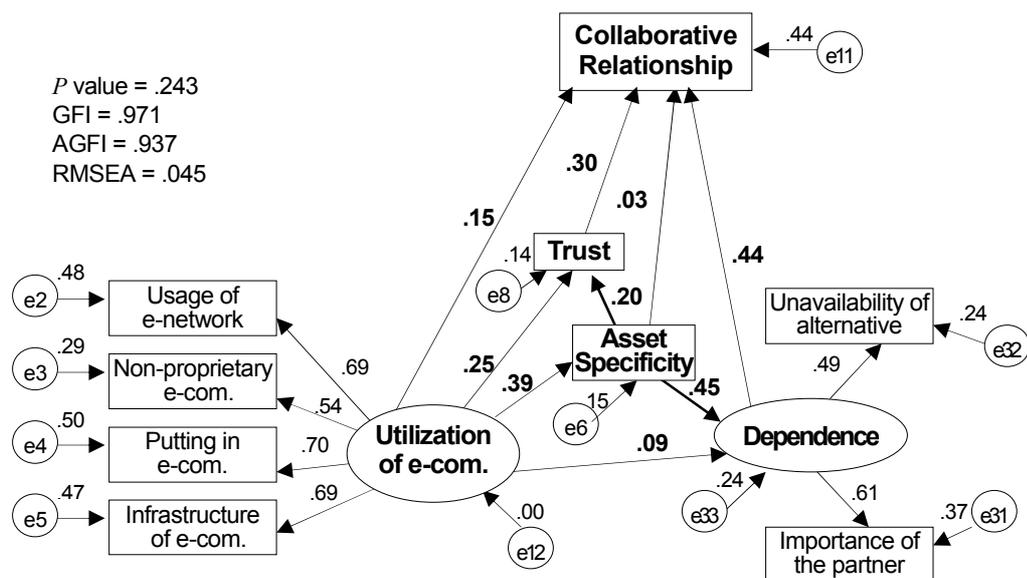


<sup>19</sup> The integrated model consists of four structural paths. As explained section 6.2.2. (Test the partial models), three of them are accepted as a good fit, but one of them has some problem with the fit. However, the last one is determined to be included in the integrated model because (1) the path from utilization of e-commerce to collaborative relationship via dependence has a theoretical ground., (2) the fit indices for assessment such as GFI, AGFI and RMSEA in the path are satisfactory., (3) the chi-square value in the path is insignificant at the level of 0.01., and (4) the hypothesized model 4 (figure 49), in which dependence is a mediator, is accepted as a good model.

The modification indices of AMOS software proposed two causal paths to improve the fitness of the original model. The one is the path from assets specificity to trust, and the other is the path from assets specificity to dependence. These paths can be justified in terms of the theory because specific assets are expected to have a positive impact on building trust and dependence between trading parties. Accordingly, two causal paths are added in the original model as illustrated in figure 52.

The null hypothesis that ‘the modified (integrated) model 1 fits the data’ can be accepted because the Bollen-Stine p-value is 0.243, which is greater than the cut-off point, 0.05 and the fit indices for assessment such as GFI, AGFI and RMSEA are satisfactory.

*Figure 52. Test of the modified (integrated) model 1*



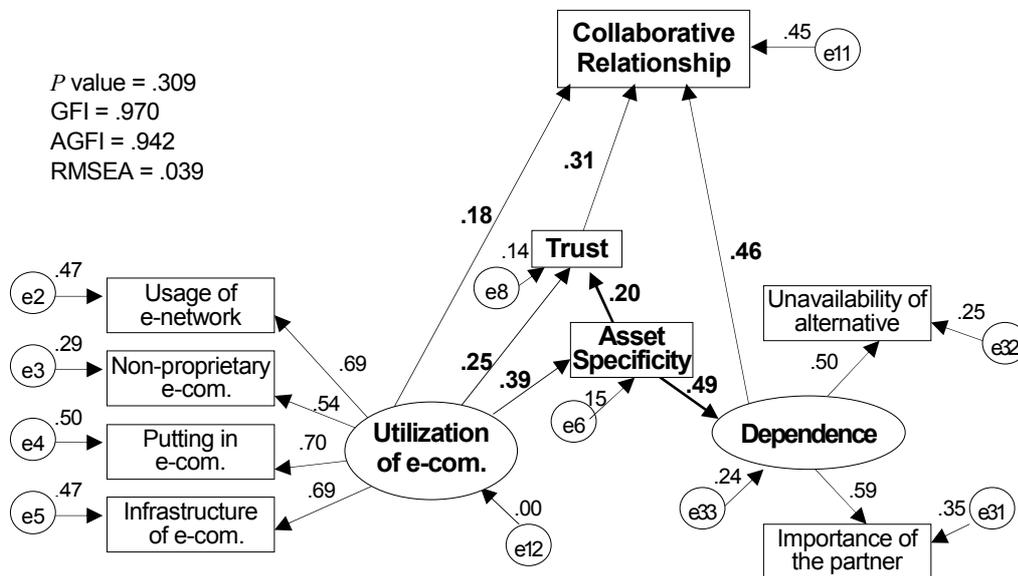
However, the modified model 1 has two insignificant paths (i.e. path from utilization of e-commerce to dependence, and path from assets specificity to collaborative relationship). The deletion of these paths could increase the fitness of the model, and thus leads to a more modified model.

The null hypothesis that ‘the modified (integrated) model 2 fits the data’ can be accepted, as illustrated in figure 53, because the Bollen-Stine p-value is 0.309, which is greater than below the cut-off point, 0.05 and the fit indices for assessment such as GFI, AGFI and RMSEA are satisfactory.

Compared to the original integrated model, some causal paths are added and deleted. At first, assets specificity indirectly affects collaborative relationship via trust and dependence in the modified model rather than directly does as in the original model. Second, the dependence is influenced by utilization of e-commerce via assets specificity in the modified model rather than is directly done by utilization of e-commerce as in the original model.

Consequently, it can be concluded that the data in the survey support hypothesis 5, however causal paths are slightly changed as a result of modification processes.

*Figure 53. Test of the modified (integrated) model 2*



#### 6.2.4. Test the Moderating Variable: Environmental Uncertainty as a Moderator

As described in the section 3.2.7. (Environmental uncertainty as a moderating variable), hypothesis 6 is that ‘environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry’.

In order to test hypothesis 6, two hundred and nine cases in the survey are divided into two clusters by k-means cluster analysis using SPSS software. The one is a higher level of environmental uncertainty cluster, and the other is a lower level of environmental uncertainty cluster. The regression weights for each causal path in the research model has been computed by using SEM technique with a maximum likelihood estimation method with a bootstrapped procedure. Regression weights for one cluster are compared to those of the other cluster.

As reported in table 75, figure 54 (the next page) and figure 55 (the next page), there are significant differences for two clusters. It is notable that utilization of e-commerce strengthens assets specificity under the lower uncertainty cluster more than the higher uncertainty cluster, while utilization of e-commerce facilitates trust and collaborative relationship under the higher uncertainty cluster more than the lower uncertainty cluster.

Consequently, it can be the conclusion that the data in the survey support hypothesis 6

*Table 75. Comparison of regression weights between dyadic uncertainty clusters*

Causal Path	Standardized Regression Weights		
	Lower Uncertainty Cluster (n=80)	Higher Uncertainty Cluster (n=129)	Difference
<i>Util. of e-Com. → Specificity</i>	.46	.27	<i>Significant</i>
<i>Util. of e-Com. → Trust</i>	.16	.36	<i>Significant</i>
<i>Util. of e-Com. → Coll. Relationship</i>	.10	.24	<i>Significant</i>
Trust → Coll. Relationship	.36	.31	-
Specificity → Trust	.21	.26	-
Specificity → Dependence	.53	.41	-
Dependence → Coll. Relationship	.47	.38	-

Figure 54. Lower level of uncertainty cluster

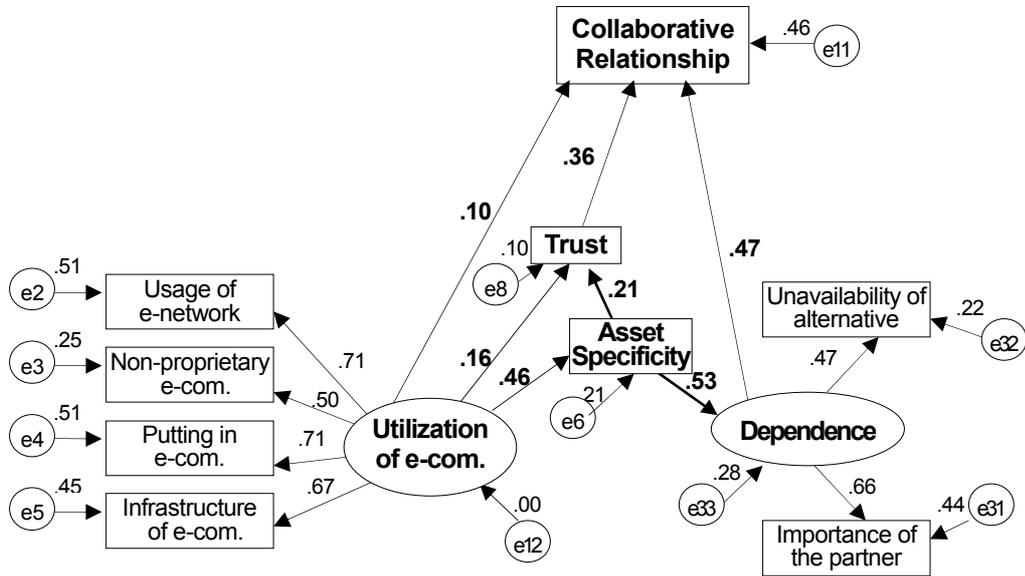
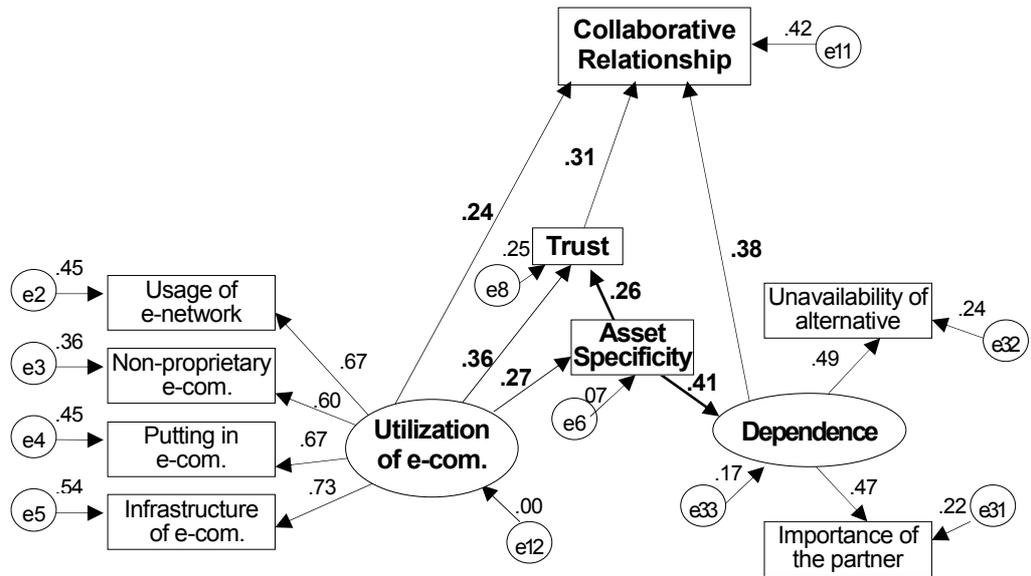


Figure 55. Higher level of uncertainty cluster

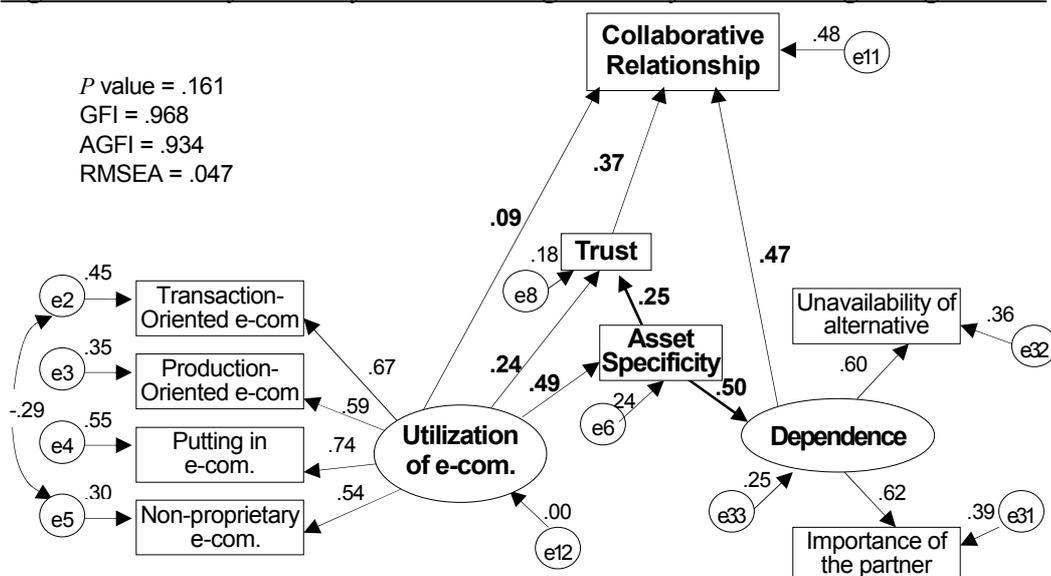


### 6.2.5. Ex-Post Analysis

As referred to in the section of 5.4. (ANOVA), ANOVA test showed that thirty percent of original items are significantly different between subgroups. As described in the section 5.5. (Factor analysis), factor analysis was also conducted on the initial items in the survey. This analysis, called as ‘factor analysis disregarding the results of ANOVA’, found the data structure that was a little different from that of reflecting ANOVA. Above all, ‘usage of e-network’ and ‘infrastructure of e-commerce’ factors in ‘factor analysis reflecting the results of ANOVA’ were replaced by ‘transaction-oriented e-commerce’ and ‘production-supported e-commerce’ in ‘factor analysis disregarding the results of ANOVA’.

At this stage of the research, it can be raised whether the original data confirm the modified research model that was confirmed in the previous section of 6.2.3. (Test the integrative model). For this purpose, the modified research model is tested by the data structure found by factor analysis of disregarding ANOVA. AMOS software produced the results of this test as shown in figure 56. In sum, the null hypothesis that ‘the modified (integrated) model 2 fits the original data’ can be accepted because the Bollen-Stine p-value is 0.161, which is greater than the cut-off point, and the fit indices such as GFI, AGFI and RMSEA are satisfactory, even as the regression weights for causal paths were changed and one covariance between two first-order (independent) constructs was added in the model.

*Figure 56. Test of the modified model using the data from the disregarding ANOVA*



## 6.3. Interpretation of the Results

### 6.3.1. Interpretation on the Partial Models

Four partial models were hypothesized in the research, and the data in the survey supported the hypotheses concerned. As explained in the previous section 6.2.2. (Test the partial models), the results are summarized as follows;

*Result 1: the data in the survey support hypothesis 1 that utilization of e-commerce will directly facilitate a collaborative relationship between buyer and supplier in the Korean electronics industry.*

*Results 2: the data in the survey support hypothesis 2 that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of assets specificity in the Korean electronics industry.*

*Results 3: the data in the survey support hypothesis 3 that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of trust in the Korean electronics industry.*

*Results 4: the data in the survey support hypothesis 4 that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of dependence in the Korean electronics industry, even though the structural path from utilization of e-commerce to dependence to collaborative relationship was not accepted.*

Result 1 shows that there is a significant causal relationship between utilization of e-commerce and collaborative relationship. This means that use of e-commerce leads to a more collaboration between buyer (supplier) and its key supplier (buyer). This result may be caused by the intrinsic characteristics of electronic commerce deployed in the Korean electronics industry. In a non-proprietary e-commerce firms select trading partners on transaction-by-transaction basis, whereas in a proprietary e-commerce firms usually have a tightly coupled relationship with their trading partners (Marchewka and Towell, 2000). It is expected that proprietary e-commerce usually generate an electronic integration effect rather than an electronic brokerage effect. As described in the section 5.3.5. (Penetration of e-commerce), mean volume of transactions via a proprietary e-commerce is about fourteen

times larger than that via a non-proprietary e-commerce in the sample companies of this study. Accordingly, dominance of proprietary e-commerce over non-proprietary e-commerce may lead to collaborative relationships between buyers (supplier) and their largest suppliers (buyers) in the Korean electronics industry.

On the other hand, this result may be related to strategic characteristics of e-commerce. E-commerce enables firms to redesign a business process and establish a flexible structure for value creation (Tang et al., 2001). Firms may choose a business relationship in order to maximize long-run values rather than to minimize the total costs posited in transaction cost economics. A long-term collaborative relationship with a core group of business can lead to a sustainable competitive advantage in industrial market (Dyer and Singh, 1998; Hoyt and Huq, 2000). The survey of this research focused on the relationships between buyers (suppliers) and their largest suppliers (buyers) in the Korean electronics industry. In most cases, the largest business partners are key sources to create a long-term value of the firm. Accordingly, firms in the Korean electronics industry may leverage electronic commerce to improve relationships with their key trading partners for a value creation.

Result 2 indicates that assets specificity significantly mediates the impacts of utilization of e-commerce on collaborative relationship. In practical terms, this means that more use of e-commerce requires significant specific assets to the buyer (supplier), which, in turn, leads to a more collaboration with the partner. For example, electronic interconnection with a major manufacturer brings a supplier to investments that are dedicated to the manufacturer, which, in turn, support the cooperation between the manufacturer and the supplier in the electronics industry.

As described in section 2.5.2. (Economic profile of the Korean electronics industry), thousands of small- and medium-sized companies are vertically integrated with a few large-sized final manufacturers in the Korean electronics industry. Most final manufacturers have their own electronic procurement systems, however there is little interoperability between major manufacturers' systems. In this situation, adoption of e-commerce for the business with the buyer (supplier) requires an investment for specific hardware, software, staff training and procedural adaptation, which might become worthless outside of the relation with the buyer (supplier) (Bakos, 1991). On the one hand these specific investments will be used for tools and equipment to facilitate cooperation such as information exchange,

order and delivery, joint marketing and product development, on the other hand they will strongly limit opportunistic behaviours such as a violation of the agreements and a break in relation without notice.

Result 3 indicates that trust significantly mediates the impacts of utilization of e-commerce on collaborative relationship. In practical terms, this means that more use of e-commerce builds trust between buyer and supplier, which, in turn, leads to more collaboration. For example, a supplier (buyer) who has well-equipped information system gains credibility for communication from the buyer (supplier), which will facilitate the buyer (supplier) to collaborate with the supplier (buyer).

Interorganizational trust can be developed by communicating valuable information, including expectations, market intelligence, and evaluations of the partner's performance (Morgan and Hunt, 1994). As described in the section 5.3.4. (Activities conducted via e-commerce), firms in the Korean electronics industry employ e-commerce for providing information on procurement policy, receiving data on products, negotiating terms of products, placing orders and conducting market research. In addition, as founded by Leek et al. (2003), the use of e-commerce technologies such as e-mail complements and enhances more traditional communication methods such as phone and fax. Accordingly, a better communication facilitated by e-commerce results in a trusting relationship in the Korean electronics industry.

Result 4 indicates that dependence can mediate the impacts of utilization of e-commerce on collaborative relationship. This finding indicates that even though e-commerce might contribute to reducing information gap and mitigating asymmetry of information between electronically linked firms, it would not weaken interfirm dependence. Rather, this result says that e-commerce would increase mutual dependence between trading parties, which shifts their relationships towards a more collaborative form.

In this study dependence construct consists of two components: unavailability of alternative, and importance of the partner. The former was measured by responses on two statements: (1) It costs a lot to switch the partner., and (2) Switching from the partner would lose a lot of investment. The latter was also measured by two items: (1) Maintaining the partner is critical to profitability of ours., (2) The partner is crucial to our future performance. When the

measurement items considered, result 4 can be understood in the concept of corporate interlocking. For example, buyer's (supplier's) electronic interconnection with a supplier (buyer) facilitates exchange of information and enhances the level of communication with the supplier (buyer), however, which leads to buyer's (supplier)' dependence on the supplier (buyer). This is because the information provided by the supplier (buyer) becomes more important to the buyer (supplier) , and it costs lots of loss to break a communication with the supplier (buyer).

However, results 4 should be more carefully interpreted. As described in the section 6.2.2.4. (Test hypothesis 4), structural path from utilization of e-commerce to dependence, to collaborative relationship was not accepted. Some modification needs to improve the fitness of the hypothesized model for result 4.

All of these results unanimously indicate that e-commerce has been used to intensify existing hierarchical structure rather than to facilitate emerging market coordination. This finding may be specific to the relationships between buyers (suppliers) and their key suppliers (buyers) in the Korean electronics industry. The impacts of e-commerce might be controlled by the characteristics of Korean culture. As described in the section 2.5.1. (Overview of Korean economy), Korean culture is characterized by relationship-orientation, strong uncertainty avoidance and long-term orientation (Kim et al., 1998; Teng et al., 1999; Calhoun et al., 2002).

It may be true that this finding of the study has some weakness for generalization. However, it corresponds to the general trend currently identified by the Economist (2004<sup>1</sup>) which reported the current state of business-to-business e-commerce as follows;

“Before the dot.com bubble popped, the really big money in e-commerce was expected to be in business-to-business (B2B) websites, especially in online auctions. --- It did not work out like that. For one thing, companies were not particularly willing to sift through tenders from lots of supplier they had never dealt with before. Most of them prefer to build stable longer-term relation with a limited number of suppliers. And instead of paying middlemen to facilitate B2B trade, many firms simply started dealing directly with one another electronically, replacing letters and faxes with e-mails and other digital documentation.”

It is notable that, as summarized in table 76, the regression coefficients for the first-order constructs (i.e., usage of e-network, putting in e-commerce, non-proprietary e-commerce, and infrastructure of e-commerce) in regression analysis are not as large as the regression weight for the second-order construct (i.e., utilization of e-commerce) in structural equation modelling. For example, the (standardized) regression weight for the second-order construct to assets specificity is 0.390, while the (standardized) regression coefficients for the first-order constructs to assets specificity ranges from 0.006, to 0.110, to 0.108, to 0.204.

*Table 76. Comparison of regression weights between first- and second- order constructs*

Causal Path	(Standardized) Regression Weight (or coefficient)		
	⇒ Assets Specificity	⇒ Trust	⇒ Relationship
First-Order Construct			
Usage of e-network ⇒	.108	*.150	.047
Putting in e-commerce ⇒	** .204	.048	** .194
Non-proprietary e-commerce ⇒	.006	.030	-.050
Infrastructure of e-commerce ⇒	.110	*.139	***.209
Second-Order Construct			
Utilization of e-commerce ⇒	***.390	***.330	***.370

\* significant at the level of 0.10, \*\*significant at the level of 0.05, \*\*\*significant at the level of 0.01

This result indicates that the impacts of e-commerce will be strongly materialized when all aspects of e-commerce are combined into. For example, each aspect of e-commerce (i.e., four first-order constructs) weakly influences trust, while the integrated one (i.e., the second order construct) strongly affects trust. Even though a firm increases investments on information technologies, the relationship with the trading partner is not likely to be improved. However, if a firm increases investments on information technology, expands usage of electronic network and employs advanced software such as SCM (supply chain management), the relationships with the trading partner is sure to be upgraded.

It is also interesting result that the partial coefficient for non-proprietary e-commerce to assets specificity is 0.006, to trust is 0.030, and to relationship is -.050. This finding means that even non-proprietary e-commerce such as open e-Marketplace does neither significantly decrease nor increase the level of assets specificity, trust and collaborative relationships between buyers (suppliers) and their key suppliers (buyers) in the Korean electronics industry. This result needs to be interpreted in terms of technological neutralism.

Non-proprietary forms of e-commerce, such as reverse auctions, are intrinsically open to all the public. This means that they have the possibility to facilitate market competition (Marchewka and Towell, 2000). However, if they were set up in cooperation with an existing partner, they would be a tool to bolster an established relationship rather than to generate a competitive effect. This reasoning can be supported by an empirical study. For example, Smart and Harrison (2003) found that reverse auctions had the potential to be used in both collaborative and competitive relationships as a means of tendering contracts in their empirical study.

### 6.3.2. Interpretation on the Integrated Full Model

The full model, which integrated four partial models, was hypothesized in the research. As explained in the section 6.2.3. (Test the integrated full model), the result of testing a full model is summarized as the following;

*Result 5: the data in the survey support hypothesis 5 that 'utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence in the Korean electronics industry'. However, causal paths are slightly changed as a result of modification processes.*

This integrated result shows a macro-view on the relationships between research constructs (i.e., utilization of e-commerce, assets specificity, trust, dependence, and collaborative relationships) and relative strengths of both direct and indirect casual paths from utilization of e-commerce to collaborative relationship.

Compared to the original integrated model, some causal paths are added and deleted in the modified full model, which is the final result of the modification processes. At first, this result suggests that the level of dependence between trading partners is indirectly affected by utilization of e-commerce via the mediating role of assets specificity. The level of dependence does not directly influenced by utilization of e-commerce, however increased assets specificity caused by utilization of e-commerce leads to intensifying interfirm dependence. In addition, assets specificity does not directly affect buyer-supplier relationship.

Rather, it indirectly affects buyer-supplier relationship via the mediating roles of trust and dependence.

The result of the full model shows the relative strength of each causal path from utilization of e-commerce to collaborative relationship. As reported in table 77, there are four significant causal paths in the modified full model: a direct path from utilization of e-commerce to collaborative relationship, an indirect path from utilization of e-commerce to collaborative relationship via trust, an indirect path from utilization of e-commerce to collaborative relationship via assets specificity and trust, and the indirect path from utilization of e-commerce to collaborative relationship via assets specificity and dependence.

Among these, the direct path (regression weight = 0.180) is the most salient, followed by the indirect path via trust (regression weight = 0.093), the indirect path via assets specificity and dependence (regression weight = 0.088), and the indirect path via assets specificity and trust (regression weight = 0.024).

*Table 77. Standardized direct, indirect and total effects of util.of e-com. on coll. relationship*

Effect	Causal Path	Std. Regression weight
Direct effect	e-Com. to Coll. relation.	.180
Indirect effect	e-Com. to Coll. relation. via Trust	.25*.31=.093
	e-Com. to Coll. relation. via Specificity and Trust	.39*.20*.31=.024
	e-Com. to Coll. relation. via Specificity and Dependence	.39*.49*.46=.088
Total effect	All Paths	.385

This finding suggests that utilization of e-commerce may facilitate collaborative relationship regardless of the mediating roles of assets specificity, trust, or dependence. Conversely, this may indicate that it is the long-term collaborative relationship that materializes benefits of electronic commerce, and thus leads to a competitive advantage.

As reported in table 78 (the next page), coefficients for direct and indirect effect have changed according to each model, whereas those for total effect remain barely changed. The coefficient for direct effect is 0.370 in the structural path, goes down 0.250 in the partial models, and drops to 0.180 in the full model. It appears that the more each model has mediating variables, the weaker direct effect is.

*Table 78. Comparison of direct and indirect effects among the models*

Model	Direct Effect (e-Com. to Relation.)	Indirect Effect (e-Com. to Relation. via Some)	Total effect (=direct + indirect effect)
Structural Path	0.370	-	0.370
Partial Model via Specificity	0.260	0.113	0.373
Partial Model via Trust	0.250	0.122	0.372
Partial Model via Dependence	0.250	0.124	0.374
Fully Integrated Model via Specificity, Trust, and Dependence	0.180	0.205	0.385

This result does not say that direct effects would be insignificant if more variables were included in the model. Rather, it only indicates the solidity of direct path in each model. All constructs comprised of the research model were chosen on the basis of their relative importance in the studies on electronic commerce and business relationships. Furthermore, every causal path that is included in the research model was hypothesized on the ground of the well-known theories. For instance, environmental uncertainty could theoretically be one of key variables that determine governance structure, but it was not empirically obvious whether there is a significant causality between e-commerce and environmental uncertainty, or environmental uncertainty remains independent of e-commerce. Accordingly, environmental uncertainty was hypothesized as a moderating variable in this study.

### 6.3.3. Interpretation on the Moderating Model

Environmental uncertainty was hypothesized as a moderating variable in the research. As explained in the section 6.2.4. (Test the moderating model), the results of testing a moderating model is summarized as the following;

*Result 6: the data in the survey support hypothesis 6 that environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry.*

As reported in table 79 (the next page), standardized regression weight for utilization of e-commerce to collaborative relationship goes up from 0.10 in lower uncertainty cluster to 0.24 in higher uncertainty cluster. The regression weight for utilization of e-commerce to

trust also goes up from 0.16 in lower uncertainty cluster to 0.36 in higher uncertainty cluster. Unlike the regression weights to collaborative relationship and trust, the regression weight for utilization of e-commerce to assets specificity comes down from 0.46 in lower uncertainty cluster to 0.27 in higher uncertainty cluster. These results mean that utilization of e-commerce strengthens assets specificity under a lowly uncertain situation more than a highly uncertain situation, whereas utilization of e-commerce facilitates trust and collaborative relationship under a highly uncertain situation more than a lowly uncertain situation.

*Table 79. Comparison of regression weights between dyadic uncertainty clusters*

Causal Path	Standardized Regression Weights		
	Lower Uncertainty Cluster (n=80)	Higher Uncertainty Cluster (n=129)	Difference
Util. of e-Com. → Coll. Relationship	.10	.24	Significant
Util. of e-Com. → Trust	.16	.36	Significant
Util. of e-Com. → Specificity	.46	.27	Significant

This result may be caused by firms' tendency to environmental uncertainty. Confronted with a highly uncertain situation, firms may choose flexibility supported by collaborative relationship rather than rigidity posited in specific assets. In other words, under a volatile situation, companies prefer building a trusting relationship to investing in specific assets.

In practical terms, this finding means that in a situation that prices and demand are difficult to predict and products have a high innovation rate and short life cycle, firms do not do a favor to commit resources or make investments or change procedures for electronic interconnection with a specific partner. Rather, under such an uncertain environment, firms will concentrate on building a close, long-term trusting relationship with the existing partners by employing e-commerce for a brisk communication.

#### 6.3.4. Interpretation on the ex-Post Model

As described in the section 6.2.5. (Ex-post analysis), the reduced original data, which were derived from the factor analysis disregarding the results of ANOVA, also confirmed the

modified research model even though the regression weights for causal paths were changed. This result consolidates the validity of the modified research model.

As reported in the table 80, however, it is notable that two causal paths are remarkably different between two kinds of data. The regression weight for utilization of e-commerce to collaborative relationship comes down from 0.180 in data reflecting ANOVA to 0.090 in data disregarding ANOVA, whereas the regression weight for utilization of e-commerce to assets specificity goes up from 0.390 in data reflecting ANOVA to 0.490 in data disregarding ANOVA. These results cause the difference of total effects between two sets of data.

These findings indicate that in case of some subgroup, the effects of e-commerce on buyer-supplier relationship might be materialized mainly by indirect paths (i.e., the mediating roles of assets specificity, trust and dependence) rather than direct path from e-commerce to buyer-supplier relationship.

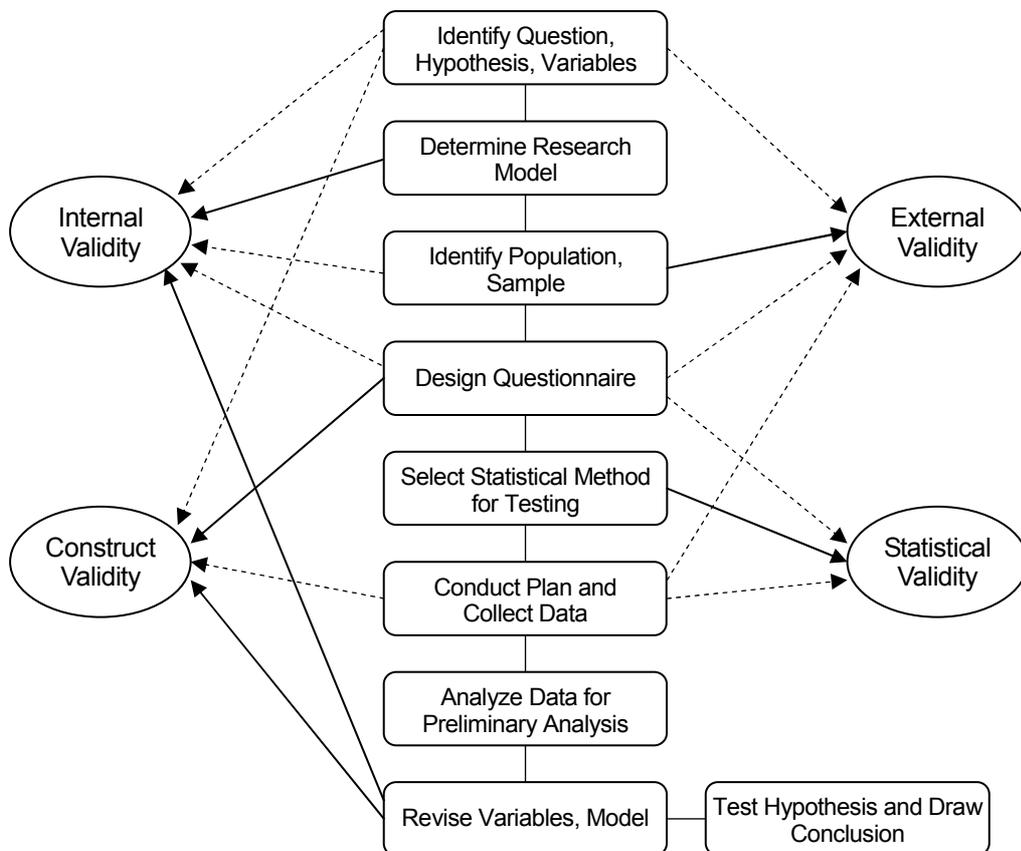
*Table 80. Comparison of regression weights between data after-and-before ANOVA*

Causal Path	Standardized Regression Weight	
	Data Reflecting (After) ANOVA	Data Disregarding (Before) ANOVA
<i>Direct Effect</i>		
Util. of e-Com. → Coll. Relationship	.180	.090
<i>Indirect effect</i>	.205	.249
Util. of e-Com. → Trust	.250	.240
Util. of e-Com. → Specificity	.390	.490
Trust → Coll. Relationship	.310	.370
Specificity → Trust	.200	.250
Specificity → Dependence	.490	.500
Dependence → Coll. Relationship	.460	.470
<i>Total Effect (Direct + Indirect)</i>	.385	.339

## 6.4 Review on the Validity of the Research

Apart from the measurement validity in the section 5.6.4. (Reliability and validity of the reduced measures), the findings of this research need to establish four types of validity: internal, external, construct and statistical (conclusion) validity. As illustrated in figure 57, every process of this study was designed and conducted under the consideration of validity. In this section, it will be discussed that each type of validity has been met in this study.

*Figure 57. Validity consideration along the research process*



A solid-line arrow ( —▶ ): Primary Concern, A dotted line arrow ( - - - -▶ ): Secondary Concern,  
Adapted from Black (1999: 58)

#### 6.4.1. Internal Validity

Internal validity refers to the extent of confidence regarding causal relationships (Trochim, 2002). Internal validity is the major consideration of this research because the object of this study is to assess the impacts of independent variable (i.e., electronic commerce) on dependent variable (i.e., buyer-supplier relationship).

In designing and revising the research model, every path from independent variable(s) to dependent variable(s) in the research model was designed based on the causality supported by well-known theories. Accordingly, all the paths that were included in the original model and confirmed by the data in the survey have internal validity.

Nevertheless, two causal paths that were created in the modification process of testing hypothesis 5 (the integrated model) may indicate some weakness regarding internal validity. For example, in the original model assets specificity was hypothesized to directly affect the buyer-supplier relationship, but the results of this study show that assets specificity indirectly influences buyer-supplier relationship via trust and dependence in a integrated full model.

However, the primary concern of this study is to examine causality between research variables. Even if the mediating variable is introduced, the positive causal relationship between asset specificity and collaborative relationship is still valid. Moreover, this causal path can be deduced from the literature review.

Therefore, it is reasonable to say that the results of this study have internal validity.

#### 6.4.2. External Validity

External validity refers to the extent to which the study may be generalized to another population. The results of this study were drawn from the empirical study that was conducted in the context of the Korean electronics industry. It depends on the external validity of this study whether the findings from this study can be applied to other industries (e.g., automobiles) or other countries (e.g., UK) or other times (e.g., the next year).

An appropriate sample selection is one way to improve external validity (Trochim, 2002). In this study, when especially identifying a research question and collecting the data, as well as identifying population and sample, external validity was the primary concern of this research. Regarding the procedure of sample selection, at first, this study was designed to focus the business-to-business e-commerce and business relationship, and thereby theoretical population was defined as buyer and supplier in industrial markets.

At second stage, the companies in the Korean electronics industry were chosen as the population of the empirical study. Electronics industries in Korea (e.g., Samsung, LG, and Daweoo) are well advanced as those in the developed Western countries (e.g., USA, UK), while business culture of Korea is similar to that of other Asian countries (e.g., Japan, China). The sample frame was made up by combining member companies of main associations in the Korean electronics industry.

At third stage, a stratified random sampling method was employed for draw samples from the sample frame because a stratified random sampling is better to represent than simple random sampling does when sample frame consist of separate subgroups. Every effort was made for enhancing respondents' participation in the survey, which resulted in the overall response rate of twenty-one percent.

In addition, two kinds of representativeness check were done. The one was the non-respondent bias check, and the other was the ANOVA. The former confirmed that there was no bias between early and late respondents. The latter suggested that there might be significant difference between three subgroups (i.e., strata in statistical term) with regard to thirty percent of questionnaire items. However, the validity of this study were not affected because the thirty percent of data were excluded from subsequent analyses (e.g., factor analysis and structural equation modelling) and from the test for the hypotheses.

Accordingly, viewed in terms of external validity, the findings of this study can be acceptable.

### 6.4.3. Construct Validity

Construct validity refers to the degree of correspondence between a construct in the research model and its (observable) measures in the questionnaire. Construct validity is related to generalizing from measures to the concept of a construct, whereas external validity involves generalizing from the results of a study to another population (Trochim, 2002).

Construct validity is usually achieved in one of three ways: (1) the logical or rational approach (i.e., theory → concept → constructs → question set), (2) the factor-analytic or homogeneous approach (i.e., concept → question → factor analysis of trial data → question set → constructs), and (3) the empirical approach (observations → questions → group scores → constructs → question set) (Black, 1999).

This study generated, at first, the concept of research constructs about e-commerce and buyer-supplier relationship on the basis of theory. Complex set of questions were developed or adapted from the previous studies based on literature review. Factor analysis identified groups of questions that were corresponded to the research constructs. In addition, as described in the section of 5.6.4. (the reliability and validity of the reduced measure), the reliability and validity of the measurement were confirmed.

Consequently, this study is considered to meet the requirement of construct validity.

### 6.4.4. Statistical Validity

Statistical (conclusion) validity is related to internal validity. While internal validity is interested in causality, statistical (conclusion) validity is only concerned with the existence of relationship (Cook and Campbell, 1979; Trochim 2002). Statistical (conclusion) validity is defined as the degree to which conclusions we reach about relationships in our data are reasonable (Trochim, 2002). This means that correct statistical procedures were chosen and the assumptions of procedures are fully met (Neuman, 2003).

This study, at first, examined the descriptive statistics of every item in the questionnaire.

Second, ANOVA (analysis of variance) was conducted to amalgamate three subgroups into a whole one. Third, factor analysis was run to detect an underlying structure of the data, which lead to creation of new reduced measures for the research constructs. Finally, this study employed structural equation modelling technique to test the research model and hypothesis because the research model consists of a set of variables (i.e., independent, mediating (independent & dependent), and dependent variables) and has to consider a series of relationships between variables simultaneously.

Through these analyses, this study satisfied the assumptions of the statistical method. For example, hypothesis-testing was proceeded after check on the assumptions of structural equation modelling: independent observations, random sampling of respondents, linearity of relationships and multivariate normality as described in the section 6.2.1. (Statistical method to test the model).

Thus, it can be concluded that this study has statistical (conclusion) validity.

## **6.5. Summary of Results and Discussion**

(1) This study takes a structural equation modelling (SEM) technique as a statistical method to test the research model.

(2) The data in the survey support hypothesis 1 that ‘utilization of e-commerce will directly facilitates a collaborative relationship between buyer and supplier in the Korean electronics industry’. This finding may be caused by firm’s strategy to e-commerce or intrinsic characteristics of e-commerce deployed in the Korean electronics industry.

Results 2: the data in the survey support hypothesis 2 that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of assets specificity in the Korean electronics industry’. In practical terms, this finding means that use of e-commerce requires significant specific assets to a buyer (supplier), which, in turn, leads to a more collaboration with the buyer (supplier).

Results 3: the data in the survey support hypothesis 3 that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of trust in the Korean electronics industry’. This results can be interpreted that a supplier (buyer) who has well-equipped information system gains credibility for communication from the buyer (supplier), which will facilitate the buyer (supplier) to collaborate with the supplier (buyer).

Results 4: the data in the survey support hypothesis 4 that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier via the mediating role of dependence in the Korean electronics industry’, even though the structural path from utilization of e-commerce to dependence to collaborative relationship was not accepted. This result means that even though e-commerce might contribute to mitigating asymmetry of information between firms, it would not weaken interfirm dependence.

Result 5: the data in the survey support hypothesis 5 that ‘utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence in the Korean electronics industry’. However causal paths are slightly changed as a result of the modification processes. This integrated test shows a macro-view on the relationships between research constructs, and relative strengths of both direct and indirect casual paths from utilization of e-commerce to collaborative relationship.

Result 6: the data in the survey support hypothesis 6 that ‘environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry. This finding means that under an uncertain situation, firms do not commit resources for electronic connection with a specific partner, rather concentrate on building a long-term trusting relationship with the partner by employing e-commerce for a brisk communication.

(3) Every process of this study was designed and conducted under consideration of the validity. The findings of this research can be acceptable in terms of internal, construct, external, statistical (conclusion) validity.

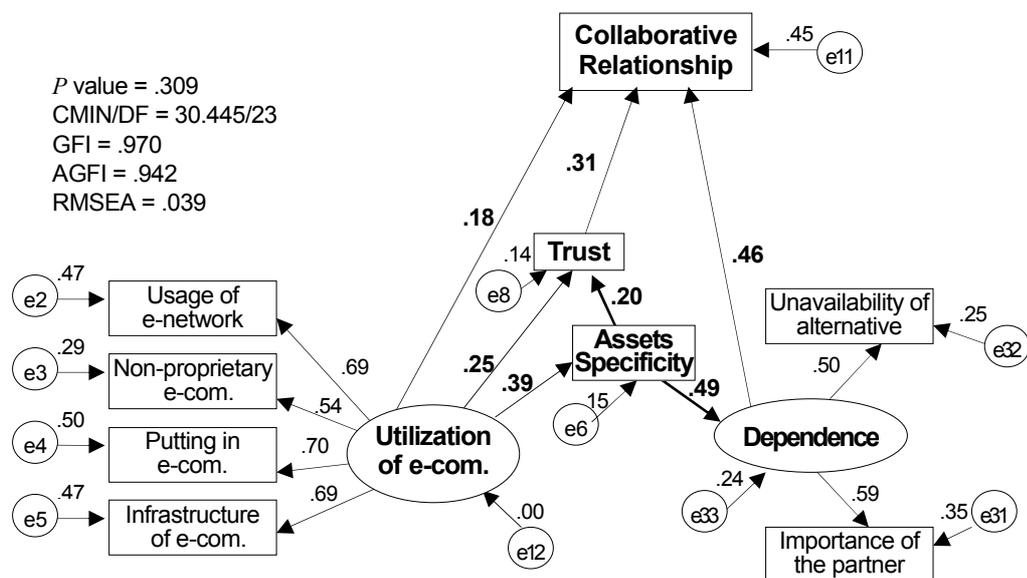
## CHAPTER 7. CONCLUSION

### 7.1. Summary of Findings

As regards partial models, the data in the survey support the impacts of electronic commerce suggested in hypothesis 1, hypothesis 2, hypothesis 3 and hypothesis 4. In the context of the Korean electronics industry it is significant that (1) utilization of e-commerce facilitates a collaborative relationship between buyer and supplier., (2) utilization of e-commerce facilitates a collaborative relationship between buyer and supplier via the mediating role of assets specificity, (3) utilization of e-commerce facilitates a collaborative relationship between buyer and supplier via the mediating role of trust, (4) utilization of e-commerce facilitates a collaborative relationship between buyer and supplier via the mediating role of dependence.

Concerning the integrated full model, it can be concluded that the data in the survey support hypothesis 5. Namely, in the context of the Korean electronics industry it is significant that utilization of e-commerce will facilitate a collaborative relationship between buyer and supplier both directly and via the mediating roles of assets specificity, trust and dependence, as illustrated in figure 58.

*Figure 58. The modified full model*



However, causal paths are slightly changed as a result of modification processes; (1) assets specificity indirectly affects collaborative relationship via trust and dependence rather than assets specificity directly does collaborative relationship. (2), dependence is influenced by utilization of e-commerce via assets specificity rather than dependence is directly done by utilization of e-commerce.

In addition to impacts of utilization of e-commerce, even if they were not hypothesized, the impacts of the first-order constructs (i.e., usage of e-network, putting in e-com, non-proprietary e-com, infra of e-com) that comprise the second-order construct (i.e., utilization of e-commerce) are also examined in this research. As reported in table 81, all of regression coefficients show positive impacts except one (i.e., regression coefficient for non-proprietary to collaborative relationship), and five out of twelve coefficients are significant.

*Table 81. Partial regression coefficients for the first-order constructs*

Factor	⇒ Assets Specificity	⇒ Trust	⇒ Relationship
	Coefficient (sig.)	Coefficient (sig.)	Coefficient (sig.)
Usage of e-Network ⇒	.108 (.183)	*.150 (.070)	.047 (.559)
Putting in e-Com. ⇒	** .204 (.012)	.048 (.558)	** .194 (.017)
Non-proprietary e-Com. ⇒	.006 (.934)	.030 (.693)	-.050 (.504)
Infrastructure of e-Com. ⇒	.110 (.169)	*.139 (.089)	***.209 (.009)

\*: significant at the level of 0.10, \*\*: significant at the level of 0.05, \*\*\*: significant at the level of 0.01

Regarding moderating variable, the data in the survey support the hypothesis that environmental uncertainty changes the form of relationships between utilization of e-commerce and dependent variables in the research model in the Korean electronics industry. There are significant differences between regression weights for two clusters: higher uncertainty cluster and lower uncertainty cluster. It is notable that utilization of e-commerce strengthens assets specificity under the lower uncertainty cluster more than the higher uncertainty cluster, while utilization of e-commerce facilitates trust and collaborative relationship under the higher uncertainty cluster more than the lower uncertainty cluster.

## **7.2. Implication of the Study**

### **7.2.1. Academic Implication**

This study is aimed at examining direct and indirect impacts of electronic commerce on relationships between buyer and supplier from an integrative angle. Toward this aim, multiple theories (i.e., transaction cost economics, relational exchange theory, and resource dependence theory) from diverse disciplines were employed and synthesized to propose a research model and hypothesis.

At first glance, it might be probable that e-commerce would facilitate competitive relationships between trading parties. This is because (1) viewed in terms of transaction cost economics, economic efficiency of information technology would be to increase the proportion of business activity coordinated by market mechanism rather than hierarchical structure (Malone et al., 1987), (2) from a view of relational exchange theory, electronic interconnection would result in prevalence of more formal, task-oriented exchange rather than face-to-face type of relational exchange (Leek et al., 2000), (3) from a resource dependence theory's perspective, interorganizational information system might asymmetry of information, which, in turn, would mitigate interfirm dependence (Zwass, 2003).

However, focusing on interfirm relationships in industrial market, especially between buyers (suppliers) and their largest suppliers (buyers) in the Korean electronics industry, this study provides a support for the view that utilization of electronic commerce contribute to building a long-term collaborative relationship rather than a transactional exchange for short-term economic gain. In addition, this study found that depersonalization caused by electronic commerce has not happened yet, and interorganizational e-commerce systems can consolidate assets specificity, trust and dependence between trading partners either direct or indirect way.

Furthermore, the integrated test of this study shows a macro-view on the relationships between research constructs (i.e., utilization of e-commerce, collaborative relationship, assets specificity, trust and dependence) and identifies relative strengths of causalities between

utilization of e-commerce and dependent constructs (i.e., collaborative relationship, assets specificity, trust and dependence) in the model.

It is notable that assets specificity and trust are affected directly by utilization of e-commerce in the integrated multi-path model, whereas dependence is indirectly done via assets specificity. This finding indicates that supplier's (buyer's) dependence on buyer (supplier) is not influenced as strongly as supplier's (buyer's) specific assets for or trust on buyer (supplier) is done by utilization of e-commerce.

It is also interesting result that assets specificity affects collaborative relationship via the mediating role of trust and dependence rather than directly in the integrated multi-path model. This result suggests that buyer's (supplier's) assets, dedicated to a specific supplier (buyer), induce buyer's (supplier's) trust or dependence on the supplier (buyer), which results in a more collaborative relationship between the buyer and the supplier.

Accordingly, from the integrative view that combines transaction cost economics, relational exchange theory and resource dependence theory, this study claims that utilization of e-commerce will facilitate a collaborative relationship between buyers (supplier) and their key suppliers (buyers) in industrial market both directly and indirectly via the mediating roles of assets specificity, trust and dependence.

With regard to impacts of the first-order constructs (i.e., usage of e-network, putting in e-commerce, non-proprietary e-commerce, and infrastructure of e-commerce) that comprise the second-order construct (i.e., utilization of e-commerce), five out of twelve regression coefficients for these first-order constructs to dependent constructs (i.e., assets specificity, trust and collaborative relationship) are significant, however, none of these first-order constructs significantly influences all of dependent variables. This finding shows that the partial impact of each first-order construct is relatively weak compared to the second-order construct that is comprised of four first-order constructs. This result suggests that impact of e-commerce will be strongly materialized when all aspects of e-commerce are combined into.

It is notable that non-proprietary e-commerce (first-order construct) does not significantly influence any dependent variable. In addition, regression coefficients for non-proprietary e-commerce to assets specificity and trust present positive value. This finding indicates that

public eMarketplace as well as private EDI systems do not weaken interfirm relationships between buyers (suppliers) and their key suppliers (buyers) in industrial market.

Regarding moderating variable, it is notable that utilization of e-commerce strengthens assets specificity under the lower uncertainty cluster more than the higher uncertainty cluster, while utilization of e-commerce facilitates trust and collaborative relationship under the higher uncertainty cluster more than the lower uncertainty cluster. This finding indicates that under a volatile situation, firms do not favour new investments for electronic interconnection with a specific partner. Rather, firms leverage e-commerce system established in order to build a long-term trusting relationship with the partner under such an uncertain environment.

In methodology, all the hypotheses are deduced from the integrative view that combines transaction cost economics, relational exchange theory and resource dependence theory. However, the results of this study are induced from the questionnaire-based survey that measured e-commerce and relationship between buyers (supplier) and their key suppliers (buyers). It is necessary to be cautious about generalization of this study in that an individual company usually applies different type of e-commerce and interfirm relationship to each partner based on the importance of the partner.

In addition, in the field of electronic commerce research, it is not common to measure both direct and indirect impacts of e-commerce for an empirical test of theory. Using structural equation modelling, this study simultaneously identifies both direct and indirect effects for the research constructs including electronic commerce, buyer-supplier relationship, assets specificity, trust, and dependence. This implies that this study suggests another road to analyze impact of e-commerce using an advanced empirical approach.

### **7.2.2. Managerial Implication**

This study deals with electronic commerce and buyer-supplier relationship, both of which are popular issues to business in these days. The results of this study do focus on the unilateral impacts of e-commerce on buyer-supplier relationship rather than identify a competitive strategy in e-commerce or a successful relationship between buyer and supplier.

However, the findings of this study have considerable significance for firms that seek for effective utilization of e-commerce and interfirm relationship.

Above all, this study provides a clear understanding that utilization of e-commerce is reconciled with growing tendency toward collaboration as an interaction strategy in an industrial market. As a firm increases electronic interconnection with a key trading partner, its relationship with the key partner can be both directly and indirectly improved.

This indicates that utilization of e-commerce enables firms to obtain a long-term value from effective relationship with the key partner as well as economic gains from efficiency of information and communication technology. With the help of key partners facilitated by interorganizational information system, firms improve their competitiveness by focusing on their core competency such as developing higher-quality products, business process reengineering, and customer satisfaction.

Accordingly, it is beneficial for buyer to take advantage of electronic interconnection with its key suppliers for supply chain management, procurement and production. In the same context, it is profitable for supplier to leverage electronic network for receiving the order, improving the delivery, developing product, and managing customer.

On the other hand, this study suggests that electronic connection with a key partner should be designed and conducted toward a collaboration with the key partner along value chain. It is a long-term collaborative relationship that materializes benefits of electronic commerce in the relation with the key trading partner. When focused on maximizing a long-term value rather than minimizing short-term cost, e-commerce system enables a firm to improve relationships with key partner. This will lead to a long-term competitive advantage of the firm.

However, the results of this study are not meant to limit electronic e-commerce to established business relationships. It is more desirable for firms to keep electronic connection open to potential partners rather than restrict to existing buyers or suppliers.

### **7.3. Limitation of the study**

A lot of attention should be paid for the generalization of this study.

First, this study shows many findings about the impact of electronic commerce on buyer-supplier relationships, however, the general implication of the findings should be understood in the context of the Korean electronics industry. This study investigated the current state of electronic commerce and buyer-supplier relationship in the Korean electronics industry. In the Korean electronics industry, proprietary e-commerce such as private EDI between trading partners dominates while non-proprietary e-commerce such as public eMarketplace is in an infancy stage. In addition, compared to Western countries, a long-term collaborative relationship plays a more important role in Korean business culture. These, undoubtedly, had a significant impact on the findings of this study.

Second, in methodology, there is some weakness in amalgamating stratified samples (i.e. buyer subgroup, supplier 1 subgroup, and supplier 2 subgroup). It is unavoidable to define sample frame by combining three kinds of associations that belong to the electronics industry because there is no data that include all the electronics firms in Korea. Thirty percent of initial questionnaire items were eliminated for the amalgamation of three sub-groups as a result of independence test.

Third, it is almost impossible to consider all aspects of the situation concerned in the research. It is unavoidable for an individual researcher to limit his study to the area of major concern. This study focuses on unilateral effect for e-commerce to buyer-supplier relationships. However, it is possible that adoption of e-commerce is determined by existing buyer-supplier relationship. It may be true that there are interactive effects between e-commerce and buyer-supplier relationship.

Fourth, the logic of transaction cost economics (TCE) is extended to this study that focuses on interfirm relationships between buyers and suppliers. Firm's binary choice between extremities (e.g., outsourcing in market and vertical integration into hierarchy) is replaced by a continuum of coordination structure between independent firms from market to hybrid to hierarchy in this study. Even though it is not unusual to borrow a reasoning of TCE for

studies on interfirm relationships, it is notable to acknowledge that this application of TCE may limit the internal validity of this study. However, as discussed in Chapter 2 a middle-ranged solution, called as the hybrid, is a more common solution than extremities such as hierarchy. In the real world of business, a wide range of hybrid forms actually exist. In this context, it can be said that market mechanism is equivalent to competitive relationships between buyers and suppliers, whereas vertical integration corresponds to collaborative relationships.

Methodologically, this study takes a quantitative technique (i.e., survey) as a data-collection method because the aim of this study is more confirmatory rather than exploratory. In order to achieve construct validity of the study, complex set of questions are employed in the survey and factor analytic techniques are used to identify research constructs. It is inevitable to introduce a reduced measure by running factor analysis and introducing the summated scales because this study mainly aims at providing a macro-view on the impacts of e-commerce on buyer-supplier relationships using structural equation modelling.

Creation of reduced measures from the questionnaire survey leads to a loss of data. For example, 'utilization of e-commerce' in the form of a reduced measure (high level of construct) consists of heterogeneous types of technologies such as 'the Internet' and 'EDI' (low level of construct) in the survey. While 'the Internet' and 'EDI' are differentiated in the survey, they are merged into 'utilization of e-commerce' in the final research model. As discussed in Chapter 2, 'the Internet' may be opposite to 'EDI' in terms of the impacts of e-commerce on buyer-supplier relationships. Even if it is not intended, however, the results of this study are mainly dominated by the major type of technology in use (i.e., EDI), and differences between these technologies are not distinguished in the findings of the research.

This weakness of the study is also related to the complex set of framework. As discussed in Chapter 2, the main underpinning for the conceptual framework of this study is based on the rationale of TCE, the dichotomy between outsourcing in market and vertical integration into hierarchy, whereas RET and RDT are employed to complement TCE. On the one hand, the integrative view of this study simultaneously considers transactional-economic attributes of TCE and relational-social characteristics of RET and RDT, and enables a researcher to

analyze the totality of relationships between buyers and suppliers. On the other hand, the integrative view results in multi-paths of research model; the first is direct path from e-commerce to buyer-supplier relationships, the second is mediating path from e-commerce to buyer-supplier relationships via assets specificity, the third is via trust, and the fourth is via dependence. Accordingly, the complex set of research model brings about a number of mediating variables, and thus makes it difficult to interpret the impacts of each technology (e.g., the Internet, EDI) in the research model.

In addition, the empirical research of this study was implemented in the Korean electronics industry, and focused on the relationships between buyer and its key supplier (or, supplier and its key buyer). As discussed in Chapter 2, in the Korean electronics industry, social relationships play a more important role in business, and a few large manufacturers dominate thousands of suppliers. These characteristics of population may place a more weight on the perspectives of RET or RDT rather than the perspective of TCE among the integrative view. However, this study could provide a comprehensive explanation with reality and validity about the impacts of e-commerce on buyer-supplier relationships by adopting the integrative view and using an advanced statistical technique.

Finally, this study focuses on relationship between buyer (supplier) and its key supplier (buyer), namely largest supplier (buyer) in terms of transaction volume. It can be raised whether the findings of this study is still valid to the relationship between one-spot trading parties for transacting not so important goods.

Despite many limitations, this study provides a clear understanding on the impact of e-commerce on buyer-supplier relationships in the context of the Korean electronics industry.

#### **7.4. Direction of Future Research**

Considering the rapid development of electronic commerce and increasing significance of interfirm relationship in industrial market, a researcher can find lots of research opportunities in studying joint issue comprising e-commerce and interfirm relationship.

This study mainly focuses on investigation of unidirectional impact of e-commerce on buyer-supplier relationship. In addition to unilateral impact of e-commerce, it will be significant to examine bilateral effects between utilization of e-commerce and buyer-supplier relationship. However, it is not easy to distinguish one-directional effect for e-commerce to buyer-supplier relationship from the opposite-directional effect for buyer-supplier relationship to e-commerce. It is considered that in earlier days the existing relationship would determine the adoption level of e-commerce, and then the adopted e-commerce systems would, in turn, influence buyer-supplier relationship. Accordingly, it would be an alternative way to adopt longitudinal and sequential approach for identifying interactive relationship between utilization of e-commerce and buyer-supplier relationship in industrial markets.

Besides the extension of research focus, this study can be a basis for further studies that have high interests of both academician and practitioner. For example, this study examined the impact of e-commerce on buyer-supplier relationship, and posited that proper relationship with trading partner would be indispensable for the competitive advantage of a firm. In terms of practical research, the premise of the study needs to be empirically tested. It is the job of future research to examine how utilization of e-commerce affects buyer-supplier relationship, and in turn, how the affected buyer-supplier relationship influences firm's financial performance such as profits as a percent of sales and return on investment.

A dominant use of proprietary e-commerce (i.e., EDI) over non-proprietary e-commerce (i.e., public e-marketplace) in sample companies of the Korean electronics industry may explain the findings of this study, while distinctive aspects of these technologies in terms of the impacts on buyer-supplier relationships are not examined in this study. However, future research could usefully explore how the development of e-commerce technologies from a

proprietary network (e.g., VAN-based EDI) to open network (e.g., the Internet-based EDI, public e-marketplace) changes the impact of e-commerce on buyer-supplier relationships.

In addition to comparing the impacts of each technology involved in e-commerce with other generation of technologies, a researcher could analyze the impacts of e-commerce from a monolithic view such as transaction cost economics. Mainly due to a focus on the integrative view, this study has not minutely provided the impacts of e-commerce on transaction cost. It will be a meaningful study to find the impacts of e-commerce on interfirm relationships by using an in-depth and qualitative study with adhering to the perspective of TCE.

The generalization of the findings is limited because the empirical study was implemented in Korea in which long-term collaborative relationships are more appreciated than in Western countries. Given this context of collaboration, the effect of e-commerce has been to strengthen these relationships rather than to weaken them (e.g., by matching them more market-like). A comparative study that compares Asian countries (China, Korea) and Western countries (UK or US) simultaneously is needed to generalize the findings on the impacts of e-commerce.

Lastly, for the purpose of external validity, it needs to investigate whether the findings of this study can be extended to the relationships between one-spot trading parties in MRO (maintenance, repair and operation goods) markets rather than key trading partners in industrial markets.

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## **APPENDICES**

### **Appendix 1. Questionnaire**

#### **< Cover Letter of the Questionnaire >**

02/06/2003

Job Title: CEO or Manager in charge of the procurement (sales)

Dear.

I am a senior official in the Ministry of Commerce, Industry & Energy of Korea, and I am currently studying electronic commerce (e-commerce) at the University of Leeds, U.K. under the education program of Korean Government.

For this research, e-commerce is defined as the use of electronic networks (e.g., intranet, extranet, or Internet) to do business. The benefits of e-commerce cover a wide scope from the reduction of communication costs to the improvement of the supply chain. It is considered that most companies in the Korean electronics industry have adopted e-commerce systems in order to take advantage of these opportunities. However, the outcome of investment in e-commerce has not yet been determined, therefore it is necessary to investigate the impact of e-commerce. In this context, this survey is intended to examine the impact of e-commerce on buyer-supplier relationships in the Korean electronics industry.

Your completion of the attached questionnaire will contribute to addressing the aforementioned issue. If you are not sure of an answer to a question, please provide your best estimate. Your responses will remain strictly confidential. It would be appreciated if you could complete the questionnaire and return it to KIET (Dr. Ha, KIET 206-9 Chonglyangli Seoul, postcode 130-742) by 22/06/2003.

Thank you for your cooperation.

If you have any questions, please do not hesitate to contact me:

Yoonjong Chun (A Senior Official in the Ministry of Commerce and Industry of Korea as well as a Research Student at Leeds University Business School, UK.

Tel: 032-682-2707 (Korea), 0044-113-216-4138 (UK)

E-mail: yoonjongchun@empal.com, or busyc@leeds.ac.uk

## < Questionnaire (for the Buyer) >

### Information about Respondent and Company

Please provide the following information about your company.

**Name of Company**

\_\_\_\_\_

How much was your company's annual sales in 2002?

\_\_\_\_\_ million KRW

How many full-time employees did your company have in 2002?

\_\_\_\_\_

When was your company established?

**Year**

When did you company adopt e-commerce (using electronic networks for business)?

**Year**

**Month**

Which is your ownership structure? (choose one)

Standalone (    ),  
Partnership (    ),  
Subsidiary (    ),  
Others (    ),

in case of others, please specify: \_\_\_\_\_

What are your company's core products?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Please provide the following information about yourself (optional).

**Your name**

\_\_\_\_\_

Your job title

\_\_\_\_\_

Your E-mail address

\_\_\_\_\_

I appreciate your time and effort that is needed to complete this questionnaire. A summary of my research, including the results of this questionnaire, will be provided on request. If you have any enquiries about this questionnaire or my research, please contact me by email at [yoonjongchun@empal.com](mailto:yoonjongchun@empal.com) or [busyc@leeds.ac.uk](mailto:busyc@leeds.ac.uk).

Please tick the box (☑) to rate the extent to which you agree with the following statements, using the five point scale.

#### 1. Attitude to e-Commerce

Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

1-1. E-commerce (i.e., using electronic networks) has caused major changes in our way of working.

1-2. E-commerce will give us new opportunities for growth and prosperity

- 1-3. E-commerce represents a high risk and threatens our existing business.
- 1-4. Our company adopted e-commerce on our own initiative.
- 1-5. Our company adopted e-commerce to keep up with our competitors.
- 1-6. Our supplier or business partner demanded that our company participate in its electronic network.
- 1-7. Government incentives helped us to engage in using e-commerce.
- 1-8. Top management of our company has a great interest in the use of e-commerce.
- 1-9. Our personnel have enough knowledge of e-commerce.
- 1-10. E-commerce is central to the business strategy of the company.

The following statements apply to doing business with **your largest, in terms of transaction volume, supplier (referred to as ‘this supplier’)**.

## 2. Technology for e-Commerce

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

- 2-1. *E-mail* is widely used for communication with this supplier.
- 2-2. We widely use an *Intranet* for internal knowledge sharing and communication about this supplier.
- 2-3. An *extranet* is widely used for communication with this supplier.
- 2-4. *Our own Internet website* is widely used for trading with this supplier.
- 2-5. Our company widely use *this supplier’s website* for trading with this supplier.
- 2-6. A *private e-commerce system* (e.g., Van-EDI, Internet-EDI) is widely used for computer -to-computer data exchange with this supplier.
- 2-7. Our company has adopted a *public eMarketplace system* (e.g., E2open, Electropia) that is widely used for trading with this supplier.
- 2-8. *SCM(supply chain management) software* is widely used for collaborating with this supplier.
- 2-9. *ERP(enterprise resource planning) software* is widely used for collaborating with this supplier.

### 3. Activity via e-Commerce

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly Agree</b>
<u>Our company uses an electronic network -</u>					
3.1. - for providing information on our procurement policy to this supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2. - for receiving data on the products from this supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3. - for negotiating prices, quantities, and terms of products with this supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4. - for placing orders for this supplier's products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.5. - when taking delivery of this supplier's products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.6. - for making payment for this supplier's products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7. - to support this supplier during their production of the products that we buy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.8. - to support this supplier when this supplier develops new products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.9. - to collaborate with this supplier when we develop new products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.10. - to collaborate with this supplier when we conduct market research.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 4. Intensity of e-Commerce

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly Agree</b>
In terms of working hours per person, our personnel who deal with this supplier use electronic networks -					
4.1. - more than our company's personnel dealing with other suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2. - more than other companies' personnel dealing with their suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our company adopted e-commerce to collaborate with this supplier -					
4.3. - earlier than for our company's other suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4. - earlier than other companies dealing with their suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our company invests more in e-commerce for this supplier-					
4.5. - than for our company's other suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.6. - than other companies dealing with their suppliers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Our company purchases a higher proportion via *proprietary e-commerce system* (e.g. Van-EDI) from this supplier -

4.7. - than from our company's other suppliers.

4.8. - than other companies dealing with their suppliers.

Our company purchases a higher proportion via *non-proprietary e-commerce system* (e.g. Electropia) from this supplier -

4.9. - than from our company's other suppliers.

4.10. - than other companies dealing with their suppliers

Please answer the following questions.

- How many hours per week do your personnel who deal with this supplier use electronic network on average ?

\_\_\_\_\_ Hours per person

- How many years has your company collaborated with this supplier via electronic networks?

\_\_\_\_\_ Years    Months

- How much has your company purchased from this supplier via *proprietary e-commerce system* (e.g., *Van-EDI*) over the last 12 months?

\_\_\_\_\_ Mil KRW

- How much has your company purchased from this supplier via *non-proprietary e-commerce system* (e.g., *Electropia*) over the last 12 months?

\_\_\_\_\_ Mil KRW

Please rate the extent to which you agree or disagree with the following statements for doing business with "this supplier".

**5. Environmental Uncertainty**

Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

5-1. Prices are difficult to predict in the market for the products our company buys from this supplier.

5-2. Design trends are difficult to predict in the market for the products we buy from this supplier.

5-3. It is difficult for us to forecast the expected volumes for this supplier's products.

5-4. The market for the end products that use this supplier's products is unstable.

5-5. The products we buy from this supplier have a very high innovation rate.

5-6. The products we buy from this supplier have a short life cycle.

5-7. It is difficult to predict technological development in the market for the products we buy from this supplier.

5-8. The design of the end product that uses this supplier's products is frequently adjusted and developed.

## 6. Assets Specificity

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6-1. We have committed a lot of time and money to the training of personnel for trading with this supplier.	<input type="checkbox"/>				
6-2. Just for this supplier, our company has recruited new personnel.	<input type="checkbox"/>				
6-3. Our personnel who deal with this supplier need to have extraordinarily good knowledge of the product of this supplier.	<input type="checkbox"/>				
6-4. We have made significant investments in tools and equipment to meet the requirements of dealing with this supplier.	<input type="checkbox"/>				
6-5. We have committed a lot of time and resources to learn and adapt to the technical standards of this supplier.	<input type="checkbox"/>				
6-6. Our company has made significant investments in an information system dedicated to interaction with this supplier.	<input type="checkbox"/>				
6-7. Just for this supplier, our company has changed our capital equipment and tools.	<input type="checkbox"/>				
6-8. Integrating our production/delivery procedures with this supplier has involved substantial commitments of time and money.	<input type="checkbox"/>				
6-9. If our company decided to stop working with this supplier, we would be wasting a lot of knowledge regarding their method of operation.	<input type="checkbox"/>				
6-10. Just for this supplier, our company has changed our purchasing procedure.	<input type="checkbox"/>				

## 7. Trust

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7-1. The staff of this supplier have been open in dealing with our company.	<input type="checkbox"/>				
7-2. If there is a problem such as delivery delay, the staff of this supplier are honest about the problem.	<input type="checkbox"/>				
7-3. The staff of this supplier have been frank in dealing with our company.	<input type="checkbox"/>				
7-4. When making important decisions, the staff of this supplier are concerned about our welfare.	<input type="checkbox"/>				
7-5. We feel that the staff of this supplier are like friends.	<input type="checkbox"/>				
7-6. This supplier has made sacrifices for our company in the past.	<input type="checkbox"/>				
7-7. Our company finds it unnecessary to be cautious with this supplier.	<input type="checkbox"/>				
7-8. This supplier keeps promises it makes to our company.	<input type="checkbox"/>				
7-9. This supplier does not make false claims.	<input type="checkbox"/>				

## 8. Dependence

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8-1. It would be very difficult for our company to find a suitable replacement for this supplier.	<input type="checkbox"/>				
8-2. If our relationship were discontinued with this supplier, our company would have difficulty in making up the purchase volume.	<input type="checkbox"/>				
8-3. It takes a lot of cost for our company to switch from this supplier to another one.	<input type="checkbox"/>				
8-4. Switching from this supplier would have significant negative effects on the quality of the products that our company manufactures.	<input type="checkbox"/>				
8-5. If our company switched to a competing supplier from this supplier, we would lose a lot of investment we have made in this supplier.	<input type="checkbox"/>				
8-6. It is critical to the profitability of our company to maintain this supplier.	<input type="checkbox"/>				
8-7. This supplier is currently important to our business.	<input type="checkbox"/>				
8-8. This supplier is crucial to our future performance.	<input type="checkbox"/>				

## 9. Buyer-Supplier relationships

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9-1. Both this supplier and our company actively work together as partners.	<input type="checkbox"/>				
9-2. Both this supplier and our company should work together to be successful.	<input type="checkbox"/>				
9-3. In our relationship with this supplier, our company carefully plans how to develop our cooperation further.	<input type="checkbox"/>				
9-4. No matter who is at fault, problems with this supplier are joint responsibilities.	<input type="checkbox"/>				
9-5. Both this supplier and our company intend to solve conflicts by working together rather than responding to neutral third party or lawsuits.	<input type="checkbox"/>				
9-6. Both this supplier and our company will not take advantage of a strong bargaining position.	<input type="checkbox"/>				
9-7. Both this supplier and our company make ongoing adjustments to cope with changing circumstances.	<input type="checkbox"/>				
9-8. There is excellent communication between this supplier and our company, so there are never any surprises that might be harmful to our working relationship.	<input type="checkbox"/>				
9-9. Our company shares proprietary information with this supplier.	<input type="checkbox"/>				
9-10. Our company regularly exchanges information about price development and market conditions with this supplier.	<input type="checkbox"/>				

- 9-11. Both this supplier and our company expect our relationship to last for a long time.
- 9-12. Maintaining a long-term relationship with this supplier is important to our company.
- 9-13. Our company focuses on long-term goals in relationship with this supplier.

Thank you for completing, please return to the KIET (Dr. Ha, KIET 206-9 Chonglyangli Seoul, postcode 130-742).

### < Questionnaire (for the Supplier) >

Please tick the box () to rate the extent to which you agree with the following statements, using the five point scale.

#### 1. Attitude e-Commerce

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

- 1-1. E-commerce (i.e., using electronic networks) has caused major changes in our way of working.
- 1-2. E-commerce will give us new opportunities for growth and prosperity.
- 1-3. E-commerce represents a high risk and threatens our existing business.
- 1-4. Our company adopted e-commerce on our own initiative.
- 1-5. Our company adopted e-commerce to keep up with our competitors.
- 1-6. Our buyer or business partner demanded that our company participate in its electronic network.
- 1-7. Government incentives helped us to engage in using e-commerce.
- 1-8. Top management of our company has a great interest in the use of e-commerce.
- 1-9. Our personnel have enough knowledge of e-commerce.
- 1-10. E-commerce is central to the business strategy of the company.

The following statements apply to doing business with **your largest, in terms of transaction volume, buyer (referred to as "this buyer")**.

#### 2. Technology for e-Commerce

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

- 2-1. *E-mail* is widely used for communication with this buyer.
- 2-2. We widely use an *intranet* for internal knowledge sharing and communication about this buyer.
- 2-3. An *extranet* is widely used for communication with this buyer.
- 2-4. *Our own Internet website* is widely used for trading with this buyer.
- 2-5. Our company widely use *this buyer's website* for trading with this buyer.
- 2-6. A *private e-commerce system* (e.g., Van-EDI, Internet-EDI) is widely used for computer-to-computer data exchange with this buyer.
- 2-7. Our company has adopted a *public eMarketplace system* (e.g., E2open, Electropia) that is widely used for trading with this buyer.
- 2-8. *CRM(customer relationship management) software* is widely used for collaborating with this buyer.
- 2-9. *ERP(enterprise resource planning) software* is widely used for collaborating with this buyer.

### 3. Activity via e-Commerce

Strongly Disagree Disagree Neutral Agree Strongly Agree

- Our company uses an electronic network -
- 3.1. - for receiving information on their procurement policy from this buyer.
- 3.2. - for providing data on our products to this buyer.
- 3.3. - for negotiating prices, quantities, and terms of products with this buyer.
- 3.4. - for accepting this buyer's orders for the products.
- 3.5. - when confirming delivery of the products to this buyer.
- 3.6. - for receiving this buyer's payments for the products.
- 3.7. - to collaborate with this buyer when we produce the products that we supply to this buy.
- 3.8. - to support this buyer when this buyer develops new products.
- 3.9. - to collaborate with this buyer when we develop new products.
- 3.10. - to collaborate with this buyer when we conduct market research.



	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
<b>5. Environmental Uncertainty</b>					
5-1. Prices are difficult to predict in the market for the products our company supplies to this buyer.	<input type="checkbox"/>				
5-2. Design trends are difficult to predict in the market for the products our company supplies to this buyer.	<input type="checkbox"/>				
5-3. It is difficult for our company to forecast the expected volumes of sales to this buyer.	<input type="checkbox"/>				
5-4. The market for this buyer's end products that use our company's components is unstable.	<input type="checkbox"/>				
5-5. The products our company supplies to this buyer have a very high innovation rate.	<input type="checkbox"/>				
5-6. The products our company supplies to this buyer have a short life cycle.	<input type="checkbox"/>				
5-7. It is difficult to predict technological development in the market for the products we supply to this buyer.	<input type="checkbox"/>				
5-8. The design of this buyer's end products that use our company's components is frequently adjusted and developed.	<input type="checkbox"/>				
<b>6. Assets Specificity</b>					
6-1. Our company has committed a lot of time and money to the training of personnel for trading with this buyer.	<input type="checkbox"/>				
6-2. Just for this buyer, our company has recruited new personnel.	<input type="checkbox"/>				
6-3. Our personnel who deal with this buyer need to have extraordinarily good knowledge of the product of this buyer.	<input type="checkbox"/>				
6-4. We have made significant investments in tools and equipment to meet the requirements of dealing with this buyer.	<input type="checkbox"/>				
6-5. We have committed a lot of time and resources to learn and adapt to the technical standards of this buyer.	<input type="checkbox"/>				
6-6. Our company has made significant investments in an information system dedicated to interaction with this buyer.	<input type="checkbox"/>				
6-7. Just for this buyer, our company has changed our capital equipment and tools.	<input type="checkbox"/>				
6-8. Integrating our production/delivery procedures with this buyer has involved substantial commitments of time and money.	<input type="checkbox"/>				
6-9. If our company decided to stop working with this buyer, we would be wasting a lot of knowledge regarding their method of operation.	<input type="checkbox"/>				
6-10. Just for this buyer, our company has changed our purchasing procedure.	<input type="checkbox"/>				

<b>7. Trust</b>	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly Agree</b>
7-1. The staff of this buyer have been open in dealing with our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-2. If there is a problem such as payment delay, the staff of this buyer are honest about the problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-3. The staff of this buyer have been frank in dealing with our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-4. When making important decisions, the staff of this buyer are concerned about our welfare.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-5. We feel that the staff of this buyer are like friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-6. This buyer has made sacrifices for our company in the past.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-7. Our company finds it unnecessary to be cautious with this buyer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-8. This buyer keeps promises it makes to our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-9. This buyer does not make false claims.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 <b>8. Dependence</b>	 <b>Strongly Disagree</b>	 <b>Disagree</b>	 <b>Neutral</b>	 <b>Agree</b>	 <b>Strongly Agree</b>
8-1. It would be very difficult for our company to find a suitable replacement for this buyer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-2. If our relationship were discontinued with this buyer, our company would have difficulty in making up the sales volume.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-3. It takes a lot of cost for our company to switch from this buyer to another one.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-4. Switching from this buyer would have significant negative effects on the quality of our products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-5. If our company switched to a competing buyer from this buyer, we would lose a lot of investment we have made in this buyer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-6. It is critical to the profitability of our company to maintain this buyer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-7. This buyer is currently important to our business.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-8. This buyer is crucial to our future performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 <b>9. Buyer-Supplier relationships</b>	 <b>Strongly Disagree</b>	 <b>Disagree</b>	 <b>Neutral</b>	 <b>Agree</b>	 <b>Strongly Agree</b>
9-1. Both this buyer and our company actively work together as partners.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9-2. Both this buyer and our company should work together to be successful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 9-3. In our relationship with this buyer, our company carefully plans how to develop our cooperation further.
- 9-4. No matter who is at fault, problems with this buyer are joint responsibilities.
- 9-5. Both this buyer and our company intend to solve conflicts by working together rather than responding to neutral third party or lawsuits.
- 9-6. Both this buyer and our company will not take advantage of a strong bargaining position.
- 9-7. Both this buyer and our company make ongoing adjustments to cope with changing circumstances.
- 9-8. There is excellent communication between this buyer and our company, so there are never any surprises that might be harmful to our working relationship.
- 9-9. Our company shares proprietary information with this buyer.
- 9-10. Our company regularly exchanges information about price development and market conditions with this buyer.
- 9-11. Both this buyer and our company expect our relationship to last for a long time.
- 9-12. Maintaining a long-term relationship with this buyer is important to our company.
- 9-13. Our company focuses on long-term goals in relationship with this buyer.

Thank you for completing, please return to the KIET (Dr. Ha, KIET 206-9 Chonglyangli Seoul, postcode 130-742).

## **Appendix 2. Revision Processes of the Research Model**

### **1. Introduction**

The initial research model consisted of nine constructs, eighty-seven questions, six correlations and twenty causal relationships, and was supposed to be tested by structural equation modelling (SEM) technique.

However, the initial model was too complex and weak to be tested by SEM. In addition, it was not certain whether factor analysis would confirm the initial data structure, or create new set of data structure.

Accordingly, the research model needed to be revised to consolidate theoretical background and complete methodological weakness. In this appendix, it will be explained why and how the initial model had been revised.

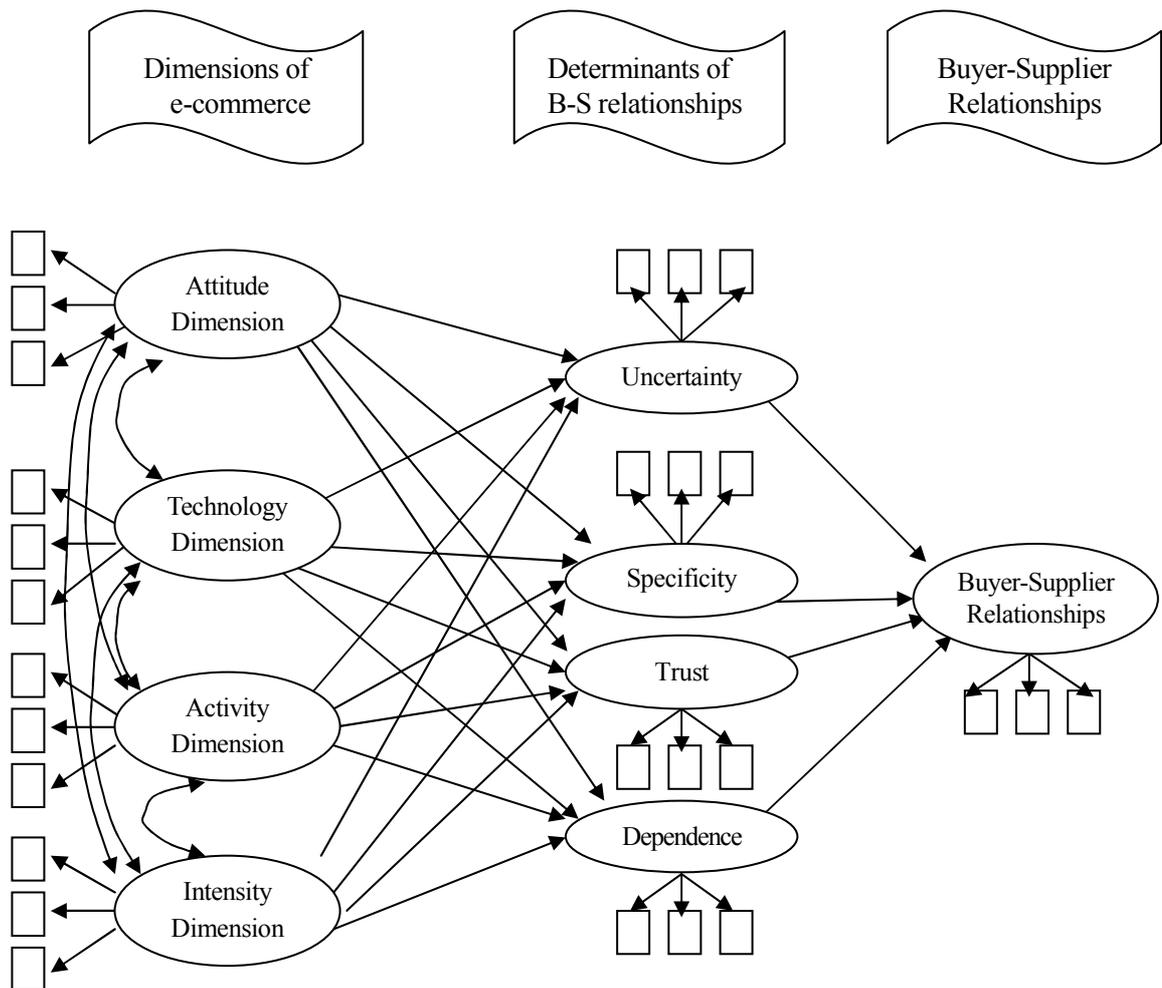
Revision process is summarized as the following: (1) reclassification of four e-commerce dimensions, (2) differentiating the role of determinant variables, (3) simplification of the model.

## 2. The Initial Model

As illustrated in figure 1, the research question was that:

*“How do the Characteristics of Electronic Commerce affect Buyer-Supplier Relationships in the Korean Electronics Industry?”*

*Figure 1. Initial hypothesized model*



The key hypothesis was that the hypothesized model in the figure 1 fitted the empirical data that would be collected by the survey. The key hypothesis was divided into three categories; (1) Causal relationships between e-commerce and determinant variables of buyer-supplier relationships, (2) Interactive relationships between four dimensions of e-commerce, (3) Causal relationships between determinant variables and buyer-supplier relationships.

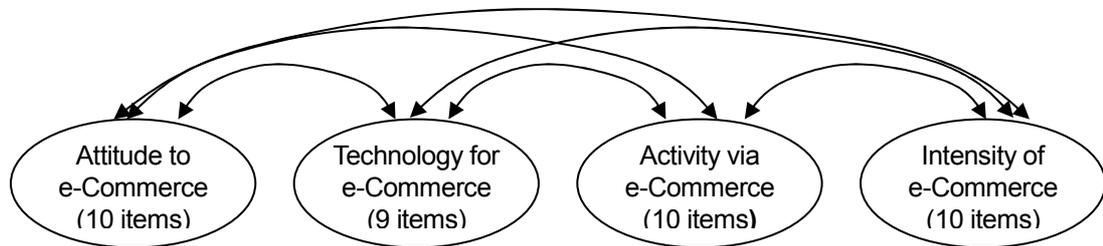
### 3. A Corrected and Simplified Model

#### 3.1. Correction 1: Reclassification of Four e-Commerce Dimensions

##### Premises in the Initial Model

In the initial model, four constructs on e-commerce are correlated, as seen in figure 2. Each construct has nine to ten items for measurement. The goodness of measurement would be confirmed by confirmatory factor analysis.

*Figure 2. e-Commerce constructs*



##### Drawbacks and Correction of the Original Model

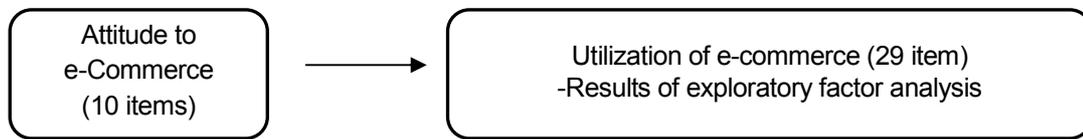
With regard to impact on interorganizational relationships, there is significant difference between attitude to e-commerce and utilization of e-commerce (i.e., technology, activity and intensity). The impact of utilization is direct and actual, while the impact of attitude is indirect and potential. Attitude to e-commerce may indirectly influence buyer-supplier relationship, which cannot be completed without the mediating role of utilization of e-commerce. Additionally, in terms of analytical method, it is desirable to run an exploratory factor analysis rather than confirmatory factor analysis on the questionnaire items that have not yet been confirmed in the previous study. Accordingly, items that measure utilization of e-commerce should be merged and, put into exploratory factor analysis, and be distinguished from those for attitude to e-commerce.

##### Corrected Model 1 and Analysis Strategy

Thirty-nine items of measures on e-commerce need to be reclassified into two high levels of constructs: (1) attitude to e-commerce and (2) utilization of e-commerce as illustrated in

figure 3 (the next page). Then, constructs and their items need to be determined through exploratory factor analysis.

*Figure 3. Correction 1 for e-commerce constructs*

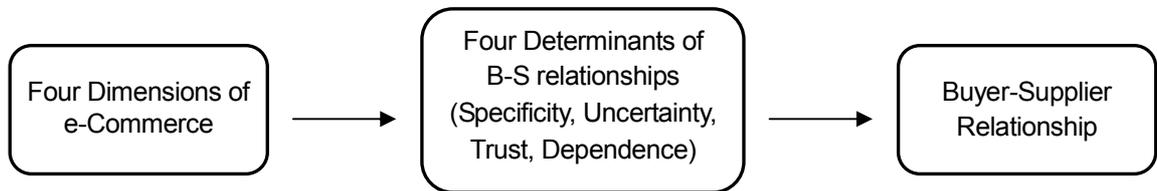


### 3.2. Correction 2; Differentiating the Role of Determinants

#### 3.2.1. Premises in the Initial Model

Every dimension of e-commerce influences every determinant (i.e. assets specificity, trust, etc) of buyer-supplier relationship, and in turn, every determinant affects B-S relationship as seen in figure 4. Namely, every determinant of B-S relationship plays a mediating role between e-commerce and buyer-supplier relationship.

*Figure 4. Relationships in Sequence*



#### 3.2.2. Drawbacks and Correction of the Initial Model

The initial model regarded all determinants of buyer-supplier relationship as a mediating variable. However, more detailed examination could find differences between determinants as described in the following.

First consideration should be placed on examining causal paths from each determinant to B-S relationship. It is theoretically clear and empirically confirmed that assets specificity and trust play a critical role in determining governance mechanism between market (or, competitive coordination) and hierarchy (or, collaborative relationship). In addition, dependence may be a facilitator of hierarchical structure like an assets specificity (and trust) because dependence also becomes a safeguard to constrain opportunism. However,

controversy over the role of environmental uncertainty in determining governance structure has not yet been settled. Empirical research reported that relations between environmental uncertainty and governance structure are mixed (i.e., positive, negative, or insignificant).

With regard to causal paths from utilization of e-commerce to each determinant, we can also find differences between determinants. At least, in industrial markets, on which this research focused, it is empirically confirmed that e-commerce system increases assets specificity of trading partners. Like assets specificity, empirical study proved that trust and dependence between trading partners might also be strengthened by utilization of e-commerce. However, there has been much dispute over the question of how e-commerce affects environmental uncertainty. It is not sure whether environmental uncertainty is directly affected by, or independent of e-commerce.

In terms of analytical method, structural equation modelling (SEM) technique that is posited to test the initial model should be run on the basis of causal relationships between constructs. Therefore, it is reasonable decision that we take environmental uncertainty out of causal paths in the model. Even though environmental uncertainty is not appropriate as a mediating variable in the model, we cannot exclude the possibility that it changes the form of relationships between utilization of e-commerce and buyer-supplier relationship. Thus, it is rather rational approach that we define and examine environmental uncertainty as a moderating variable.

Besides mediating paths from e-commerce to buyer-supplier relationship, direct path needs to be considered. It is highly possible that e-commerce directly influence B-S relationship without being intervened by mediators such as assets specificity, trust and dependence.

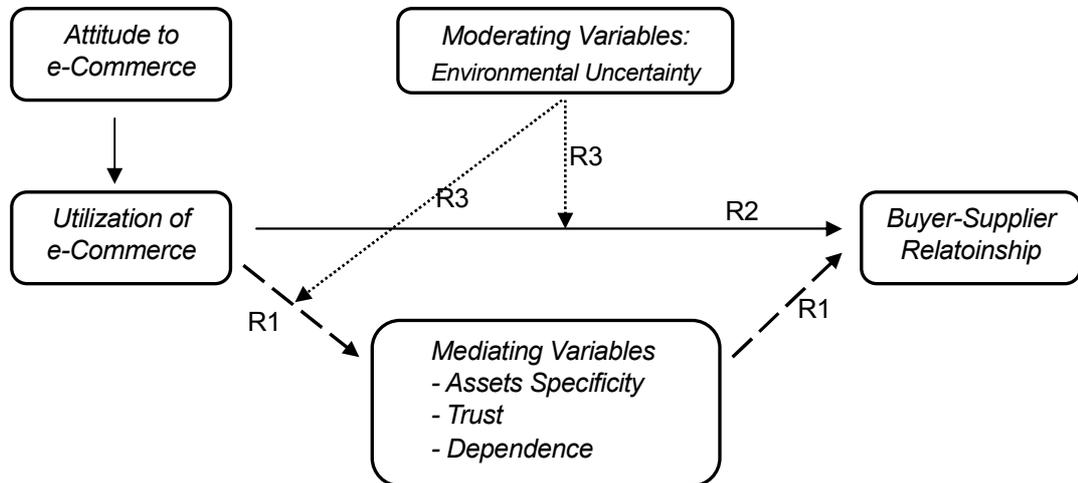
### **3.2.3. Corrected Model 2 and Analysis Strategy**

Investigation of the drawbacks concerning a mediating variable and direct path leads to the modification of the model as illustrated in figure 5.

In sum, the utilization of e-commerce can indirectly facilitate collaborative relationships between buyer and supplier via the mediating roles of as assets specificity, trust and dependence (R1 in figure 5, the next page), and directly affect buyer-supplier relationships

(R2 in figure 5). In addition, it is also possible that the form of relationships between e-commerce and buyer-supplier relationship is changed by the moderating role of environmental uncertainty (R3 in figure 5).

*Figure 5. Correction 2*

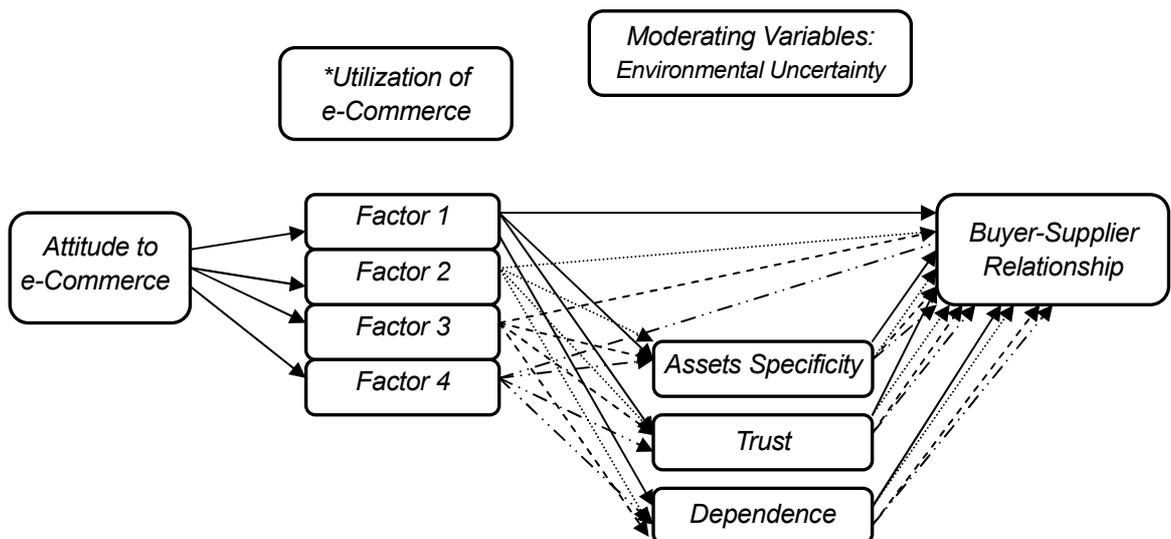


### 3.3. Simplification of the Corrected Model

#### 3.3.1. The Corrected Research Framework

The initial model (illustrated in figure 1) has been developed into the corrected model as illustrated in figure 6 through correction processes.

*Figure 6. Corrected Model*



\*This model is built on the assumption that four factors would be extracted for utilization of e-commerce.

### 3.3.2. Necessity to Simplify the Model

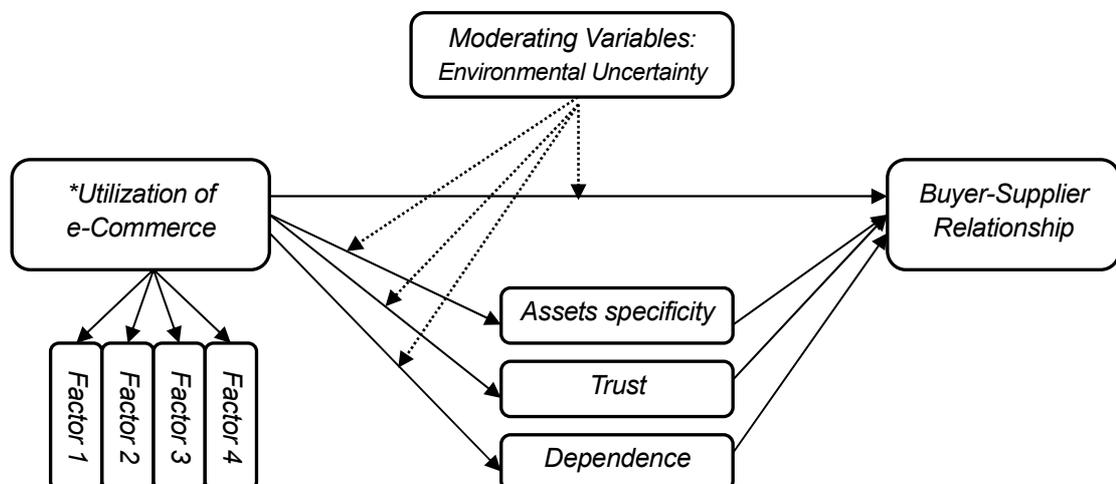
In the corrected model as illustrated in figure 6 (the previous page), there are thirty-two causal paths that are expressed by arrow line. The corrected model puts an high stress on investigations into partial impacts of each factor that comprises utilization of e-commerce.

The primary aim of this research is to examine impacts of e-commerce on buyer-supplier relationships. The Model should focus on not comparing each factor of e-commerce with other factors, but effects of e-commerce on buyer-supplier relationships. In this context, the second order (or, high level of) factor that represents the first order (or, low level of) factors needs to be introduced into the model. In addition, causal paths from attitude to e-commerce to utilization of e-commerce are meaningful to be confirmed, but not of core interest of this research. Namely, the paths from attitude to e-commerce to utilization of e-commerce come under redundancy of the model, and need to be removed.

### 3.3.3. A Corrected and Simplified - Model

In response to necessities of simplification, the second order factor (i.e., utilization of e-commerce) is introduced into the model and redundant paths (i.e., causal paths from attitude to e-commerce to utilization of e-commerce) are excluded. This simplification procedure results in the simplified model as illustrated in figure 7.

*Figure 7. The Corrected and simplified model*



\*This model is on the assumption that four factors would be extracted for utilization of e-commerce.