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**ORGANIZATIONAL, TECHNOLOGICAL, AND ENVIRONMENTAL
DETERMINANTS OF ELECTRONIC COMMERCE ADOPTION IN SMALL AND
MEDIUM ENTERPRISES IN TAIWAN**

Dissertation

Submitted to the Faculty of the College of Business and Management

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Lynn University

By

Chang-Shuo Lin (Xenos)

February, 2006

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ORGANIZATIONAL, TECHNOLOGICAL, AND ENVIRONMENTAL
DETERMINANTS OF ELECTRONIC COMMERCE ADOPTION IN SMALL
AND MEDIUM ENTERPRISES IN TAIWAN

Lin, Chang-Shuo, Ph.D.

Lynn University, 2006

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**ORGANIZATIONAL, TECHNOLOGICAL, AND ENVIRONMENTAL
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By Chang-Shuo Lin

February, 2006

ABSTRACT

In the Internet age, the development of electronic commerce (EC) was considered a major indicator of the overall competitiveness of organizations. Moreover, the EC marketing channel can bring customers more benefits, such as greater shopping convenience and potentially lower prices. In Taiwan, small and medium enterprises (SMEs) represent 98% of the total number of business. Today, most SMEs were forced to adopt EC by their major suppliers and value chain partners in order to carry out business processes more efficiently. Hence, the purpose of this study is to seek the determinants of the extent of EC adoption by SMEs in Taiwan.

This study presents a framework based on Tornatzky and Fleischer's (1990) OTE model that includes organizational context, technological context, and environmental context, which have been widely used to examine the factors that influence organizational technology adoption. According to the OTE model, the research model of this study identified nine determinants, including (1) organizational size, (2) CEOs' attitudes toward EC adoption, (3) CEOs' innovativeness, (4) CEOs' technology knowledge, (5) CEOs' perceptions of EC on relative advantages, (6) CEOs' perceptions of EC on compatibility, (7) CEOs'

perceptions of EC on complexity, (8) information intensity, and (9) competition intensity.

A quantitative, correlational, non-experimental and explanatory research design based on a questionnaire survey was used to collect data, test hypotheses, and answer research questions in this study. 1,500 CEOs of Taiwanese SMEs were randomly selected from the database of E-Volunteer and invited to participate via email on a hyper-link provided to the survey web site. A total of 219 usable questionnaires were obtained for data analysis.

The results of this study indicated that all three contexts were important in the decision of EC adoption by Taiwanese SMEs. The findings also supported significance of five determinants that had a positive relationship with the extent of EC adoption. These determinants were organizational size and CEOs' attitudes toward EC adoption, CEOs' perceptions of EC on relative advantage and compatibility, and information intensity. No statistically significant relationship with the extent of EC adoption was established for CEOs' technology knowledge, CEOs' perception of EC on complexity, and competition intensity. This study may not only expand the current body of EC knowledge, but also contribute to the knowledge of CEOs concerning SMEs, EC consultants, suppliers or value chain partners, and government agencies.

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CHAPTER I

INTRODUCTION

Introduction and Background to the Problem

Technology has driven organizational changes over the last decade. Especially, information-related technology has become more and more important in influencing and shaping organizational strategy and success. Hence, to efficiently adopt technological innovation to an organization has become a significant managerial concern. However, existing frameworks on technological innovation adoption were developed upon the technology at that time. Due to rapid development of technology, these frameworks were restricted in the ability to provide a core set of constructs for current organizations (Grover, 1993). To deeply analyze technological innovation adoption in the organization, the central theme of this study focuses on the determinants of the decision to adopt electronic commerce (EC) that is popular in today's information technology.

“Electronic commerce is associated with the buying and selling of information, products and services via computer networks” (Kalakota & Whinston, 1996, p. 1). In general, EC uses information or processing capabilities to improve organizational performance and relationships among suppliers and customers. There are many successful cases of adopting EC to gain competitive advantages today. Hence, many organizations, especially those operating globally, treat EC as both communications and transactions vehicles. Moreover, deeply understanding the context of EC is needed, so that

organizations become more aware of the opportunities and barriers to adopting EC.

Another theme that this study focuses on is Small and Medium Enterprises (SMEs). SMEs played a very important role in Taiwan's economic growth during the past several decades. According to the White Paper on SMEs in Taiwan (Small and Medium Enterprise Administration, 2004), SMEs represented 97.73% of the total number of Taiwan's business in 2003. SMEs have greater flexibility because their size allows them to adopt new processes, services, materials, and products more easily than large enterprises (Corman & Lussier, 1996). However, SMEs face the disadvantage of being less competitive due to insufficient resources and limited managerial abilities. In recent years, rising wages, the high cost of land, and environmental protection awareness have altogether caused Taiwan's industries to be less competitive. Furthermore, SMEs lack the resources to communicate with outside vendors, suppliers or customers, causing the organizations difficulty in staying competitive in the global marketplace. Today, most SMEs are forced to adopt EC by their major suppliers and value chain partners in order to carry out everyday business processes more efficiently. Moreover, the electronic marketing channel can bring customers more benefits, such as greater shopping convenience, more complete product information, and potentially lower prices. Hence, studying SMEs and their pattern of EC adoption has become a recent trend. However, most prior studies regarding EC adoption were conducted for large enterprises and for organizations in the USA or Europe. There are fewer studies of SMEs in the Asia-Pacific regions.

In conclusion, the question still exists as to whether current theories of EC adoption are appropriate for SMEs in Taiwan, or only for large enterprises and organizations in other specific regions. Additionally, one of many underlying concerns is whether EC can be adequately supported in the current environment and existing infrastructure. To answer these questions, investigation of various aspects of this new market channel is needed. The analysis should define the role of technology in the decision to adopt EC and identify the organization-related determinants of EC adoption.

Purpose

The main purpose of this study was to seek the determinants of EC adoption by SMEs in Taiwan. This study examined determinants of the extent of EC adoption, including the contexts of organization, technology, and environment. As part of an in-depth survey study, evidence was gathered from the chief executive officers (CEOs) of participating organizations. Information on CEOs' characteristics and perceptions of EC, organizational profiles, industrial environment, and the extent of EC adoption of the organization was collected and analyzed. This study attempted to identify key determinants that influence adoption decisions, and to explore the tendency of EC adoption. Results of the study may extend the body of knowledge on EC as a business process and explore organizational goals, strategies, and experiences. For the organizations that have not yet begun EC, this study may provide a better understanding of success factors, resources, competencies, and technical issues of EC adoption.

Definition of Terms

Conceptual Terms

Innovation adoption. Rogers (1962) defined an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (p. 12). Daft (1978) further defined organizational innovation adoption as “the adoption of an idea or behavior that is new to the organization adopting it” (p. 197). Recently, Swanson (1994) classified organizational innovations into three types: those that

1. Are confined to the technical tasks (p. 1069).
2. Support administration of business (p. 1069).
3. Are embedded in the core technology of the business (p. 1069).

The central theme of this study focused on an organization’s adoption of EC. Hence, according to Swanson’s innovation typology, the third type of definition of innovation was adopted in this study.

Electronic commerce (EC). Wigand (1997) stated that “electronic commerce represents the applications of information and communication technology along the whole value chain of business processes conducted electronically and designed to enable the accomplishment of a business goal” (Wigand, 1997, p. 5). Hence, according to Swanson’s innovation typology, EC can be regarded as one form of organizational innovation. In this study, business-to-business (B2B) and business-to-customer (B2C) EC were studied to examine the adoption of EC by SMEs in Taiwan. B2B EC is the part of the economy which deals with commercial activities via an electronic network

(Stehling & Moormann, 2002), whereas B2C EC is the processes by which organizations conduct business electronically with their customers (Faulkenr Information Services, 2001).

Study Variables

Tornatzky and Fleischer's OTE Model

Theoretical definition. Tornatzky and Fleischer (2003) identified three dimensions that affect organizational innovation adoption. The definition of each element is as follows:

1. Organizational context is typically defined in terms of several descriptive measures: firm size and scope; the centralization, formalization, and complexity of its managerial structure; the quality of its human resource; and the amount of slack resources available internally (p. 153).
2. Technological context describes both the internal and external technologies relevant to the firm. This includes existing technologies inside the firm, as well as the pool of available technologies in the market (p. 153).
3. Environment context is the arena in which a firm conducts its business – its industry, competitors, access to resources supplied by others, and dealings with government (p. 153).

Operational definition. The measurement of Tornatzky and Fleischer's OTE model was developed by various studies. For example, the organizational context was measured by organizational size (Grover & Goslar, 1993;

Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999; Zhu, Karaemar, & Xu, 2003), centralization (Grover & Goslar, 1993), formalization (Chau & Tam, 1997; Grover & Goslar, 1993), satisfaction with existing systems (Chau & Tam, 1997; Lertwongsatien & Wongpinunwatana, 2003), CEOs' characteristics (Thong, 1999), top management support (Lertwongsatien & Wongpinunwatana, 2003), and employees' knowledge (Thong, 1999). The technological context was measured by Rogers' attributes of innovation (Chau & Tam, 1997; Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999). The environmental context was measured by environmental uncertainty (Chau & Tam, 1997; Grover & Goslar, 1993), information intensity (Thong, 1999), competition intensity (Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999; Zhu, Karaemar, & Xu, 2003), and consumer and partner readiness (Zhu, Karaemar, & Xu, 2003).

Rogers' Attributes of Innovations

Theoretical definition. Rogers (2003) identified five attributes of innovations based on individual perceptions. An individual's perceptions of innovation lead to a decision to adopt or reject innovation (Rogers, 2003). The theoretical definitions for each attributes are as follows:

1. Relative advantage: "the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 229).
2. Compatibility: "the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters" (p. 240).

3. Complexity: “the degree to which an innovation is perceived as relatively difficult to understand and use” (p. 257).
4. Trialability: “the degree to which an innovation may be experimented with on a limited basis” (p. 258).
5. Observability: “the degree to which the results of an innovation are visible to others” (p. 258).

Operational definition. Based on Rogers' (2003) theory, Soh, et al.

(1997) developed an instrument of measurement that included five attributes of 22 items to examine the individual perceptions of innovation adoption. Thong (1999) modified Moore and Benbasat's (1991) instrument to measure individual perceptions of relative advantage, compatibility and complexity with nine items on information systems adoption. Recently, Seyal and Rahman (2003) reworded an instrument that had been developed by Soh, et al. (1997) to capture information regarding EC adoption. The measurement instrument included five attributes of 21 items.

Extent of Electronic Commerce Adoption

Theoretical definition. The extent of EC adoption refers to the degree to which EC has been adopted. In this study, the extent of EC adoption focuses on business processes. Wu, Mahajan and Balasubramanian (2003) developed an EC framework that divides EC into four processes. The definitions of each process are:

1. Communication: Exchanging information with customers, suppliers, partners, or within the organization;

2. Internal Administration: Conducting internal activities within the organization;
3. Order Taking: Facilitating transactions with customers; and
4. Procurement: Linking with suppliers to purchase input materials.

Operational definition. The extent of EC adoption was measured by 15 items for internal, outbound, and inbound communications, three items for internal administration processes, three items for order taking processes, and four items for procurement processes developed by Wu, Mahajan and Balasubramanian (2003).

Research Questions

To examine the determinants of EC adoption, the following research questions were proposed:

- Q1: What is the association between the organizational factors and the extent of EC adoption? (The organizational factors include organizational size and CEOs' characteristics).
- Q2: What is the association between the technological factors and the extent of EC adoption? (The technological factors include CEOs' perceptions of EC on relative advantage, compatibility, and complexity).
- Q3: What is the association between the environmental factors and the extent of EC adoption? (The environmental factors include information intensity and competition intensity).

Q4: What factors can predict the overall extent of EC adoption from a combination of organizational factors, technological factors and environmental factors?

Delimitations and Scope

Target population: SMEs in Taiwan

Only SMEs in Taiwan that are based on item 2, article 2 of the Small and Medium Enterprise Development Statute were selected to investigate. Large enterprises and the organizations managed by foreign companies were excluded. Moreover, due to insufficient resources to facilitate the implementation of EC, Small scale enterprises (SSEs), defined by the number of regular employees being fewer than five persons were excluded.

Subjects: Chief Executive Officers (CEOs)

Because the organizational structure of SMEs is less complex, the CEO is the main decision-marker. Moreover, the CEOs are usually the owners of SMEs. Hence, CEOs' perception of innovation adoption can represent the organizational intention to adopt innovation.

Electronic Commerce Activities: B2B and B2C

This study focused on EC adoption of customer interface and supplier interface. Hence, only business-to-business (B2B) and business-to-customer (B2C) EC activities were examined. The government-to-business (G2B), customer-to-customer (C2C), or other EC businesses were excluded.

CHAPTER II

THE REVIEW OF LITERATURE

Chapter two presents a critical analysis of the literature. There are four major sections in this chapter, including:

1. Innovation Adoption: Review of the literature regarding innovation, innovation adoption, and organizational innovation adoption.
2. Electronic Commerce (EC): Definition of EC activities, including B2B EC and B2C EC, and description of the status of EC in Taiwan.
3. Small and Medium Enterprises (SMEs): Description of the definition of SMEs in Taiwan and review of the literature regarding SMEs on innovation adoption.
4. Tornatzky and Fleischer's OTE Model: Description of three dimensions of the OTE model, including organizational context, technological context, and environmental context. Review of empirical studies that used the OTE model to explore its relationship with the adoption of organizational innovation.

The purpose of this chapter is to review the theoretical literature and empirical studies about determinants that influenced organizational EC adoption, and to identify areas of future scholarly inquiry.

Innovation Adoption

The Definition of Innovation

The first proposed concept of innovation was based on the economics theory (Schumpeter, 1939). Freeman (1990) wrote the following sentence at the beginning of his book, "The Economics of Innovation":

All schools of thought in economics have always recognized the central importance of technological innovations and of organizational innovations for the competitive performance of firms and of nations and for the long-term growth of the world economy (p. 1).

Sundbo (1995) argued that most economic growth can be explained not only by the three traditional factors of (a) land, (b) labor and (c) capital, but also by the fourth factor, called "technology." Innovation in business practices usually is named "organizational innovation." Earlier studies considered organizational innovation as a "new product" or a "new production." For example, Kline and Rosenberg (1986) summarized the concept of organizational innovation as follows:

1. A new process of production.
2. The substitution of a cheaper material, newly developed for a given task, in an essentially unaltered product;
3. The reorganization of production, internal functions, or a distribution arrangement leading to increased efficiency, better support for a given product, or lower costs; or
4. An improvement in instruments or methods of innovation.

Poutsma, Van Uxem, and Walravens (1987) further extended Kline and Rosenberg's definition and proposed four classifications of organizational innovation, as shown in the following table:

Table 1
Classifications of Organizational Innovation

Classification	Definition
1 Process Innovation	Production process, data processing, distribution, and services
Product Innovation	Development, production, and dissemination of new consumer and capital goods and services
2 Radical innovation	Revolutionary changes in technology
Incremental innovation	Minor improvements in current technology
3 Technology-push	Developed under pressure exerted by the competing suppliers and the ascribed superiority of the innovation,
Market-pull	Developed in response to a market need which is felt, acknowledged, and translated into technical demand
4 Planned Innovation	Innovation developed according to plan where the business aims to control the market
Incidental Innovation	Innovation developed according to specific reaction of a business to new market demand

Recently, the innovation of EC has been frequently examined in the context of organizational innovation. Based on Poutsma, Van Uxem, and Walravens' (1987) classifications of organizational innovation, EC may be classified as process, radical, technology-push, market-pull, planned, and incidental innovation (Thong, 1999). Swanson (1994) classified information system innovation into three types: those which

1. Are confined to technical tasks (p. 1069).
2. Support administration of business (p. 1069).
3. Are embedded in the core technology of the business (p. 1069).

The central theme of this study was to examine the adoption of EC that can be regarded as a form of the information system. According to Swanson's (1994) typology, EC can be viewed as the third type of innovation (Wu, Mahajan, & Balasubramanian, 2003). Details of EC will be discussed in the Electronic Commerce section.

Overview of Organizational Innovation Adoption

Daft (1978) defined the adoption of organizational innovation as "the adoption of an idea or behavior that is new to the organization adopting it" (p. 197).

Prior studies regarding innovation adoption had identified various dimensions of factors that influence adoption of innovation by an organization (Fichman & Kemerer, 1997; Kimberly & Evanisko, 1981; Tornatzky & Fleischer, 1990).

Innovation is a means of changing organizations, whereas innovation adoption is a process that includes the generation, development, and implementation of new ideas or behaviors (Rogers, 2003). Kwon and Zmud (1987) identified five dimensions of factors that influence innovation adoption by an organization.

They are:

1. User characteristics;
2. Task characteristics;
3. Innovation characteristics;
4. Organizational characteristics; and

5. Environmental characteristics.

Kimberly and Evannisko (1981) proposed three dimensions of factors that influence innovation adoption by an organization. They are:

1. Characteristics of the organization;
2. Characteristics of its leaders; and
3. Characteristics of the environment.

Recently, a number of studies cooperated with strategic management theory, named “absorptive capacity” (Cohen & Levinthal, 1990), to examine innovation adoption. For example, Boynton, Zmud, and Jacobs (1994) indicated that innovation adoption is influenced by the development of information technology knowledge. The researchers further indicated that the organizational climate is the key factor that influences the ability of organizations to absorb new technology-related knowledge.

Based on prior innovation models, Tornatzky and Fleischer (1990) conceptualized the context of innovation adoption as consisting of three dimensions: (a) organizational context; (b) technological context; and (c) environmental context. Because this model can be applied to any type of organization and is consistent with prior models (Tornatzky & Fleischer, 1990), Tornatzky and Fleischer’s OTE model was used in this study.

Electronic Commerce (EC)

The Definition and Content of EC

Generally speaking, EC is a modern business strategy that links the needs of organizations, suppliers, and consumers to reduce costs while improving the

quality of products and services, and improving the speed of service delivery (Shaw, 2003). With the development of technology, there are many different definitions and classifications of EC (Kalakota & Whinston, 1996; Wigand, 1997; Zwass, 1996). For example, Kalakota and Whinston (1997) observed prior literature to define EC from four perspectives. They are:

1. Communication Perspective: EC is the delivery of information, products, services, and payments over an electronic network.
2. Business Process Perspective: EC is the application of technology toward the automation of business transactions.
3. Service Perspective: EC is a tool that addresses the desire of organizations, customers, and management to reduce service costs, improve the quality of services, and increase the speed of service delivery.
4. Online Perspective: EC provides the capability of buying and selling products and information on the online network.

Furthermore, Turban, Lee, King, and Chung (2000) classified EC by transactions into six types of EC. The definition of each type is shown in the following table:

Table 2

EC Classification by Transactions

Type	Definition
Business-to-Business (B2B)	Electronic market transactions between organizations
Business-to-Consumer (B2C)	Electronic transactions with individual shoppers
Consumer-to-Consumer (C2C)	Consumer sells directly to consumers and uses an electronic network to advertise items for sale or services
Consumer-to-Business (C2B)	Individuals who sell products or services to organizations via electronic transactions and communications
Nonbusiness EC	Nonbusiness institutions use various electronic network to reduce costs and improve operations and services
Intrabusiness EC	Internal organizational activities are performed on intranets

In this proposed study, B2B and B2C EC were investigated to examine the extent of EC adoption by SMEs in Taiwan. The details of B2B and B2C EC are discussed in the following sections.

Business-to-Business Electronic Commerce

Stehling and Moormann (2002) defined B2B EC as that part of the economy which deals with commercial activities via an electronic network between two or more different organizations. Its implementation involves organizations allowing their value chain partners or suppliers to access their information systems via the electronic network (Lee, Seddon, & Corbitt, 1999). The first B2B EC concept was found in the form of electronic data interchange (EDI) in the late 60's (Kalakota & Whinston, 1996). With rapid development of technology, numerous technologies were used to support B2B EC, including

inter-organizational systems (IOS) (Bakos, 1991) and electronic markets (Klein & Langenohl, 1999; Malone, Yates, & Benjamin, 1987). In the past, B2B EC was commonly used by private networks and implemented mainly by large. With the advent of the Internet, EC has become popular in public networks.

Business-to-Consumer Electronic Commerce

B2C EC refers to the processes by which organizations conduct business electronically with their customers (Faulkner Information Services, 2001). A unique characteristic of B2C EC environments is that it allows organizations to create interfaces with highly interactive features. From a customer perspective, interactivity can help them in their purchase decisions. Hence, organizations should customize the shopping environment to meet customers' preferences by using sophisticated tools (Häubl & Trifts, 2000). According to Peterson Balasubramanian, and Bronnenberg (1997), the new marketing channel has the following characteristics:

1. Organizations have more ability to store huge amounts of information at different virtual locations at a lower cost.
2. B2C EC provides organizations and customers with powerful and cheap means of searching, organizing, and disseminating information.
3. The characteristic of interactivity provides organizations more information that customers demand.
4. B2C EC provides customers with perceptual experiences that are better than a printed catalog, although not as rich as personal inspection.

5. B2C EC can serve not only as a transaction medium, but also as a physical distribution medium for certain goods, such as software and music.
6. B2C EC has relatively low entry and establishment costs for organizations.

These characteristics can be translated into benefits for customers, including greater shopping convenience, more current and complete product information, custom-tailored products and services, and potentially lower prices.

The Status of Electronic Commerce in Taiwan

In the Internet age, the development of EC is often considered a major indicator of overall competitiveness (United Nations Conference on Trade and Development, 2002). The International Institute for Management Development (IMD), the International Data Corporation (IDC), and the Economist Intelligence Unit (EIU) are the most often quoted sources of global competitiveness data (R.O.C. Department of Commerce, 2004). In 2004, Taiwan was ranked 12th by the IMD (International Institute for Management Development, 2004); 24th by the IDC (International Data Corporation, 2004); and 20th by the EIU (Economist Intelligence Unit, 2004) on index of global competitiveness. According to a World Bank report entitled "Trade Facilitation and Economic Development: Measuring the Impact" (Wilson, Mann, & Otsuki, 2003), Taiwan was ranked 5th among Asia-Pacific Economic Cooperation (APEC) members according to Indexed Input of E-Business Usage, trailing behind only Singapore among Asian APEC members. Moreover, according to the Global Information Technology

Report 2002-2003 (Dutta, Lanvin, & Paua, 2004) published by the World Economic Forum, Taiwan's Networked Readiness Index (NRI) was ranked 9th among 84 nations, and only behind Singapore in Asia (3rd). These rankings reflected that Taiwan has considerable competitive advantages of high technology development.

Business-to-Business Electronic Commerce

The drive behind Taiwan's B2B EC development was from the short product life cycles of the information technology and telecommunication industries between 1998 and 1999. At that time, foreign manufacturers were imposing strict delivery requirements, called "955" and "983" materials requirements (95% of products delivered within 5 days of order and 98% of products delivered within 3 days). Taiwan manufacturers responded by implementing electronic business management methods such as ERP (Enterprise Resource Planning), MRPI (Material Requirement Planning), MRPII (Manufacturing Resource Planning), and SCM (Supply Chain Management). The most representative example is in the domestic OEM semiconductor industry. Their moves were seen as major achievements among both domestic suppliers and internationally. Hence, the trend of B2B EC adoption in Taiwan spread from the electronics industries to other industries. Currently, the level of B2B EC adoption remains highest in the electronics industries; in traditional industries, B2B EC still has considerable room for growth (R.O.C. Department of Commerce, 2004).

According to recent research, EC Infrastructure Preparation and B2C Promotion Project (R.O.C. Department of Commerce, 2003), in 1999, the size of

Taiwan's B2B E-Commerce market was NT \$716.8 billion (around US \$23 billion). By 2003, the total market size had reached NT \$4.9445 trillion (around US \$164 billion); in five years' time, the market had grown by NT \$4.2277 trillion (around US \$141 billion), with an annual average growth rate of 63.1%. From 2004 to 2008, the domestic B2B market is expected to grow by an average of 17.6% annually. By 2008, the market is expected to reach NT \$10.6588 trillion (around US \$355 billion).

Business-to-Consumer Electronic Commerce

As the number of personal computers and those with Internet access continues to grow, the concept of online shopping is gaining acceptance among consumers in Taiwan. According to the Institute for Information Industry research group in the report of Taiwan Internet Connectivity Status (Institute for Information Industry research group, 2004), Internet connection penetration rate among households is nearly 60%, and 70% of those who have Internet access use broadband to access the Internet, mainly via ADSL. Browsing web pages and sending/receiving email are the main online activities. The study also indicated that the B2C EC market showed slight growth, because traditional retailers have begun offering their products and services online, and using their corporate image to counter consumers' skepticism about purchasing online. Moreover, as Internet use continues to rise on campuses, a large population of computer literate graduates with substantial consumption capacity is emerging. The Internet has naturally become an indispensable resource for pricing and purchasing products for these consumers.

According to the Taiwan E-Commerce Yearbook (R.O.C. Department of Commerce, 2004), 2004 online shopping in Taiwan reached NT \$34.72 billion (around US \$1.15 billion), a 57.2% increase over 2003, and is expected to grow by another 40% in 2005 to reach NT \$49.31 billion (around US \$1.64 billion). By 2008, online shopping will reach NT \$95.22 billion (around US \$3.17 billion), with a compounded annual growth rate (CAGR) of 28.7% between 2004 and 2008. By comparison, the estimated 2004 total retail sales volume in Taiwan is approximately NT \$2.8886 trillion (around US \$96 billion), with online shopping accounting for 1.2% of the total volume.

Small and Medium-Size Enterprises (SMEs)

The Definition of SMEs

The criteria for defining a small and medium enterprise (SME) usually vary because the economic development, industry structure, and development direction in each country are different (Fink, 1998). Generally, there are qualitative and quantitative criteria to define SMEs. Qualitative criteria focus on the special characteristics that distinguish small SMEs from large enterprises. Bolton (1971) defined SMEs by the following qualitative features:

1. An SME has a relatively small market share;
2. An SME is managed by its owners in a personalized way, not by an organized managerial structure; and
3. An SME is independent with the owners or managers that have control of the activities of the business.

A quantitative definition usually has a specific index to distinguish small SMEs from large enterprises. Generally, there are four indicators of quantitative criteria: (1) the industry category; (2) capital stock, (3) amount of sales; and (4) the number of regular employees (Small and Medium Enterprise Administration, 2004).

In Taiwan, all small and medium enterprises are governed by The Small and Medium Enterprise Administration (SMEA) of the Ministry of Economic Affairs, R.O.C. The quantitative definition of an SME in Taiwan is based on item 2, article 2 of the Small and Medium Enterprise Development Statute (SMEDS). According to SMEDS (Small and Medium Enterprise Administration, 2004), SMEs are identified by the following standards:

1. For the industries of manufacturing, construction, mining, and quarrying, an organization would be considered an SME when its capital stock does not exceed NT \$80 million (around US \$2,500,000).
2. For industries of forestry, agriculture, fishing, animal raising, plumbing, electrical, gas and fuel oil, commerce, transportation, warehousing, communications, finance, insurance, real estate, industrial and commercial service, social service, and personal service, an organization would be considered as an SME when sales of the past year did not exceed NT \$100 million (around US \$3,125,000).

SMEDS also allows classification based on the number of regular employees if the above stated standards are not applicable. The standard based on number of employees is as follows:

1. For industries of manufacturing, construction, mining and quarrying, the number of regular employee should not exceed 200 persons. Moreover, if the number of regular employees does not exceed 20 persons, the organization would be considered as a “Small Scale Enterprise (SSE).”
2. For industries of forestry, agriculture, fishing, animal raising, plumbing, electrical, gas and fuel oil, commerce, transportation, warehousing, communications, finance, insurance, real estate, industrial and commercial service, social service, and personal service, the number of regular employees should not exceed 50 persons. Moreover, if the number of regular employees does not exceed 5 persons, the organization would be considered as a “Small Scale Enterprise (SSE).”

SMEDS further specifies that the “sales” mentioned earlier would be based on the operating income listed on the organizational final income tax report documents. The number of regular employees would be based on the number of persons whom the organization has insured during the most recent 12 months.

SMEDS still considers an organization as SME, even if it exceeds the standard limits set earlier, if it is under the following conditions:

1. An SME that exceeds the size limit after government assistance would still be classified as an SME for a period of 2 years following the date of expansion.

2. An SME that has merged and exceeds the size limit after government assistance would still be classified as an SME for a period of 2 years following the date of merger.
3. When a company receiving focused guidance and assistance exceeds the size limits and the guidance agency considers that it is necessary to classify it as an SME, the company would be considered an SME for the duration of the focused guidance period.

According to the White Paper on Small and Medium Enterprises in Taiwan (Small and Medium Enterprise Administration, 2004), there were 1,171,780 enterprises in Taiwan, which included 25,428 large enterprises and 1,146,352 SMEs. The SMEs generated an average of US \$20 million revenues a year. Furthermore, SMEs made up 90% of the Asia-Pacific Enterprise Cooperation (APEC) membership and 80% of the Taiwanese workforce.

SMEs on Technological Innovation Adoption

Many studies showed that the SMEs are not willing to adopt technological innovations because of their small scale of operations and insufficient resources (Baldrige & Burnham, 1975; Moch & Morse, 1977; Lind, Zmud, & Fischer, 1989; Yap, Thong, & Raman, 1994). Moreover, prior theories related to the adoption of innovation were only applicable to large enterprises (Welsh & White, 1981). Due to the fact that SMEs have very different characteristics from large enterprises, prior studies based on large enterprises may not be generalized to SMEs. To analyze the characteristics of SMEs, a study of technological innovation adoption is needed.

Rothwell and Dodgson (1993) indicated that both SMEs and large enterprises have their own advantages. Large enterprises have material advantages because of their greater capability to support research and development, whereas SMEs have behavioral advantages because of their greater flexibility and ability to adapt to change in the market. Thwaites and Wynarczyk (1996) suggested that large enterprises are important in creating new innovation, whereas SMEs can be innovative in using existing innovation.

With the rapid development of the Internet, more and more SMEs had invested in the adoption of EC to gain competitive advantages. However, some studies reported that most SMEs had a slow innovation adoption rate and were difficult to realize the benefits in the same way as large enterprises (Poon & Swatman, 1995). Walczuch, Van Braven, and Lundgren (2000) reviewed prior research studies focusing on barriers of innovation for SMEs and concluded that the primary barriers of innovation adoption for SMEs were startup costs, unfamiliarity with new technology, and lack of guidance in the adoption processes.

Recently, Thong (2001) developed a resource-based model for SMEs based on Welsh and White's (1981) framework of resource constraints and Attewell's (1992) knowledge theory to explore barriers to innovation adoption in SMEs. Thong (2001) identified three characteristics of SMEs as barriers to innovation adoption. They are: (a) highly centralized structures; (b) resource poverty; and (c) knowledge deficiency. In the SMEs, CEOs usually are the owners and the critical decision maker (Lefebvre & Lefebvre, 1992). As highly centralized structures, these CEOs have great power to influence the decisions

affecting technology adoption (Lefebvre, Mason, & Lefebvre, 1997). When CEOs of SMEs make decisions, the decision-making process is more intuitive and less dependent on formal decision processes (Rice & Hamilton, 1979). Hence, the CEOs' perceptions on innovation adoption are an important determinant and need to be examined.

With regard to resource poverty of SMEs, according to Welsh and White (1981) resource poverty can be divided into three dimensions: time constraints, financial constraints, and expertise constraints. Thong (2001) indicated that:

1. Because of limited time, the CEOs and their employees are not very involved in adopting innovation projects. Hence, the quality of adopted innovations would suffer.
2. Because of limited financial resources, SMEs should carefully control funds for innovation adoption projects. Adopting an insufficient system would be inadequate for the organizational needs.
3. Because of lack of internal information technology expertise, SMEs do not have the capability to execute their own information technology projects.

In addition to the internal resources, the external resources are also important for SMEs. Because of the knowledge deficiency in SMEs, external resources in the form of external experts are significant to SMEs in successfully adopting innovation. In summary, resources represent the most critical difficulties in SMEs (Cohn & Lindberg, 1972). Insufficient resources spent would increase the risk of innovation adoption failure. In this study, the CEOs' characteristics,

attitudes toward innovation adoption, and perceptions of innovation were examined based on characteristics of SMEs. The following section discusses each determinant toward innovation adoption in detail.

Tornatzky and Fleischer's OTE Model

Tornatzky and Fleischer's (1990) OTE model has been widely used to examine the factors that influence organizational innovation adoption (Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999; Zhu, Kraemer, & Xu, 2003). Tornatzky and Fleischer (1990) identified three dimensions that affect innovation adoption. The constructs of each dimension are as follows:

1. **Organizational Context:** including "firm size and scope; the centralization, formalization, and complexity of its managerial structure; the quality of its human resource; and the amount of slack resources available internally" (p. 153).
2. **Technological Context:** including "existing technologies inside the firm, as well as the pool of available technologies in the market" (p. 153).
3. **Environment Context:** "the arena in which a firm conducts its business – its industry, competitors, access to resources supplied by others, and dealings with government" (p. 153).

Similarly, Rogers (2003) identified three characteristics as antecedents of innovation adoption in his theory of innovation diffusion. The three characteristics are:

1. Individual characteristics, such as individual attitudes toward change;

2. Internal characteristics of organizational structure, such as centralization, complexity, formalization, interconnectedness, organizational slack, and size; and
3. External characteristics of the organization, such as system openness.

In Rogers' theory, Individual characteristics can be considered as organizational factors, especially in SMEs as characteristic of highly centralized structures. In addition, Rogers described five attributes of innovations that influence the rate of innovation adoption. The five attributes can be viewed as technological factors in examining technological innovation adoption. Hence, Tornatzky and Fleischer's (1990) model is consistent with Rogers' (2003) theory of innovation diffusion and can provide a useful starting point to examine organizational innovation adoption.

Based on Tornatzky and Fleischer's (1990) OTE model, the theoretical framework of this study and summary of prior empirical studies are illustrated in Figure 1 and Table 3. In this study, nine determinants of innovation adoption were identified within the three contexts to examine relationships between each of the contexts and the extent of EC adoption, to determine whether each context influences the EC adoption. Each context and determinants are discussed in the following sections.

Table 3

Studies Using Tornatzky and Fleischer's OTE Framework

Study	Variables
Grover & Goslar (1993) Telecommunications technologies adoption	Organizational Context <ul style="list-style-type: none"> ◆ Organizational size ◆ Centralization ◆ Formalization Technological Context <ul style="list-style-type: none"> ◆ IS maturity Environmental Context <ul style="list-style-type: none"> ◆ Environmental uncertainty
Chau & Tam (1997) Open system adoption	Organizational Context <ul style="list-style-type: none"> ◆ Complexity of IT infrastructure ◆ Satisfaction with existing systems ◆ Formalization on system development and management Technological Context <ul style="list-style-type: none"> ◆ Perceived benefits ◆ Perceived barriers ◆ Perceived importance of compliance to standards, interoperability, and interconnectivity Environmental Context <ul style="list-style-type: none"> ◆ Market Uncertainty
Thong (1999) Information system adoption Small business	Organizational Context <ul style="list-style-type: none"> ◆ CEOs' innovativeness ◆ CEOs' IS knowledge ◆ Business size ◆ Employees' IS knowledge Technological Context <ul style="list-style-type: none"> ◆ Relative advantage of IS ◆ Compatibility of IS ◆ Complexity of IS Environmental Context <ul style="list-style-type: none"> ◆ Competition ◆ Information intensity
Lertwongsatien & Wongpinunwatana (2003) E-Commerce adoption Small and medium enterprises	Organizational Context <ul style="list-style-type: none"> ◆ Size ◆ Top management support for E-Commerce ◆ Existence of IT department Technological Context <ul style="list-style-type: none"> ◆ Perceived benefits ◆ Perceived compatibility Environmental Context <ul style="list-style-type: none"> ◆ Competitiveness
Zhu, Kraemer, & Xu (2003) Electronic business adoption	Organizational Context <ul style="list-style-type: none"> ◆ Firm scope ◆ Firm size Technological Context <ul style="list-style-type: none"> ◆ Technology competence Environmental Context <ul style="list-style-type: none"> ◆ Consumer readiness ◆ Competitive Pressure ◆ Lack of trading partner readiness

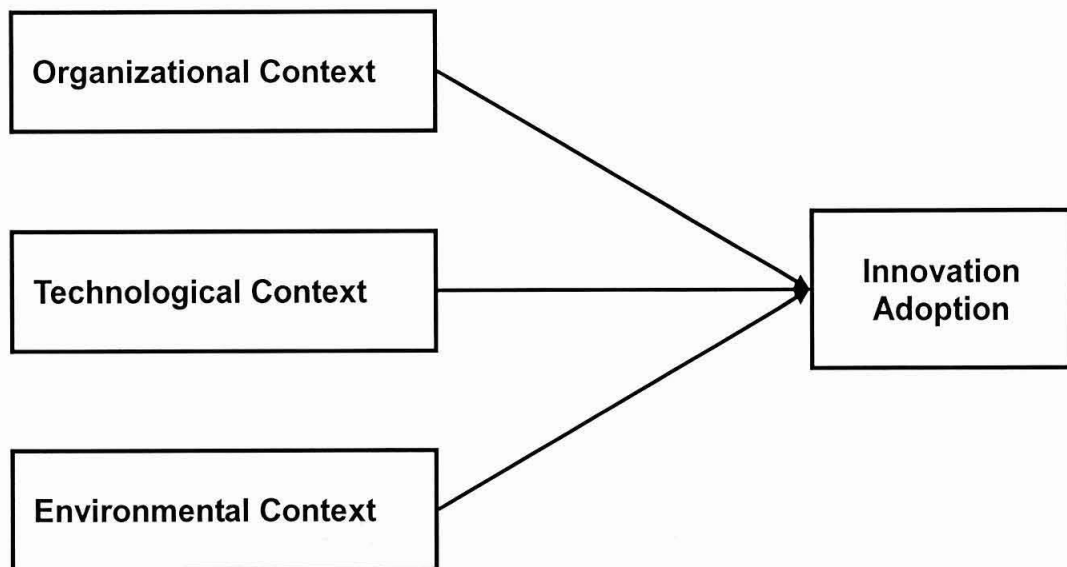


Figure 1. Theoretical framework based on OTE model.

Organizational Context

Organizational factors were the most often used factors to examine the influence on the decision of innovation adoption. Tornatzky and Fleischer (1990) indicated that organizational structure and processes would constrain or facilitate the adoption of innovation. Under the aspect of organizational structure, many studies examined the factors, such as organizational size, centralization, and formalization, as determinants of innovation adoption (Grover, 1993; Sabherwal & King, 1995). Due to characteristics of highly centralized structures in SMEs, centralization and formalization would not be seen as significant in influencing innovation adoption. Most studies regarding innovation adoption in SMEs used only organizational size as the organizational structure factor to examine its relationship to innovation adoption (Lertwongsatien & Wongpinunwatana, 2003; Seyal & Rahman, 2003; Thong, 1999). Under the aspect of organizational

process, roles of top managers were frequently seen as a key determinant factor that influences innovation adoption. Prior innovation literature reported a positive effect of top managers' support of innovation adoption (Orlikowski, 1993; Rai & Patnayakuni, 1996). In the SMEs, the organizational structure is less complex and simpler to manage. Top managers in SMEs usually refer to the CEO, who makes most of the critical decisions (Mintzberg, 1979). This study examined organizational size and CEOs' characteristics as the determinants in the organizational context of EC adoption.

Organizational Size

Organizational size was one of the most frequently examined determinants in the studies of innovation adoption (Grover, 1993; Lertwongsatien & Wongpinunwatana, 2003; Rai & Patnayakuni, 1996; Thong, 1999; Zhu, Kraemer, & Xu, 2003). These studies showed that organizational size had a positive association with innovation adoption. Prior studies found that larger organizations were more likely to adopt innovation because they had enough ability to absorb the risk and had sufficient resources to facilitate the innovation adoption (Fichman & Kemerer, 1997). Moreover, SMEs had several unique characteristics, such as operating in a highly competitive environment, financial constraints, lack of professional expertise, and susceptibility to external forces, that would be barriers to innovation adoption (Welsh & White, 1981). Zhu, Kraemer, and Xu (2003) concluded that larger organizations had some advantages over smaller organizations regarding innovation adoption. They are:

1. Larger organizations had more resources to facilitate innovation adoption.
2. Larger organizations may more easily achieve economies of scale.
3. Larger organizations were more capable of absorbing the risk associated with early stages of innovation adoption.
4. Larger organizations had more power to urge suppliers or partners to adopt the same technology.

Consequently, larger organizations should have a higher potential to use EC due to a larger scale of business operations (Lind, Zmud, & Fischer, 1989). SMEs encounter more barriers to adoption of innovation than large organizations. However, Alpar and Reeves (1990) argued that, even in the SMEs, the larger organizations had more ability to adopt innovation by hiring employees with specialized skills. Hence, organizational size still has an impact on innovation decisions within SMEs.

Thong (1999) conducted an empirical study to examine information systems adoption in small businesses. The results showed that organizational size is the major determinant in the adoption of information systems. A significant difference was found between adopters and non-adopters of information systems among small businesses. Moreover, even among small businesses with insufficient resources, larger organizations tended to adopt more information systems. The researcher observed that only those organizations with sufficient resources would consider adoption of information systems. Hence, having sufficient resources is the first step toward the decision of innovation

adoption by SMEs. This study also found that organizational size was not correlated with any of the other independent variables.

Recently, Seyal and Rahman (2003) investigated EC adoption in SMEs in Brunei. The study found that organizational size was not statistically significant in EC adoption. However, the study further found that there was a significant difference in the organizational revenue generated by adopted EC between small enterprises and medium enterprises. This result reflected that small enterprises did not strategically use EC. The researchers indicated that this was probably due to several economic and organizational constraints. This was still consistent with findings from other studies in the technological innovation literature.

CEOs' Attitudes toward Electronic Commerce Adoption

Attitudes refer to the extent of individual favorable or unfavorable reaction toward a given behavior (Fishbein & Ajzen, 1975). In the SMEs with few layers of management, the top managers are usually the CEOs of organizations and they have great power to control the decision process directly. Thong and Yap (1995) investigated CEOs' attitudes toward adoption of information technology in small businesses. The results showed that the CEOs' attitudes were crucial in determining the innovation adoption by small businesses. A study conducted by Mehrtens, Cragg, and Mills (2001) also found that CEOs' attitudes toward adopting new technology had a direct impact on decisions of organizational innovation adoption. Moreover, prior studies found that the existence of champions was the major determinant in the decision of innovation adoption (Grover, 1993; Teo & Tan, 1998). Teo and Tan (1998) conducted an empirical

study to examine the difference between adopters and non-adopters of the Internet in Singapore. The study found that 63.4 percent of adopters had champions for the Internet adoption process. Among these champions, 48.2 percent were from top management.

Recently, a study conducted by Seyal and Rahman (2003) found that CEOs' attitudes had a positive influence on the decision of EC adoption. The researchers proposed that smaller businesses had strong needs for managerial support to allocate more resources for EC. Rai and Patnayakuni (1996) indicated that when top managers had positive attitudes toward innovation adoption, they could ensure that the required resources would be rapidly available when they were needed. Because the CEO of an SME plays an important role in making organizational strategies (Kohli & Jaworski, 1990), the role of the CEO in the decision of EC adoption would be significant. Specifically, CEOs of the SMEs had the authority to reduce conflict within the organization (Dess & Origer, 1987). Hence, CEOs' positive attitudes toward EC adoption can facilitate adoption processes by building an organizational strategic consensus (Wu, Mahajan, & Balasubramanian, 2003).

CEOs' Innovativeness

Rogers (2003) defined innovativeness as "the degree to which an individual is relatively earlier in adopting new ideas than other members of a system" (p. 267). Kirton (1976) proposed that an individual would be categorized on a continuous range from the innovator who had an ability to do things differently than the adaptor who had an ability to do things better. Based on

Kirton's theory, Rogers (2003) indicated innovators had the following personality characteristics compared to adaptors: (a) greater empathy, (b) less dogmatism, (c) a greater ability to deal with abstractions, (d) greater rationality, (e) greater intelligence, (f) a more favorable attitude to change, (g) a greater ability to cope with uncertainty and risk, (h) a more favorable attitude toward science, (i) less fatalism, and (j) higher aspirations. In business practice, the CEOs who are categorized as adaptors would seek solutions based on their experience. On the other hand, CEOs who are categorized as innovators would solve problems by changing the organizational structure in which the problems were embedded. However, changing the structure would be risky because this solution has not been tried out (Kirton, 1984). Among the SMEs, CEOs make most of the critical decisions (Mintzberg, 1979) and determine the innovative attitude of the business (Rizzoni, 1991). Hence, CEOs' innovativeness would be a significant determinant and should be examined as a component of organizational innovation adoption in the SMEs.

Thong and Yap (1995), and Thong (1999) conducted studies to investigate the CEOs of small businesses in Singapore. Both of the studies found that CEOs' innovativeness had a positive relationship to small businesses' decisions to adopt information systems. The researchers observed that adopting technological innovation usually required large financial resources for a small business with insufficient resources. If the performance of the adopting innovation did not achieve the expected goal, the small business may suffer irreparable damages. Innovation adoption was more risky for small businesses

compared to larger businesses with sufficient resources. Hence, in small businesses, the CEOs with less innovativeness would look for other less risky solutions to solve existing problems. On the other hand, innovative CEOs would take a risk to change the current organizational structure to solve problems radically.

CEOs' Technology Knowledge

According to a study by Attewell (1992), most organizations delayed their innovation adoption because of insufficient knowledge on how to implement the innovation. Even though adopting the technological innovation is urgent and necessary, these organizations tend to delay adoption of complex technological innovations until the barriers of knowledge are lowered (Attewell, 1992). Hence, based on Attewell's theory, overcoming the obstacles of developing technical knowledge will lead to greater motivation toward innovation adoption.

Prior studies regarding innovation adoption found that most SMEs lack specialized technological knowledge (DeLone, 1988; Gable, 1991; Lees, 1987). In the SMEs, the CEOs usually were owners of the organizations and established the organizations since its founding. Hence, the CEOs of SMEs have the authority to influence other members and have comprehensive knowledge in most strategic decisions (Markus, 1983; Thong, Yap, & Raman, 1996). The organizational knowledge and experience were considered to be the CEOs' individual knowledge and experience in SMEs (Raymond & Blili, 2000). However, Gable and Raman (1992) found that CEOs tend to lack technological knowledge. Many of them refused to adopt technological innovation when they

did not believe that they would get benefits from the investments (Attewell, 1992; Senn & Gibson, 1981; Yap, Thong, & Raman, 1994).

Recently, Thong and Yap (1995) and Thong (1999) conducted studies to investigate the influences of CEOs' characteristics on innovation adoption. Both of the studies found that CEOs' technological knowledge had a significant positive relationship to the decision of information system adoption in small businesses. The results were consistent with Attewell's (1992) theory that the degree of uncertainty regarding innovation adoption would decrease when CEOs became more knowledgeable. Hence, if these CEOs could be familiar with technological knowledge and learn about the benefits of the innovation, they would be more willing to adopt innovation.

Technological Context

The technological context describes the pool of technologies available for innovation adoption by an organization (Tornatzky & Fleischer, 1990). This context has been investigated by many studies related to innovation adoption (Tornatzky & Klein, 1982). The main focus of these studies was on how technology characteristics can affect the adoption decision (Tornatzky & Fleischer, 1990). According to the Meta-analysis by Tornatzky and Klein (1982), 30 perceived innovation characteristics had been studied (e.g., relative advantage, association with major enterprises, clarity of results, compatibility, communicability, etc.). One of the most cited reviews of perceived technological characteristics was Rogers' (1962) theory of diffusion of innovations (Prescott & Conger, 1995). According to Rogers' theory, the adoption decision was influenced by individual

perceptions toward the innovation adoption. In SMEs, the CEOs were the main decision makers. Their perceptions toward innovation adoption were crucial determinants (Rizzoni, 1991). Rogers (1962) identified five characteristics of innovations on an individual's perceptions. They were: (a) relative advantage; (b) complexity; (c) compatibility; (d) trialability; and (e) observability. Tornatzky and Klein (1982) found that the characteristics of relative advantage, complexity, and compatibility had more influence on the decision of innovation adoption than the characteristics of trialability and observability. Hence, this study adopted the characteristics of relative advantage, complexity, and compatibility as technological antecedents of EC adoption. The following sections discuss these characteristics in detail.

Relative Advantage

Relative advantage is "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003, p. 229). The higher the level of understanding on the relative advantage of EC, the more willing to allocate the managerial and financial resources to adopt EC (Lertwongsatien & Wongpinunwatana, 2003). Tornatzky and Klein (1982) argued that this characteristic lacked conceptual strength, reliability, and prescriptive power because the definition was too broad and amorphous. Almost all the studies related to innovation adoption had used this characteristic. However, the results were inconsistent. For example, Soh et al. (1997) investigated the experience of early adopters in Singapore. Most respondents stated that the Internet had a high impact on customers' satisfaction and organizational image. However, they

did not perceive relative advantage over other current business practices in terms of increasing sales and enlarging market share. Seyal and Rahman (2003) also found that relative advantage was an insignificant contributor to EC adoption. The researchers indicated that most of the managers were not sure about the direct benefits that could be derived from EC. However, many studies still had positive results. Premkumar and Ramamurthy (1995), Tan and Teo (1998), Teo and Tan (2000), and Lertwongsatien and Wongpinunwatana (2003) found that this characteristic was a significant predictor of innovation adoption.

Compatibility

Compatibility is “the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (Rogers, 2003, p. 240). Rogers’ definition was a kind of normative of cognitive compatibility (Tornatzky & Klein, 1982). Tornatzky and Klein (1982) further defined compatibility as “compatibility with values or norms of potential adopters or may represent congruence with existing practices of the adopter” (p. 33). This definition had a more practical and operational compatibility, not only compatibility with what the individual felt or thought about technology (Thong, 1999). If the innovation was compatible with existing work practices and environments, the organizations would be more likely to adopt it (Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999). Most studies confirmed that compatibility had a positive association with innovation adoption (Grover, 1993; Seyal & Rahman, 2003; Soh, et al., 1997; Thong, 1999). Lertwongsatien and Wongpinunwatana (2003) conducted an empirical study to investigate EC

adoption for SMEs in Thailand. The researchers divided organizations into three levels based on their EC adoption action. They were: (a) adopters (already adopted); (b) prospectors (plan to adopt within one year); and (c) laggards (no intention to adopt). The results showed that due to limited resources, laggards hesitated to invest in innovations because they were uncertain about the compatibility with their existing business environment. On the other hand, adopters and prospectors were more willing to take on the risks of EC adoption because they were more certain of the compatibility of the technology with their organizations. Moore and Benbasat (1996) also indicated that compatibility and relative advantage were the most influential determinants of innovation adoption.

Complexity

Complexity is “the degree to which an innovation is perceived as relatively difficult to understand and use” (Roger, 2003, p. 257). Unlike other characteristics, complexity had a negative association with innovation adoption. A number of studies examined innovation adoption with this characteristic and found it to have a negative effect on adoption (Chong & Bauer, 2000; Karahanna, Straub, & Chervany, 1999; Soh, et al., 1997). Thong (1999) conducted an empirical study of information system adoption in small business. The study examined two stages of information system adoption: (1) likelihood of information system adoption (whether the organization is or is not computerized); and (2) extent of information system adoption (the degree to which the information system has been adopted). The results showed that there was a greater chance toward innovation adoption by small businesses if the innovation was better than the

existing system, and was easy to use and understand. However, there was no significant effect on the extent of information system adoption. The researcher indicated that most CEOs of organizations lacked knowledge of information systems. After the initial decision to adopt information systems, lowering knowledge became a barrier and took precedence over the perception of technological characteristics. The CEOs' knowledge became the major determinant of the extent of adoption by small businesses.

Environmental Context

The third context of this study is external factors. Environmental context is the arena in which an organization conducts its business (Tornatzky & Fleischer, 1990). When organizations face a complex and rapidly changing environment, innovation is necessary (Pfeffer & Leblebici, 1977). Prior studies found that the intensity of information and competition would stimulate innovation adoption (Grover, 1993; Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999; Zhu, Kraemer, & Xu, 2003). Because environmental factors can not be controlled by organizations, the environmental factors create a need for organizations to adopt innovation (Lertwongsatien & Wongpinunwatana, 2003). The environmental factors of information intensity and competition intensity are examined in the following sections.

Information Intensity

Information intensity refers to the degree of information that is present in the product or service of an organization (Thong, 1999). Generally, organizations in different sectors had different information needs. Porter and

Millar (1985) stated that organizations can enhance their products with high information intensity via information technology. For example, the services of travel agencies are highly information intense and they need efficient information systems to provide customers with sufficient information. Malone, Yates, and Benjamin (1987) suggested that organizations need more information to specify the attributes of the product when the product is complex. Hence, organizations in the high information intensity sectors are more likely to adopt innovation (Yap, 1990).

Thong (1999) conducted an empirical study to examine the relationship between information intensity and likelihood of information system adoption, and information intensity and extent of information system adoption. Regarding the likelihood of information system adoption, the results showed that information intensity does not have a significant direct effect on the decision to adopt an information system. However, the characteristics of technology were found to have indirect effects on information system adoption. Information intensity was positively associated with relative advantage and compatibility of the information system. Regarding the extent of information system adoption, the results showed that the higher the information intensity of the product or service, the higher the extent of information system adoption. The researcher indicated that when an organization takes on an uncertain task, it has to analyze the benefits of various design strategies before making a decision of adoption. Thus, information intensity did not have a direct influence on the decision of innovation adoption. On the other hand, organizations can extend existing information

systems to deal with a product or service with high information intensity to meet its needs. Hence, higher information intensity would lead an organization to perceive innovation as a competitive tool and increase the extent of innovation adoption.

Competition Intensity

Competition intensity refers to the degree of competitive environment within the industry in which organizations operate (Lertwongsatien & Wongpinunwatana, 2003). Pfeffer and Leblebici (1977) proposed that, in a competitive environment, organizations would be innovative due to competition. Moreover, in a highly competitive environment, organizations would allocate resources for offering innovative products or services to respond to competitors (Reich & Benbasat, 1990). Porter and Millar (1985) indicated that adopting information systems can enable an organization to:

1. affect the industry structure, which would alter rules of competition;
2. create a competitive advantage, which would leverage new ways to outperform the competitors; and
3. spawn new businesses from within existing operations, which would change the competitive environment.

This analysis of information system adoption can be extended to the EC domain. EC can be considered as a strategic tool to implement an organization's new strategy and to respond to competitors (Lertwongsatien & Wongpinunwatana, 2003). On the other hand, an organization within a lower competitive environment would not be likely to adopt the innovation or push to be innovative.

Most empirical studies showed that higher competition intensity is associated with higher adoption rates. For example, Zhu, Kraemer and Xu (2003) examined electronic business adoption by European firms. The results showed that adopters are under higher competitive pressure than non-adopters. Lertwongsatien and Wongpinunwatana (2003) investigated EC adoption for small and medium enterprises in Thailand. The study also found that EC adopters are more likely to operate in a highly competitive environment. The results of these studies were consistent with prior innovation literature that points to competition as the key determinant to influence the decision to adopt innovation. However, there were no studies to examine the relationship between competition intensity and the extent of EC adoption. Additional research needs to be conducted.

Extent of Electronic Commerce Adoption

Most studies regarding innovation adoption focused on investigating the likelihood of innovation adoption. However, there are a few studies that examined the extent of innovation adoption. Along with the rapid development of technology, 80 percent of SMEs in Taiwan had Internet access (R.O.C. Department of Commerce, 2003). Hence, investigating the extent of EC adoption represents a more critical research question than investigating the likelihood of EC adoption. In Taiwan, most SMEs had intensively utilized new technologies to enhance their competencies to compete (R.O.C. Department of Commerce, 2003). Hence, it is more important to understand the degree of EC adoption by SMEs in Taiwan.

To conceptualize the extent of EC adoption, analyzing the business operation process and business activities is needed. According to Porter's (1985) value chain theory, business activities can be divided into five stages:

1. Inbound Logistics: get the raw materials from suppliers, including the receiving, warehousing, and controlling of inventory.
2. Operations: transform the inputs into the final product.
3. Outbound Logistics: get the finished product to the customer, including warehousing and order fulfillment.
4. Marketing and Sales: attract customers to purchase the product, including channel selection, advertising, and pricing.
5. Service: maintain and enhance the product's value, including customer support and repair services.

Based on Porter's (1985) value chain theory, many researchers proposed various frameworks of EC activities. For example, Ho (1997) categorized EC activities into three categories based on the business purposes:

1. Promotion of product and services: Using EC to market products and services.
2. Provision of data and information: Using EC to communicate.
3. Processing of business transactions: Using EC to transact.

Nambisan and Wang (1999) also proposed a similar classification of EC activities.

They were:

1. Information Access: Using EC to disseminate information of products and services.

2. Work Collaboration: Using EC to facilitate real-time work collaboration and document flow during the business processes.
3. Core Business: Integrating EC into core business processes and transactions.

According to a survey of major commercial uses of EC (Soh, et al., 1997), organizations used EC to perform the following major functions:

1. Marketing and Advertising
2. Information Gathering
3. Customer Service and Support
4. Electronic Transaction

Recently, Wu, Mahajan and Balasubramanian (2003) reviewed prior innovation adoption literature and, based on Porter's (1985) theory, developed an EC framework that distinguishes EC into four distinct processes:

1. Communication: Exchanging information with customers, with suppliers, or within the organization
2. Internal Administration: Conducting internal activities within the organization
3. Order Taking: Facilitating transactions with customers
4. Procurement: Linking with suppliers to purchase input materials

The researchers indicated that although the four processes can not completely represent the extent of EC adoption domains, they provide the major set of processes between internal and external constituencies.

As the purpose of this study, only B2B EC and B2C EC were examined. Moreover, because SMEs have a less complex organizational structure, the internal administration process was excluded. Hence, this study modified the Wu, Mahajan and Balasubramanian's model and focused only on customer interface and supplier interface. The framework is presented in Table 4 and the business activities for each business process are presented in Table 5.

Table 4

Framework of the Business Processes on EC

	Customer Interface	Supplier Interface
Communication Processes	Outbound communication	Inbound communication
Order-taking Processes	Online order taking	---
Procurement Processes	---	Electronic procurement

Table 5

Business Activities for Each Business Process

B2B	Inbound Communication	<ul style="list-style-type: none"> ◆ Send suppliers regular updates via electronic network ◆ Provide inventory planning information to suppliers via electronic network ◆ Provide database system for supplier linking up
	Procurement	<ul style="list-style-type: none"> ◆ Search potential suppliers online ◆ Place and track orders via electronic network ◆ Invite suppliers to submit bids online ◆ Use online marketplaces to source supplies

B2C	Outbound Communication	<ul style="list-style-type: none"> ◆ Provide general information on the web site ◆ Allow customers to send information to appropriate contacts via electronic network
	Order Taking	<ul style="list-style-type: none"> ◆ Permit customers to order online ◆ Permit customers to pay online ◆ Provide online tracking information

CHAPTER III

RESEARCH METHODOLOGY

Chapter three presents a description of empirical aspects of this research study. This chapter is comprised of seven major sections, including:

1. **Research Design:** Describe the type of research method that is conducted in this study and identify the independent and dependent variables.
2. **Researcher Questions and Researcher Hypotheses:** Based on the research framework, four researcher questions, nine major hypotheses, and 36 sub-hypotheses are developed in this study.
3. **Population and Sampling Plan:** In this section, target population and accessible population of this study are defined and the sampling method of this research is described.
4. **Instrumentation:** The descriptions of constructs of the questionnaire, and their reliability and validity are discussed in this section.
5. **Procedures:** The data collection method, ethical considerations, and the results of the pilot test are described.
6. **Data Analysis:** The statistical analysis of exploratory data analysis, internal consistency reliability, exploratory factor analysis, and multiple regression are used in this study.
7. **Evaluation of Research methods:** An evaluation of research method of this study is provided, including the strengths and weaknesses.

The purpose of this chapter is to develop an empirical research study and identify critical determinants of the extent of EC adoption in SMEs in Taiwan based on Tornatzky and Fleischer's theoretical framework.

Research Design

A quantitative research design was conducted for this study. A correlational, non-experimental and explanatory research based on a questionnaire survey was used to collect data, answer research questions, and test hypotheses in this study.

The purpose of this research design is to examine the relationships between the extent of EC adoption by an organization and the contexts of organization, technology, and the environment. Based on the literature review, Tornatzky and Fleischer's (1990) model was used on most studies that investigated the drivers of EC adoption in SMEs. The model includes three dimensions: (a) the organizational context; (b) the technological context; and (c) the environmental context. In order to answer research questions and test the research hypotheses, this study included nine independent variables and four dependent variables as follows:

Organizational Context

- IV1: Organizational Size
- IV2: CEOs' Attitudes toward EC Adoption
- IV3: CEOs' Innovativeness
- IV4: CEOs' Technology Knowledge

Technological Context

IV5: CEOs' Perception of EC on Relative Advantage

IV6: CEOs' Perception of EC on Compatibility

IV7: CEOs' Perception of EC on Complexity

Environmental Context

IV8: Information Intensity

IV9: Competition Intensity

Extent of EC Adoption

DV1: Extent of EC Adoption on B2B Communications

DV2: Extent of EC Adoption on B2B Procurement

DV3: Extent of EC Adoption on B2C Communications

DV4: Extent of EC Adoption on B2C Order Taking

The proposed research model is shown in Figure 2, and the properties of each variable are discussed in the Instrumentation section.

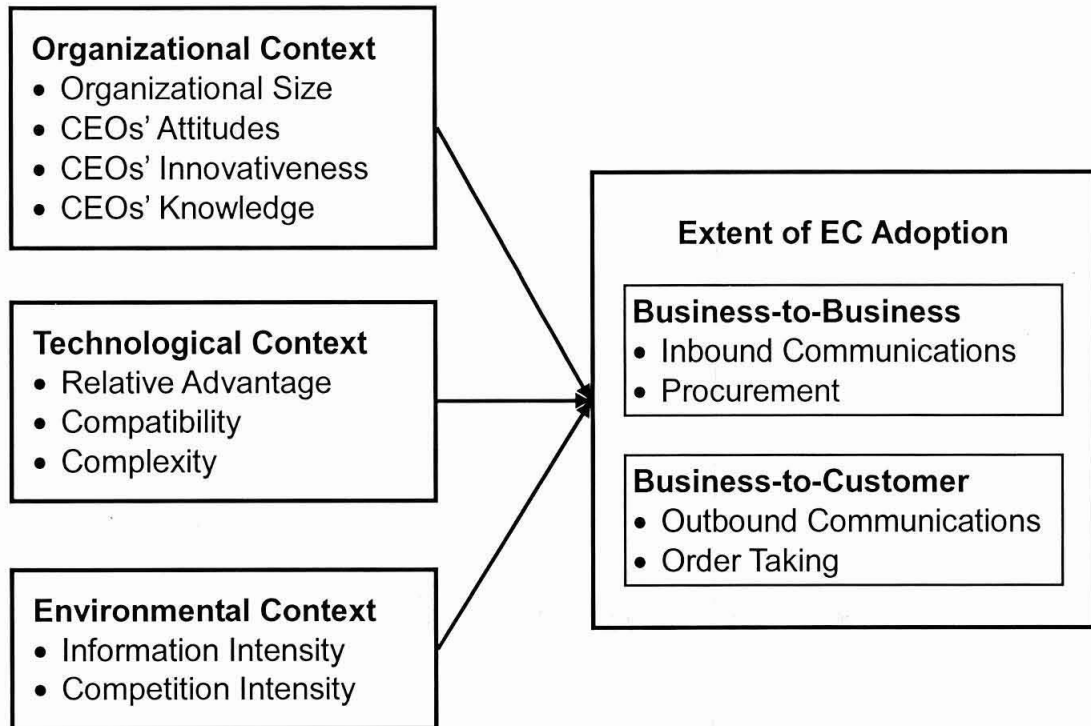


Figure 2. Proposed research model.

Research Questions and Research Hypotheses

Research hypotheses are statements that describe the relationship between two variables with specific predictions; research questions are similar to hypotheses. However, they are phrased in question format and do not express specific predictions (Leech, Barrett, & Morgan, 2005). In this study, there were four research questions and nine major research hypotheses that examined the relationship between the determinants and the extent of EC adoption in SMEs in Taiwan.

Research Questions

Q1: What is the association between the organizational factors and the extent of EC adoption?

- Q2: What is the association between the technological factors and the extent of EC adoption?
- Q3: What is the association between the environmental factors and the extent of EC adoption?
- Q4: What factors can predict the overall extent of EC adoption from a combination of organizational factors, technological factors and environmental factors?
- Q4a: What factors can predict the extent of EC adoption on B2B communications from a combination of organizational factors, technological factors and environmental factors?
- Q4b: What factors can predict the extent of EC adoption on B2B procurement from a combination of organizational factors, technological factors and environmental factors?
- Q4c: What factors can predict the extent of EC adoption on B2C communications from a combination of organizational factors, technological factors and environmental factors?
- Q4d: What factors can predict the extent of EC adoption on B2C order taking from a combination of organizational factors, technological factors and environmental factors?

Research Hypotheses

- H1: Organizational size has a significantly positive relationship with the overall extent of EC adoption.
- H1a: Organizational size has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H1b: Organizational size has a significantly positive relationship with the extent of EC adoption on B2B procurement.
- H1c: Organizational size has a significantly positive relationship with the extent of EC adoption on B2C communications.
- H1d: Organizational size has a significantly positive relationship with the extent of EC adoption on B2C order taking.
- H2: CEOs' attitude toward EC has a significantly positive relationship with the overall extent of EC adoption.
- H2a: CEOs' attitude toward EC has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H2b: CEOs' attitude toward EC has a significantly positive relationship with the extent of EC adoption on B2B procurement.
- H2c: CEOs' attitude toward EC has a significantly positive relationship with the extent of EC adoption on B2C communications.

- H2d: CEOs' attitude toward EC has a significantly positive relationship with the extent of EC adoption on B2C order taking.
- H3: CEOs' Innovativeness has a significantly positive relationship with the overall extent of EC adoption.
- H3a: CEOs' Innovativeness has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H3b: CEOs' Innovativeness has a significantly positive relationship with the extent of EC adoption on B2B procurement.
- H3c: CEOs' Innovativeness has a significantly positive relationship with the extent of EC adoption on B2C communications.
- H3d: CEOs' Innovativeness has a significantly positive relationship with the extent of EC adoption on B2C order taking.
- H4: CEOs' technology knowledge has a significantly positive relationship with the overall extent of EC adoption.
- H4a: CEOs' technology knowledge has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H4b: CEOs' technology knowledge has a significantly positive relationship with the extent of EC adoption on B2B procurement.

- H4c: CEOs' technology knowledge has a significantly positive relationship with the extent of EC adoption on B2C communications.
- H4d: CEOs' technology knowledge has a significantly positive relationship with the extent of EC adoption on B2C order taking.
- H5: Perceived relative advantage of EC has a significantly positive relationship with the overall extent of EC adoption.
- H5a: Perceived relative advantage of EC has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H5b: Perceived relative advantage of EC has a significantly positive relationship with the extent of EC adoption on B2B procurement.
- H5c: Perceived relative advantage of EC has a significantly positive relationship with the extent of EC adoption on B2C communications.
- H5d: Perceived relative advantage of EC has a significantly positive relationship with the extent of EC adoption on B2C order taking.

H6: Perceived compatibility of EC has a significantly positive relationship with the overall extent of EC adoption.

H6a: Perceived compatibility of EC has a significantly positive relationship with the extent of EC adoption on B2B communications.

H6b: Perceived compatibility of EC has a significantly positive relationship with the extent of EC adoption on B2B procurement.

H6c: Perceived compatibility of EC has a significantly positive relationship with the extent of EC adoption on B2C communications.

H6d: Perceived compatibility of EC has a significantly positive relationship with the extent of EC adoption on B2C order taking.

H7: Perceived complexity of EC has a significantly negative relationship with the overall extent of EC adoption.

H7a: Perceived complexity of EC has a significantly negative relationship with the extent of EC adoption on B2B communications.

H7b: Perceived complexity of EC has a significantly negative relationship with the extent of EC adoption on B2B procurement.

- H7c: Perceived complexity of EC has a significantly negative relationship with the extent of EC adoption on B2C communications.
- H7d: Perceived complexity of EC has a significantly negative relationship with the extent of EC adoption on B2C order taking.
- H8: Information intensity of the industry has a significantly positive relationship with the overall extent of EC adoption.
- H8a: Information intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2B communications.
- H8b: Information intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2B procurement.
- H8c: Information intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2C communications.
- H8d: Information intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2C order taking.

H9: Competition intensity of the industry has a significantly positive relationship with the overall extent of EC adoption.

H9a: Competition intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2B communications.

H9b: Competition intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2B procurement.

H9c: Competition intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2C communications.

H9d: Competition intensity of the industry has a significantly positive relationship with the extent of EC adoption on B2C order taking.

Population and Sampling Plan

Target Population

In this study, the target population was the CEOs of SMEs that had adopted EC in Taiwan. The definition of SMEs in Taiwan was based on item 2, article 2 of the Small and Medium Enterprise Development Statute (SMEDS). According to the White Paper on Small and Medium Enterprises in Taiwan (Small and Medium Enterprise Administration, 2004), there were 1,146,352 SMEs in 2003. The purpose of this study was to examine the extent of EC adoption in SMEs in Taiwan. To target the population that already had EC adoption, only the

SMEs that had Internet access were investigated in this study. According to the report 2003 Taiwan Business Internet Access and Applications Annual Survey (Small and Medium Enterprise Administration, 2004), 79.2% of SMEs had Internet access as of 2003. Hence, the target population of this study would be around 908,000 SMEs.

Accessible Population

Due to the large scale of the target population, this study narrowed the sample to two industries, wholesale and retail, and manufacturing. Of Taiwan's 15 major industries, the wholesale and retail industries had the largest number of SMEs, 611,000 (53.33% of all SMEs) in 2003, whereas the manufacturing sector had the second largest number of SMEs (134,000, or 11.65% of the total). Moreover, these two industries generated up to 75 % of total sales of SMEs in 2003 (Small and Medium Enterprise Administration, 2004). Hence, SMEs in Taiwan could be represented by choosing wholesale and retail, and manufacturing industries as the accessible population of this study. The accessible population would be 590,000 SMEs.

Sampling Plan

Eligibility Criteria and Exclusion Criteria

The purpose of this study was to examine the extent of EC adoption in SMEs in Taiwan. The measurement of the extent of EC adoption in this study was based on business-to-business (B2B) and business-to-customer (B2C) EC activities. Hence, firstly, the organizations were chosen from a population that had Internet access. Secondly, these organizations must implement either B2B

or B2C EC businesses. The organizations that only had business-to-government (B2G) or customer-to-customer (C2C) EC activities or other EC businesses were excluded. In addition to the criteria of EC, the population was limited by the number of employees. This study focused on SMEs in Taiwan. The large enterprises and the organizations managed by foreign companies were excluded. Moreover, based on SMEDS (Small and Medium Enterprise Administration, 2004), organizations whose regular employees did not exceed 5 persons would be seen as a Small Scale Enterprise (SSE). These organizations may not have sufficient resources and infrastructure to facilitate the implementation of EC activities as defined in this study. The determinants of EC adoption of SSEs would be different from SMEs. Hence, the organizations that were considered as "Small Scale Enterprises" were excluded in this study.

Simple Random Sampling

The population list was derived from the database of E-Volunteer (<http://www.e-volunteer.org.tw>) that was hosted by Small and Medium Enterprise Administration (SMEA) that governs all SMEs in Taiwan. Simple random sampling, a probability sampling plan, was used in this study. Although simple random sampling can highly represent a population, Black (1999) argued that there are several disadvantages:

1. Simple random sampling is not possible without obtaining a complete list of population members.
2. It is potentially uneconomical and costly to achieve.

3. It can be disruptive to isolate members from the group.
4. The time-scale may be too long, and data could change.

In this study, the complete population list was obtained in the form of a computer database file via assistance from SMEA. The random sampling procedure was also completed by a computer program that reduces the complexity of simple random sampling. The disadvantages and barriers of simple random sampling were eliminated in this study. Moreover, simple random sampling provided a sample that is not biased, and met the requirements for statistical validity.

The appropriate sample size can increase generalizability and reduce sampling errors. Gay and Airasian (2000) suggested that if the population is over 5,000, a sample size of 400 should be adequate. In this study, data were collected using an online survey technique. Sheehan (2001) reported that the average response rate of online surveys is 36.83%. Hence, 1,500 email invitations were sent out for this research to achieve the sample size suggested by Gay and Airasian (2000).

Instrumentation

The questionnaire of this study included four parts with a total of 76 items, including organizational context, technological context, environmental context, and the extent of EC adoption (See Appendix A for English version and Appendix B for Chinese version). The questionnaire developers and number of items for each construct are listed in Table 6. This survey research was conducted via the Internet. All participants were invited by email that instructed participants to

connect to the survey web site. Only checklists were used in the questionnaire.

The details of each construct are discussed in the following sections.

Table 6

Constructs of the Questionnaire

Part	Name	Questionnaire Developers	Items
1	Organizational Context	Researcher, Seyal & Rahman (2003), and Hurt et al. (1977)	42
2	Technological Context	Seyal & Rahman (2003)	11
3	Environmental Context	Thong & Yap (1995)	6
4	Extent of EC Adoption	Wu et al. (2003)	17

Part 1: Organizational Context

Description

Tornatzky and Fleischer (1990) indicated that the organizational context on innovation adoption can be analyzed from two aspects: organizational structure and organizational processes. The instrument of organizational structure was developed by the researcher. Four items were used to measure organizational profile. The operational definition of organizational profile is summarized in the following table:

Table 7

Constructs of Organizational Profile

Item	Scale	Level or Category
Employees	8 levels of checklists	Number of regular employees
Sales	8 levels of checklists	Annual sales
Organization Location	4 categories of checklists	Northern Taiwan, Central Taiwan, Southern Taiwan, and Eastern Taiwan
Have Organizational Web site	Dichotomous checklists	Yes, No

For the organizational processes, CEOs' characteristics that include CEOs' profiles, CEOs' attitudes toward EC adoption, CEOs' innovativeness, and CEOs' technology knowledge were investigated in this study. CEOs' profiles were measured by four items developed by the researcher, including gender, age, educational level, and CEO tenure. The measurement and operationalization are summarized as follows:

Table 8

Constructs of Socio-Demographic Profiles of CEOs

Item	Scale	Level or Category
Gender	Dichotomous checklists	Male, Female
Age	5 levels of checklists	In years
Education	6 levels of checklists	Below high school, High school, Associate's degree, Bachelor's degree, Master's degree, Doctorate degree
CEO Tenure	5 levels of checklists	In years

The instrument of CEOs' attitudes toward EC adoption was measured by four items developed by Seyal and Rahman (2003). CEOs' innovativeness was measured by 20 items developed by Hurt, Joseph, and Cook (1977). These items were measured by five-point Likert scales ranging from "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." The participants were asked to select one of five scales for each question. CEOs' technology knowledge was measured by 10 items developed by the researcher. The score of CEOs' technology knowledge was measured by the number of types of computer experience.

Reliability and Validity

Hurt, Joseph, and Cook (1977) reported the instrument of CEOs' innovativeness with Cronbach's coefficient alpha 0.92. Seyal and Rahman (2003) reported the instrument of CEOs' attitudes toward EC adoption with Cronbach's coefficient alpha 0.76. The results of principal components analysis and confirmatory factors analysis of both studies indicated high construct validity in this instrument. Hence, both of reliability and validity of the instruments were sufficient for social science research.

Part 2: Technological Context

Description

The instrument of Rogers' attributes of innovation was used in the technological context of this study. Prescott and Conger (1995) indicated that Rogers' attributes of innovations was the most cited review on measuring the perception of innovation adoption. Moreover, Tornatzky and Klein (1982) found

that the attributes of relative advantage, complexity, and compatibility had the most significant influence on innovation adoption. Rogers (1962, 2003)

described the definition for these attributes as follows:

1. Relative Advantage: “the degree to which an innovation is perceived as being better than the idea it supersedes” (p. 229).
2. Compatibility: “the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (p. 240).
3. Complexity: “the degree to which an innovation is perceived as relatively difficult to understand and use” (p. 257).

This study adopted the same scale as was used by Seyal and Rahman (2003).

The instrument consisted of three dimensions with a total of 11 items. The operational definitions of each dimension are summarized in Table 9.

Table 9

Operational Definition of Roger's Attributes of Innovation

Characteristics	Operationalization
Relative Advantage	<ul style="list-style-type: none"> ◆ Increase sale and enlarge market share ◆ Reduce cost ◆ Develop new business ◆ Establish strong relationship with suppliers
Compatibility	<ul style="list-style-type: none"> ◆ Compatible with the earlier experience of technological innovation adoption ◆ Compatible with the values, beliefs, and business needs of the organization. ◆ Compatible with EC activities adopted by suppliers or partners
Complexity	<ul style="list-style-type: none"> ◆ Lack of appreciation of tool ◆ Lack of funding ◆ Lack of expertise ◆ Lack of industry standard

This instrument used five-point Likert scales ranging from "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." The participants were asked to select one of five scales for each question to represent their perceptions of EC adoption.

Reliability and Validity

In a study conducted by Seyal and Rahman (2003), the Cronbach's coefficient alpha and average variance of the instrument were provided as follows:

1. Relative Advantage: alpha = 0.78; average variance = 0.65
2. Compatibility: alpha = 0.75; average variance = 0.65
3. Complexity: alpha = 0.77; average variance = 0.68

Each Cronbach's coefficient alpha was above 0.70; that was sufficient on internal consistency reliability of social science research suggested by Leech, Barrett, and Morgan (2005). Moreover, Igbaria and Iivari (1995) indicated that validity could be measured by the average variance of each construct and should be above 0.5. Hence, for Seyal and Rahman's study, the results showed considerable reliability and validity support.

Part 3: Environmental Context

Description

The environmental context of this study included two factors: information intensity and competition intensity. Information intensity refers to the degree of information that is present in the product or service of an organization (Thong, 1999), whereas competition intensity is the degree of competitive environment within the industry in which the organization operated (Lertwongsatien & Wongpinunwatana, 2003). The instruments of information intensity and competition intensity were developed by Thong and Yap (1995) with six items. The operationalization for each dimension is summarized in Table 10.

Table 10

Operational Definition of Environmental Context

Dimension	Operationalization
Information Intensity	<ul style="list-style-type: none"> ◆ Dependent on up-to-date information ◆ Have access to reliable, relevant, and accurate information ◆ Access information quickly whenever the information is needed
Competition Intensity	<ul style="list-style-type: none"> ◆ Ease for a customer to switch to a competitor ◆ Level of rivalry among organizations in the same industry ◆ Effect of substitutable products and services

This instrument used five-point Likert scales ranging from “Strongly Disagree,” “Disagree,” “Neutral,” “Agree,” and “Strongly Agree.” The participants were asked to select one of five scales for each question to describe the industry in which their organizations operated.

Reliability and Validity

Both the reliability of information intensity and competition intensity were 0.82 (Grover, 1993; Thong, 1999). Moreover, Grover (1993) and Thong (1999) examined the construct validity of information intensity and competition intensity by using factor analysis. The results were greater than the cutoff point of 0.50 recommended by Igbaria and Livari (1995). Hence, both reliability and validity were satisfied for adoption by this study.

Part 4: Extent of Electronic Commerce Adoption

Description

The instrument of the extent of EC adoption for this study was developed by Wu, Mahajan and Balasubramanian (2003). The researchers measured the

extent of EC adoption by 15 items for internal, outbound, and inbound communications, three items for internal administration processes, three items for order taking processes, and four items for procurement processes. However, due to fewer layers of management in SMEs, the EC activities of internal communications and internal administration processes were excluded in this study. Moreover, the purpose of this study focused only on supplier interface (B2B EC activities) and customer interface (B2C EC activities). Hence, this study employed 17 items to measure four business processes on EC. The operational definitions of each process are shown in Table 11.

Table 11
Constructs of the Extent of E-Commerce Adoption

Processes	Operationalization	Item
Inbound Communications	Electronic communication with suppliers	4
Outbound Communications	Electronic communication with customers	6
Order Taking	Online order taking	3
Procurement	Electronic procurement	4

This instrument used five-point scales ranging from 1, “Not used at all,” to 5, “Extensively used.” The participants were asked to select one of five scales for each question to describe the extent of EC adoption in their organizations.

Reliability and Validity

In a study conducted by Wu, Mahajan and Balasubramanian (2003), the Cronbach’s coefficient alpha was provided as follows:

1. Inbound Communications: $\alpha = 0.82$
2. Outbound Communications: $\alpha = 0.83$

3. Order Taking: $\alpha = 0.75$
4. Procurement: $\alpha = 0.77$

Each Cronbach's coefficient alpha was above 0.70; that is sufficient on internal consistency reliability of social science research suggested by Leech, Barrett, and Morgan (2005). For validity, Wu, Mahajan and Balasubramanian (2003) indicated that all items were subject to principal components analysis and confirmatory factors analysis. The results showed high construct validity on this instrument. Hence, both of reliability and validity of the instruments were sufficient for this study.

Data Collection Procedures

1. The questionnaire of this study was divided into four parts: (a) organizational context; (b) technological context; (c) environmental context; and (d) the extent of EC adoption. All permissions from instrument developers had been received (See Appendix F).
2. The Institutional Review Board (IRB) application was submitted. The data collection process was begun after approval of the IRB of Lynn University (See Appendix E).
3. The population list was from the database of E-Volunteer (<http://www.e-volunteer.org.tw>) that was hosted by Small and Medium Enterprise Administration (SMEA) that governs all SMEs in Taiwan. The content of the list includes the names of companies and CEOs, and email address of CEOs. This information is not confidential and also can be found in public. SMEA provided the researcher a list with

computer database files that could reduce complexity on the sampling procedure. The permission letter of using E-Volunteer database had been received (See Appendix G).

4. Because most CEOs that participated in this survey were Taiwanese, the questionnaire translated into Chinese language with an official endorsement from an expert who was fluent in both Chinese and English languages. Reverse-translation method was used to ensure the consistency of the questionnaire. The certification letter approved by IRB is attached in Appendix H.
5. A pilot test was conducted before the survey was begun. The researcher interviewed 10 selected Taiwanese CEOs of SMEs face-to-face to ask for their suggestions on each statement of the questionnaire and to ensure that all of the questions could be clearly understood by the participants. Their suggestions were incorporated into the final questionnaire. There were minor modifications to particular questions of the preliminary questionnaire.
6. The survey was done on the Internet (<http://www.surveymonkey.com>), without personal contact. All Taiwanese CEOs were invited to participate via email that provided an explanation of the research and a hyper-link to the survey web site (See Appendix I). An Authorization for Voluntary Consent Form was provided before participants started to answer the questionnaire (See Appendix C for the English version and Appendix D for the Chinese version).

Participants were anonymous to the degree that technology allows, and there were no identifiers. Hence, the permission of waive of documentation of signature was granted by IRB.

7. The data collection process took one month from when 1,500 email invitations were sent out. The data collection ended on November 20th, 2005 with 323 questionnaires returned. The researcher submitted the Lynn University IRB Report of Termination of Project.

Methods of Data Analysis

The computer software, the Statistical Package for Social Sciences (SPSS), was used for data analysis in this study. Various statistics analysis such as Exploratory Data Analysis, Internal Consistency Reliability, Exploratory Factor Analysis, and Multiple Regression were conducted. The procedures of data analysis were as follows:

1. Data Coding: the process of assigning numbers to the values of levels of each variable.
2. Exploratory Data Analysis: using descriptive statistics to check error and statistical assumptions of parametric test (e.g., *t*-test, analysis of variance, Pearson correlation, and multiple regression). If the variables did not meet the assumptions, transforming variables were considered.
3. Internal Consistency Reliability: Most variables in this study were composed of multiple Likert-type items. Hence, Cronbach's coefficient alpha was used to measure the consistency of the

multiple-item scale. Each Cronbach's coefficient alpha should be above 0.70; that is sufficient on internal consistency reliability of social science research suggested. If the alpha is below 0.70, the items with lower item-total correlations were deleted.

4. Exploratory Factor Analysis (EFA): EFA was conducted to assess the underlying structure for the multiple items of the CEOs' characteristics, CEOs' perceptions of EC, environmental factors, and the extent of EC adoption.
5. Pearson and Spearman Correlation: For all research hypotheses and research question 1 to research 3, Pearson correlation was used to examine the relationship between the independent variable and the dependent variable when both variables were approximately normally distributed. When the assumption of normality was markedly violated, the Spearman *rho*, nonparametric statistics, was used.
6. Multiple Regression: For research question 4, the statistical technique of multiple regression was used to analyze the relationship between each of the explanatory variables and the dependent variables. The main effects are represented by the following set of equations:

$$(1) \text{ Extent of EC Adoption} = c_1 + b_{11}X_1 + b_{12}X_2 + b_{13}X_3 + b_{14}X_4 + b_{15}X_5 \\ + b_{16}X_6 + b_{17}X_7 + b_{18}X_8 + b_{19}X_9 + \varepsilon_1$$

$$(2) \text{ B2B Communications} = c_2 + b_{21}X_1 + b_{22}X_2 + b_{23}X_3 + b_{24}X_4 + b_{25}X_5 \\ + b_{26}X_6 + b_{27}X_7 + b_{28}X_8 + b_{29}X_9 + \varepsilon_2$$

$$(3) \text{ B2B Procurement} = c_3 + b_{31}X_1 + b_{32}X_2 + b_{33}X_3 + b_{34}X_4 + b_{35}X_5 + b_{36}X_6 \\ + b_{37}X_7 + b_{38}X_8 + b_{39}X_9 + \varepsilon_3$$

$$(4) \text{ B2C Communications} = c_4 + b_{41}X_1 + b_{42}X_2 + b_{43}X_3 + b_{44}X_4 + b_{45}X_5 \\ + b_{46}X_6 + b_{47}X_7 + b_{48}X_8 + b_{49}X_9 + \varepsilon_4$$

$$(5) \text{ B2C Order Taking} = c_5 + b_{51}X_1 + b_{52}X_2 + b_{53}X_3 + b_{54}X_4 + b_{55}X_5 + b_{56}X_6 \\ + b_{57}X_7 + b_{58}X_8 + b_{59}X_9 + \varepsilon_5$$

Here, X_1 = organizational size, X_2 = CEOs' attitudes toward EC adoption, X_3 = CEOs' innovativeness, X_4 = CEOs' technology knowledge, X_5 = CEOs' perception of EC on relative advantage, X_6 = CEOs' perception of EC on complexity, X_7 = CEOs' perception of EC on compatibility, X_8 = information intensity, X_9 = competition intensity, and ε_i = error term.

7. Multivariate Analysis of Variance (MANOVA): For further analysis, MANOVA was used to analyze differences between groups of the nominal variables (e.g., CEOs' gender, education, organizational location, and organizational web site), and the interactions between them on the extent of EC adoption.

Evaluation of Research Methods

The internal validity and external validity were examined to address strengths and weaknesses of the research design. Internal validity is concerned with factors other than the independent variable that affect the dependent variable, whereas external validity is concerned with the extent to which the study results

can be generalized to other groups (Gay & Airasian, 2000). Strengths and weaknesses addressed were as follows:

Strengths

1. This study used quantitative and correlational research methods with regression analysis that has higher internal validity than qualitative research methods.
2. Simple random sampling can represent the accessible population. This probability sampling enhanced the external validity of this study.
3. Higher instrument reliability and validity enhanced the internal validity of this study.
4. Conducting a pilot test improved the validity of the instrument.
5. Using the online survey technique resulted in a good response rate and wide geographical accessibility. This strengthened the ecological validity of this study.
6. Data analysis procedures considered in this study were appropriate to test the research hypotheses and answer the research question of this study. This helped to strengthen the internal validity of the study.

Weaknesses

1. Only two industries were selected in this study. This limitation reduced generalization of this study and was a threat to population validity.

2. Only the CEO of each organization participated and may not represent the actual strategy of organizations. This threatened the internal validity of this study.
3. Using the online survey technique cannot avoid sampling error and response bias.

CHAPTER IV

DATA ANALYSES AND RESULTS

Chapter four presents the procedural details of data analysis and provides the evaluation of the results. This chapter begins with a socio-demographic descriptive analysis that provides a brief summary of profiles of participants and organizations. The next section examines the instrument validation, including reliability analysis and factory analysis. Cronbach's coefficient alpha is employed to measure internal consistency reliability, and exploratory factor analysis is employed to measure construct validity. The purpose of this study is to seek the determinants of EC adoption by SMEs in Taiwan. Hence, the following section examines the correlation between nine factors and four EC adoption variables. Multiple regression analysis is adopted to predict five dependent variables from nine independent variables. The dependent variables of this study are the extent of overall EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking. The independent variables of this study are organizational size, CEOs' attitudes toward EC adoption, CEOs' innovativeness, CEOs' technology knowledge, the CEOs' perceptions of EC on relative advantage, compatibility and complexity, and the intensity of information and competition. The final section uses multivariate analysis of variance (MANOVA) to analyze differences between groups of the nominal variables (e.g., CEOs' gender, organizational location, and organizational web site), and the interactions between them on the extent of EC adoption.

In this study, 1,500 CEOs of Taiwanese SMEs were randomly selected from the database of E-Volunteer (<http://www.e-volunteer.org.tw>) and invited to participate via email on a hyper-link provided to the survey web site. After one month of data collection, 323 questionnaires were returned. However, 104 questionnaires were uncompleted because the organizations had not adopted EC at all. Hence, a total of 219 usable questionnaires were obtained for data analysis. All questionnaires were coded for statistical analysis with the computer software of Statistical Package for Social Sciences (SPSS).

Socio-Demographic Descriptive Analysis

Of 219 respondents, 195 (72.6%) were males and 60 (27.4%) were females. The average age of respondents was 45 years old. The frequency distribution of respondents' age is shown in Table 12 and Figure 3.

Table 12
Frequency of Sample by CEOs' Age

Age	Frequency (F)	Percent (%)
18 ~ 30	1	.5
30 ~ 40	26	11.9
40 ~ 50	78	35.6
50 ~ 60	90	41.1
60 +	24	11.0

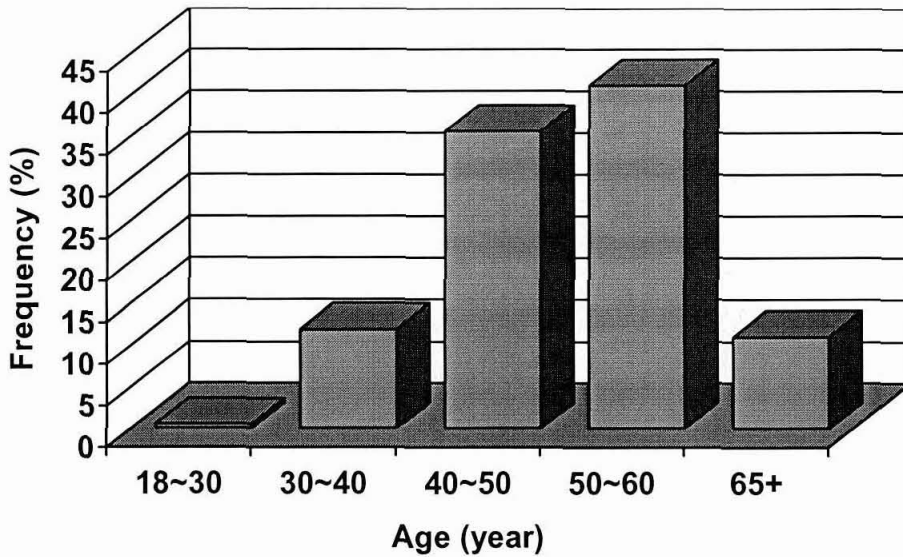


Figure 3. Distribution of sample by CEOs' age.

The result of this study indicated that 79.9% of Taiwanese CEOs of SMEs had graduated from colleges or universities. 57 (26.0%) respondents had a master's degree and 4 (1.8%) respondents had a doctorate degree. Only 2.7% of Taiwanese CEOs of SMEs had less than high school educational level. The frequency distribution of respondents' educational levels is shown in Table 13 and Figure 4.

Table 13

Frequency of Sample by CEOs' Educational Level

Educational Level	Frequency (F)	Percent (%)
Under High School	6	2.7
High School	13	5.9
Associate's Degree	25	11.4
Bachelor's Degree	114	52.1
Master's Degree	57	26.0
Doctorate Degree	4	1.8

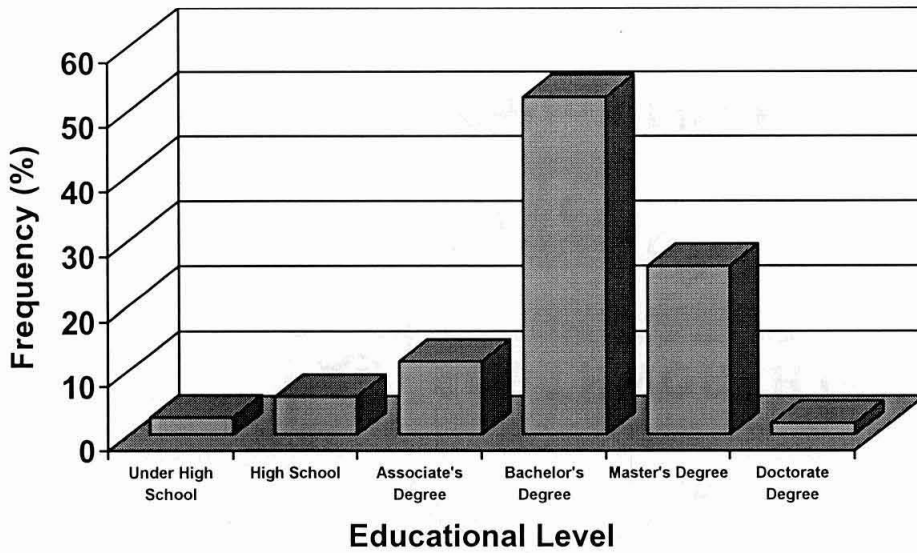


Figure 4. Distribution of sample by CEOs' educational level.

In this study, the average Taiwanese CEOs' length of service was 13 years. Moreover, more than 75% of Taiwanese CEOs had at least 10 years of CEO tenure. The frequency distribution of respondents' CEO tenure is shown in Table 14 and Figure 5.

Table 14

Frequency of Sample by CEOs' Tenure

Tenure (year)	Frequency (F)	Percent (%)
1 ~ 5	10	4.6
6 ~ 10	40	18.3
11 ~ 15	61	27.9
16 ~ 20	68	31.1
21 +	40	18.3

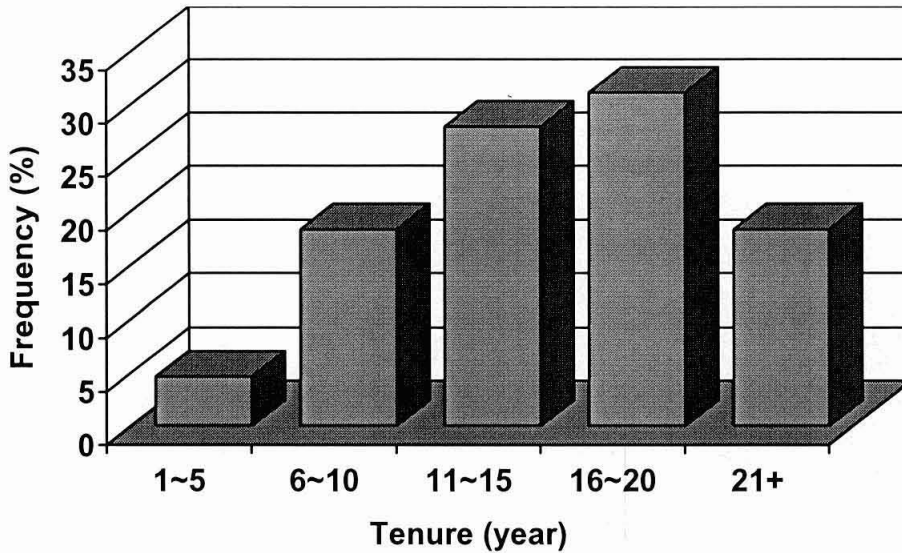


Figure 5. Distribution of sample by CEOs' tenure.

Regarding the organizational profile, the distribution of number of employees produced a polarization (see Figure 6). The result indicated that 20.1% of Taiwanese SMEs had less than 20 employees and over 20% of Taiwanese SMEs had more than 120 employees. The likely explanation is that some organizations maintained fewer employees to gain the advantages of greater flexibility and ability to adapt to change in the market. Some organizations increased their size to gain the advantages of greater capability to support research and development. The frequency distribution of number of employees is shown in Table 15 and Figure 6.

Table 15

Frequency of Sample by Number of Employees

# of Employees	Frequency (F)	Percent (%)
Under 20	44	20.1
20 ~ 40	49	22.4
40 ~ 60	27	12.3
60 ~ 80	26	11.9
80 ~ 100	12	5.5
100 ~ 120	11	5.0
120 ~ 140	22	10.0
140 +	28	12.8



Figure 6. Distribution of sample by number of employees.

Annual sales of organization are another index of organizational size.

Unlike the number of employees, the result of this study indicated that only 11 (5.0%) Taiwanese SMEs had annual sales below 5 million Taiwan dollars (around 170 thousand U.S. dollars). The rest of Taiwanese SMEs (95.0%) were distributed on the average in the range from 5 million to 75 million Taiwan dollars

(around 170 thousand to 2.5 million U.S. dollars). The frequency distribution of organizational annual sales is shown in Table 16 and Figure 7.

To check whether these responses can represent the population of Taiwanese SMEs, nonresponse bias analysis was assessed to examine the difference between the samples of this study and the population of Taiwanese SMEs in terms of annual sales. The population data was provided by Small and Medium Enterprise Administration (2004). The result of *t*-test showed that there was no significant difference between the two groups in terms of annual sales at the significant level of .05 ($t = 0.52, p = 0.743$). Hence, the nonresponse bias was not a problem in this study, and the samples of this study well represented the whole population of Taiwanese SMEs.

Table 16
Frequency of Sample by Annual Sales

Annual Sales (NT\$)	Frequency (F)	Percent (%)
Under 5 million	11	5.0
5 ~ 15 million	40	18.3
15 ~ 25 million	29	13.2
25 ~ 35 million	27	12.3
35 ~ 45 million	32	14.6
45 ~ 55 million	29	13.2
55 ~ 65 million	24	11.0
Above 65 million	27	12.3

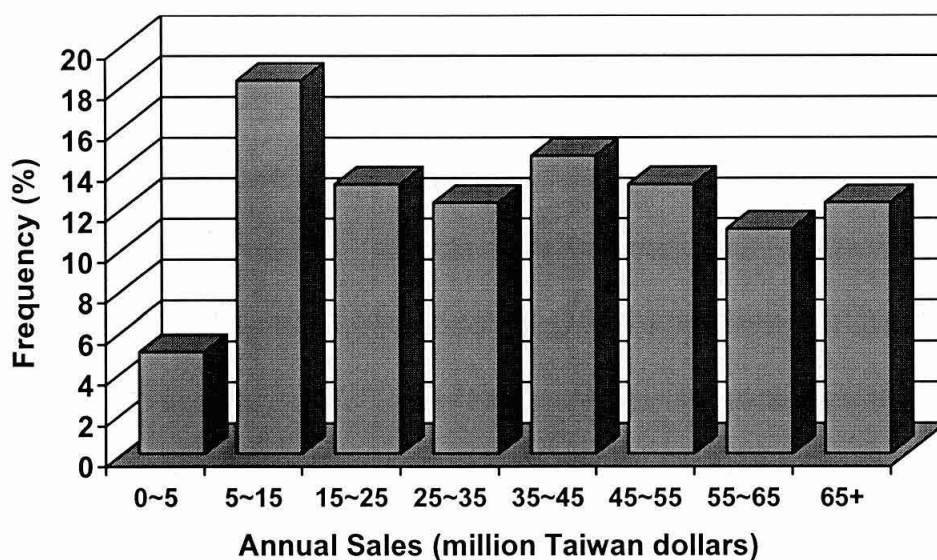


Figure 7. Distribution of sample by annual sales.

In this study, the results indicated around 46% of Taiwanese SMEs located their headquarters in northern Taiwan and around 36% of Taiwanese SMEs were in southern Taiwan, and around 19% of Taiwanese SMEs were located in central Taiwan. There were none in Eastern Taiwan. The frequency distribution of organizational location is shown in Table 17 and Figure 8.

Table 17

Frequency of Sample by Organizational Location

Location	Frequency (F)	Percent (%)
Northern Taiwan	100	45.7
Central Taiwan	41	18.7
Southern Taiwan	78	35.6
Eastern Taiwan	0	0

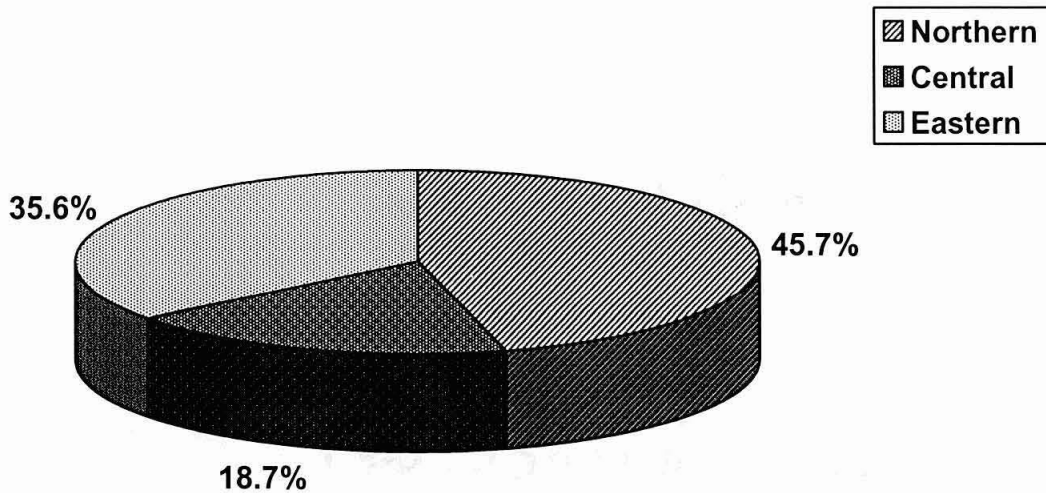


Figure 8. Distribution of sample by organizational location.

The sampled organizations also indicated that 159 (72.6%) Taiwanese SMEs had an organizational web site and 60 (27.4%) Taiwanese SMEs did not. As cross-analysis with organizational location, Table 18 shows the Pearson Chi-Square results and indicated that the proportion of Taiwanese SMEs that had built their own web site showed a significant difference in different areas of Taiwan. ($\chi^2 = 20.771$, $df = 1$, $N = 219$, $p < .001$). Cramer's V was .308, which indicated that the strength of the association was considered to be medium to large, according to Leech, Barrett, and Morgan (2005).

Table 18
Chi-Square Tests and Effect Size

	Value	df	Sig.
Pearson Chi-Square	20.771	2	.000
Cramer's V	.308	–	.000

The results indicated that the organizations located in northern Taiwan were more likely than expected to have a company web site (see 錯誤! 書籤的自

我參照不正確。)。 Northern Taiwan had abundant resources in terms of finance, technology information, and human resource compared to central and southern Taiwan. Hence, this finding indicated that the organizations that established their headquarters in more advanced cities were more willing to build own web sites and may have more technology usage in the organization. Figure 9 summaries the frequency counts in the different locations.

Table 19

Organizational Location x Own Web site Cross-tabulation

Location		Owned Web site		Total
		Yes	No	
Northern	Observed	84	16	100
	Expected	72.6	27.4	100.0
Central	Observed	19	22	41
	Expected	29.8	11.2	41.0
Southern	Observed	56	22	78
	Expected	56.6	21.4	78.0
Total		159	60	219

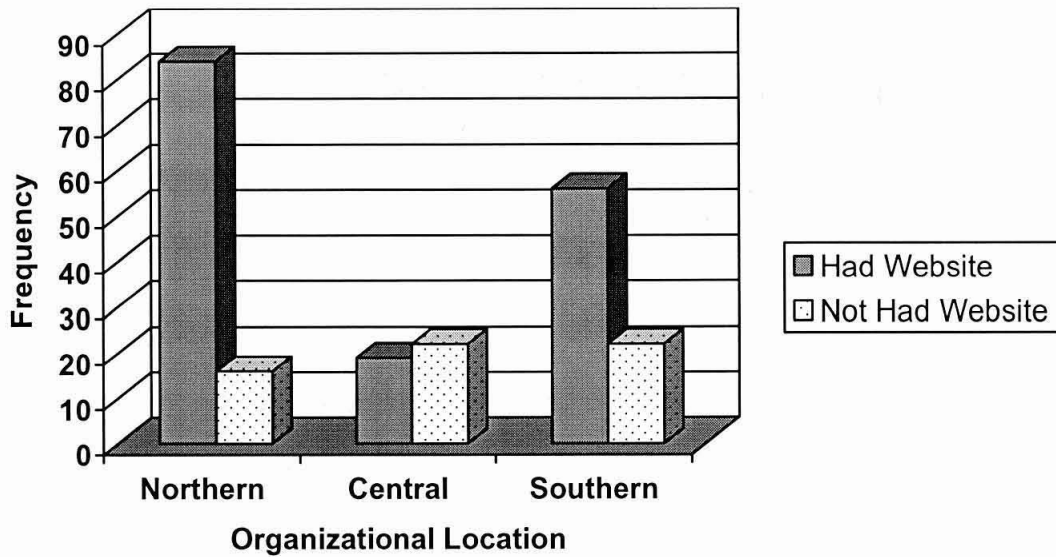


Figure 9. Distribution of sample by organizational location and web site.

Reliability Analysis

Cronbach's coefficient alpha was employed to measure internal consistency reliability based on the mean or average correlation of each item in the scale with every other item. Alpha is typically used when the variables are composed of several Likert scale items. Hence, reliability analysis was used in 10 variables of this study. Each Cronbach's coefficient alpha of variables is shown in the following table.

Table 20

Reliability Statistics

Variables	Items	Cronbach's Alpha (α)
Attitudes toward EC Adoption	4	.960
Relative Advantages	4	.841
Compatibility	3	.792
Complexity	4	.833
Information Intensity	3	.864
Competition Intensity	3	.791
B2B Communications	4	.836
B2B Procurement	4	.923
B2C Communications	6	.891
B2C Order Taking	3	.929

According to Leech, Barrett, and Morgan (2005), Cronbach's alpha should be above .70. Hence, as shown in Table 20, all Cronbach's alpha values were above .7 in this study. The internal consistency reliability of instruments of this study was considered to be sufficient for social science research.

Exploratory Factor Analysis

The original purpose of factor analysis was to examine the associations among variables, based on the correlations between them, to see if there are underlying factors. Since most instruments in this study were adopted from prior research and had been examined by the instrument developer, the factor analysis in this study was used to examine whether the construct of this study was the same as the original set of variables. Moreover, the result of factor analysis represents the construct validity of the instrument of this study.

There were three dimensions of instrument that needed to be examined by factor analysis in this study. They were CEOs' perceptions of EC, environmental factors, and the extent of EC adoption. Each dimension was composed of several constructs or variables. For example, CEOs' perceptions were composed of CEOs' attitudes toward EC adoption, perceptions of EC on relative advantage, compatibility, and complexity; environmental factors were composed of information intensity and competition intensity; and the extent of EC adoption was composed of B2B communications, B2B procurement, B2C communications, and B2C order taking. Each construct was combined with several items that participants needed to answer in the questionnaire. Factor analysis was used to examine if the items hung together by each of these constructs and were consistent with original construct sets.

Kaiser-Meyer-Olkin (KMO) test and Bartlett's test needed to be examined before performing factor analysis. KMO indicates whether or not enough items are predicted by each construct. Bartlett's test indicates whether the items are correlated highly enough to provide a reasonable basis for factor analysis. According to Leech, Barrett, and Morgan (2005), KMO value should be larger than .70 and Bartlett's test should be significant ($p < .05$). As shown in Table 21, all constructs in this study were sufficient for social science research and factor analysis could be performed.

Table 21

KMO and Bartlett's Test

	KMO	Bartlett's Test		
		Value	df	Sig. (<i>p</i>)
CEOs' Perceptions	.856	2608.564	105	.000
Environmental Factors	.763	630.643	15	.000
Extent of EC Adoption	.901	3936.866	136	.000

Principal axis factor analysis was conducted to examine the underlying structure for the 15 items of CEOs' perceptions on EC adoption. Based on the prior research conducted by Seyal and Rahman (2003), the items were designed to be categorized into four constructs: CEOs' attitudes toward EC adoption, and CEOs' perceptions for EC on relative advantage, compatibility, and complexity. Table 22 presents the items and factor loadings for the rotated factors. The results indicated that all factor loadings were larger than .50, which represented acceptable construct validity recommended by Igbaria and Iivari (1995). Moreover, all construct design was consistent with prior research conducted by Seyal and Rahman (2003).

Table 22

Factor Loadings for the CEOs' Perceptions

Item	Factor Loading			
	1	2	3	4
Attitude #1	.896			
Attitude #2	.908			
Attitude #3	.896			
Attitude #4	.909			
Relative Advantage #1		.723		
Relative Advantage #2		.823		
Relative Advantage #3		.776		
Relative Advantage #4		.726		
Compatibility #1			.705	
Compatibility #2			.761	
Compatibility #3			.765	
Complexity #1				.860
Complexity #2				.775
Complexity #3				.678
Complexity #4				.795

For the environmental factors, six items were examined. Based on the prior research conducted by Thong and Yap (1995), the items were designed to be categorized into two constructs: information intensity and competition intensity. Table 23 presents the items and factor loadings for the rotated factors. The results indicated that all factor loadings were larger than .50, which represented acceptable construct validity recommended by Igbaria and livari (1995). Moreover, all construct design was consistent with prior research conducted by Thong and Yap (1995).

Table 23

Factor Loadings for the Environmental Factors

Item	Factor Loading	
	1	2
Information Intensity #1	.866	
Information Intensity #2	.864	
Information Intensity #3	.860	
Competition Intensity #1		.911
Competition Intensity #2		.859
Competition Intensity #3		.688

For the dependent variables, the extent of EC adoption, principal axis factor analysis was conducted to examine the underlying structure for the 17 items. Based on the prior research conducted by Seyal and Rahman (2003), the items were designed to be categorized into four constructs: B2B communications, B2B procurement, B2C communications, and B2C order taking. Table 24 presents the items and factor loadings for the rotated factors. The results indicated that most factor loadings were larger than the cutoff point of .50, except B2C Communications #5, in which factor loadings was only .299. The question of B2C Communications #5 was "Provide after-sales service to our customers (e.g., via online information about installation and troubleshooting)." With further analysis of this item, the results indicated that the frequency distribution produced a polarization that differed from other B2C communication items that produced a normal distribution. Moreover, this item had a high correlation with items of B2C order taking. The likely explanation is that online after-sales services were provided only when the organization provided online order services. Further

research on this issue is needed. In this study, the item of B2C Communications #5 was removed from the construct of B2C Communications.

Table 24

Factor Loadings for the Extent of EC Adoption

Item	Factor Loading			
	1	2	3	4
B2B Communications #1	.685			
B2B Communications #2	.793			
B2B Communications #3	.868			
B2B Communications #4	.655			
B2B Procurement #1		.503		
B2B Procurement #2		.871		
B2B Procurement #3		.886		
B2B Procurement #4		.864		
B2C Communications #1			.547	
B2C Communications #2			.894	
B2C Communications #3			.913	
B2C Communications #4			.581	
B2C Communications #5			.299	
B2C Communications #6			.614	
B2C Order Taking #1				.577
B2C Order Taking #2				.850
B2C Order Taking #3				.862

Extent of EC Adoption Descriptive Analysis

The dependent variables of this study were the extent of EC adoption.

Four major categories of EC businesses were examined in this study. They are:

B2B communications, B2B procurement, B2C communications, and B2C order

taking. The overall extent of EC adoption was the composite score of four categories. According to Leech, Barrett, and Morgan (2005), the values of skewness and kurtosis of variables are measured to present the curve of frequency distribution. They suggested that the variable is approximately normal if the skewness and kurtosis of the variables are less than plus or minus one. As shown in Table 25, most variables were approximately normal, except the activities of B2C order taking. Moreover, the B2C communications had a large negative value on skewness.

Table 25
Descriptive Statistics of the Extent of EC Adoption

	Mean	S.D.	Skewness	Kurtosis
B2B Communications	3.759	.799	-.623	.484
B2B Procurement	3.201	1.069	-.269	-.787
B2C Communications	3.786	0.971	-.964	.281
B2C Order Taking	2.997	1.372	-.019	-1.350
Overall EC	3.436	0.881	.009	-.911

Figure 10 displays the frequency distribution of the extent of EC adoption on B2C order taking and indicated that over 20% of Taiwanese SMEs did not accept online orders and over 25% of Taiwanese SMEs used an online ordering system extensively. This result may possibly indicate that only those Taiwanese SMEs with sufficient resources would consider adopting an online ordering system. Once the system had been processed successfully, the Taiwanese SMEs would use the system extensively.

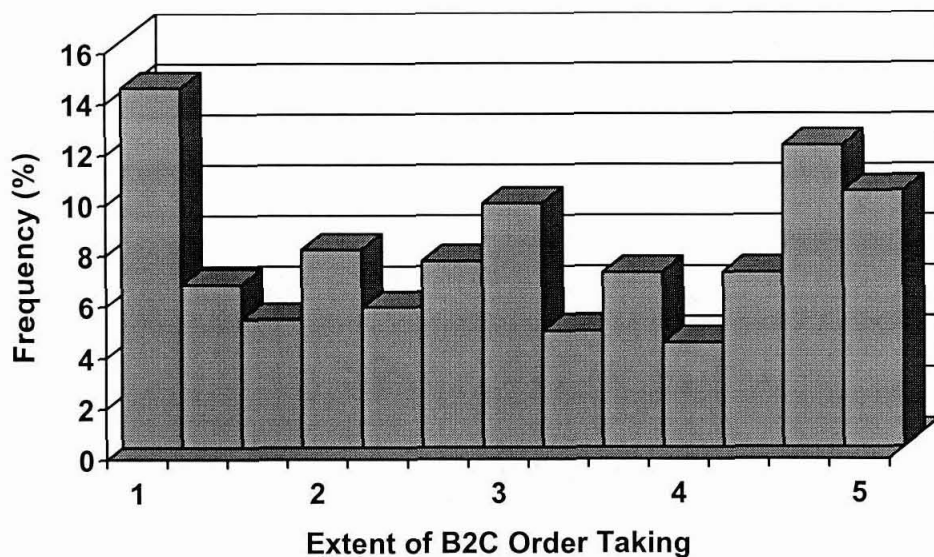


Figure 10. Distribution of sample by the extent of B2C order taking.

Figure 11 displays the frequency distribution of the extent of EC adoption on B2C communications and indicated that over 50% of Taiwanese SMEs frequently used email to contact their customers. It reflected that email as a communication tool was very popular in Taiwan for businesses as well as individuals.

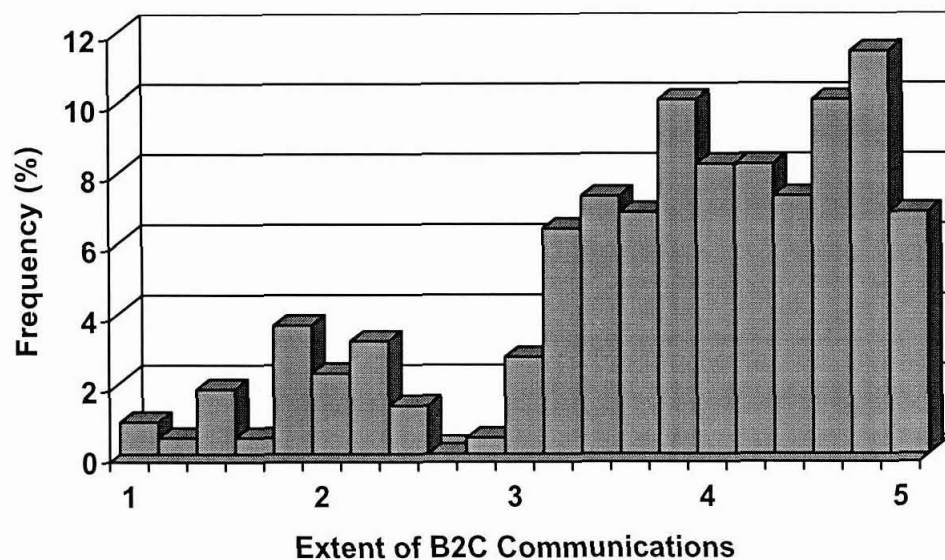


Figure 11. Distribution of sample by the extent of B2C communications.

Pearson and Spearman Correlations

Pearson and Spearman correlations were employed to answer Research Question 1, Research Question 2 and Research Question 3 and test all research hypotheses of this study. When both variables had an approximately normal distribution, the Pearson r correlation that is a parametric statistic was used. On the other hand, when frequency distribution of the variable was not approximately normal, Spearman ρ correlation that is a nonparametric statistic was employed. Before examining the correlation between two variables, the value of skewness of each variable was measured to test the normality of each variable. Leech, Barrett, and Morgan (2005) suggested that the variable is approximately normal if the skewness and kurtosis of variable is less than plus or minus one. For each research hypothesis, the significant level, direction of the effect, and effect sizes will be reported in this study. According to Leech, Barrett, and Morgan (2005), the definitions are as follows:

1. Significant level: If significant level (p) is less than .05, the results are statistically significant or the null hypothesis of no relationship is rejected.
2. Direction of the effect: If the Pearson r or Spearman ρ is negative, that means two variables have a negative relationship. If the Pearson r or Spearman ρ is positive, that means two variables have a positive relationship.
3. Effect sizes: If the absolute value of r or ρ is greater than .70, the strength of relationship is considered very large; If the absolute value

of r or ϕ is between .50 and .70, the strength of relationship is considered large; If the absolute value of r or ϕ is between .30 and .50, the strength of relationship is considered medium; If the absolute value of r or ϕ is between .10 and .30, the strength of relationship is considered small.

Research Question 1: Organizational Factors

The first research question of this study was “What is the association between the organizational factors and the extent of EC adoption.” The organizational factors included organizational size, CEOs’ attitudes toward EC adoption, CEOs’ Innovativeness, and CEOs’ technology knowledge. To answer this research question, four research hypotheses were presented. Correlation analysis was employed to test these research hypotheses. The following sections analyze each research hypothesis in detail.

Research Hypothesis 1: Organizational Size

In this study, the measurement of organizational size was the composite of number of employees and annual sales. The frequency distribution is shown in Figure 12 with a mean score of 4.19, which indicated that the average organizational size of Taiwanese SMEs was 64 employees with annual sales of 27 million Taiwan dollars (around 900 thousand U.S. dollars). The details of descriptive data of organizational size are presented in Table 26.

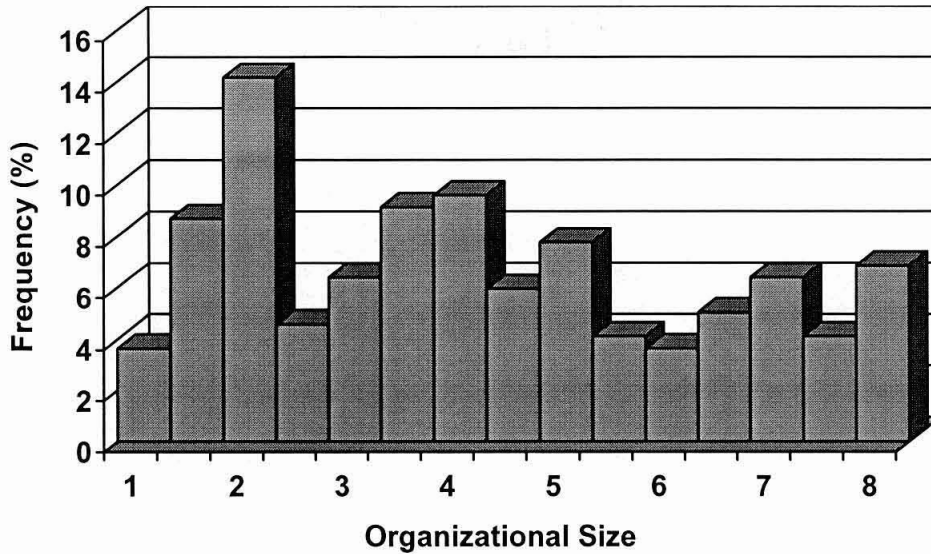


Figure 12. Distribution of sample by organizational size.

Table 26

Descriptive Statistics of Organizational Size

N	Mean	S.D.	Skewness	Kurtosis
219	4.190	2.105	.321	-1.072

Because the absolute value of kurtosis of organizational size was greater 1, Spearman ϕ correlation analysis was employed to examine the association between organizational size and the extent of EC adoption. As shown in Table 27, the correlation coefficient (ϕ) between organizational size and the overall extent of EC adoption was .423, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 1. The strength of the relationship between organizational size and each of the four categories of EC adoption from highest to lowest were as follows:

1. B2B Procurement: The correlation coefficient (φ) between organizational size and the extent of EC adoption on B2B procurement was .393, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 1b.
2. B2C Order Taking: The correlation coefficient (φ) between organizational size and the extent of EC adoption on B2C order taking was .384, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 1d.
3. B2B Communications: The correlation coefficient (φ) between organizational size and the extent of EC adoption on B2B communications was .325, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 1a.
4. B2C Communications: The correlation coefficient (φ) between organizational size and the extent of EC adoption on B2C communications was .300, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 1c.

Table 27

Correlation Analysis of Organizational Size

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.325**	.000	Medium
	Procurement	.393**	.000	Medium
B2C	Communications	.300**	.000	Medium
	Order Taking	.384**	.000	Medium
Overall EC Adoption		.423**	.000	Medium

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 2: CEOs' Attitudes toward EC Adoption

In this study, the measurement of CEOs' attitudes toward EC adoption was the composite of 4 items on the questionnaire. The frequency distribution is shown in Figure 13 with a mean score of 3.4, which indicated that most Taiwanese CEOs of SMEs had positive attitudes toward EC adoption. The details of descriptive data of CEOs' attitudes toward EC adoption are presented in Table 28.

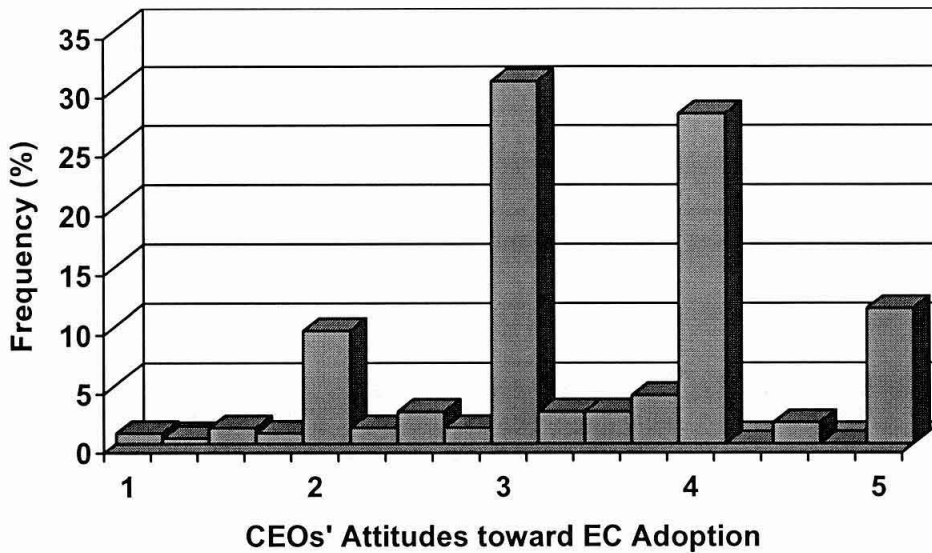


Figure 13. Distribution of sample by CEOs' attitudes toward EC adoption.

Table 28

Descriptive Statistics of Attitudes toward EC Adoption

N	Mean	S.D.	Skewness	Kurtosis
219	3.404	.925	-.116	-.388

Pearson r correlation analysis was employed to examine the association between CEOs' attitudes toward EC adoption and the extent of EC adoption. As shown in Table 29, the correlation coefficient (r) between CEOs' attitudes toward EC adoption and the overall extent of EC adoption was .769, with statistical significance at the significant level of .01. The direction of effect was positive with very large effect size. Hence, the findings supported Hypothesis 2. The strength of the relationship between CEOs' attitudes toward EC adoption and each of the four categories of EC adoption from highest to lowest were as follows:

1. B2C Order Taking: The correlation coefficient (φ) between CEOs' attitudes toward EC adoption and the extent of EC adoption on B2C

order taking was .759, with statistical significance at the significant level of .01. The direction of effect was positive with very large effect size. Hence, the findings supported Hypothesis 2d.

2. B2B Procurement: The correlation coefficient (r) between CEOs' attitudes toward EC adoption and the extent of EC adoption on B2B procurement was .728, with statistical significance at the significant level of .01. The direction of effect was positive with very large effect size. Hence, the findings supported Hypothesis 2b.
3. B2B Communications: The correlation coefficient (r) between CEOs' attitudes toward EC adoption and the extent of EC adoption on B2B communications was .623, with statistical significance at the significant level of .01. The direction of effect was positive with large effect size. Hence, the findings supported Hypothesis 2a.
4. B2C Communications: The correlation coefficient (r) between CEOs' attitudes toward EC adoption and the extent of EC adoption on B2C communications was .404, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 2c.

Table 29

Correlation Analysis of CEOs' Attitudes toward EC Adoption

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.623**	.000	Large
	Procurement	.728**	.000	Very Large
B2C	Communications	.404**	.000	Medium
	Order Taking	.759**	.000	Very Large
Overall EC Adoption		.769**	.000	Very Large

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 3: CEOs' Innovativeness

In this study, the measurement of CEOs' innovativeness was the composite of 20 items on the questionnaire, including 7 reversed items. The frequency distribution is shown in Figure 14. According to Hurt, Joseph, and Cook (1977), scores above 68 are considered highly innovative, and scores below 64 are considered low in innovativeness. In this study, the average score of innovativeness was 62.39, which indicated that the average CEOs of SMEs in Taiwan had lower innovativeness. The details of descriptive data of CEOs' innovativeness are presented in Table 30.

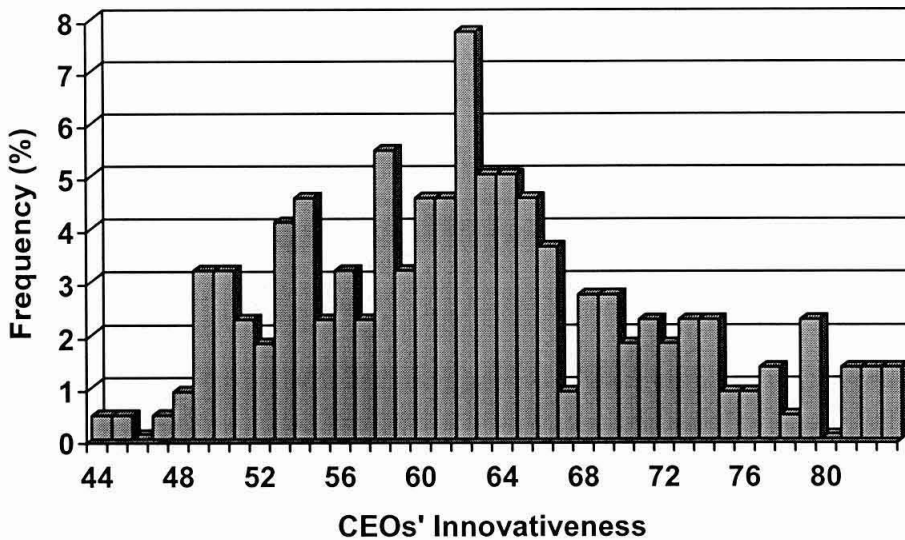


Figure 14. Distribution of sample by CEOs' innovativeness.

Table 30

Descriptive Statistics of CEOs' Innovativeness

N	Mean	S.D.	Skewness	Kurtosis
219	62.39	8.731	.395	-.353

Pearson *r* correlation analysis was employed to examine the association between CEOs' innovativeness and the extent of EC adoption. As shown in Table 31, the association between CEOs' innovativeness and the overall extent of EC was not statistically significant, with $p = .687$. Moreover, the relationships between CEOs' innovativeness and each of the four categories of EC adoption were not statistical significant. Hence, these findings did not support Hypothesis 3 and its sub-hypotheses, Hypothesis 3a to Hypothesis 3d.

Table 31

Correlation Analysis of CEOs' Innovativeness

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.077	.257	-
	Procurement	-.153	.053	-
B2C	Communications	.121	.074	-
	Order Taking	-.072	.291	-
Overall EC Adoption		-.027	.687	-

* correlation is significant at the 0.05 level (2-tailed).
 ** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 4: CEOs' Technology Knowledge

In this study, the measurement of CEOs' technology knowledge was counted by 10 computer skills. The frequency distribution is shown in Figure 15 with a mean score of 5.71. The details of descriptive data of CEOs' technology knowledge are presented in Table 32.

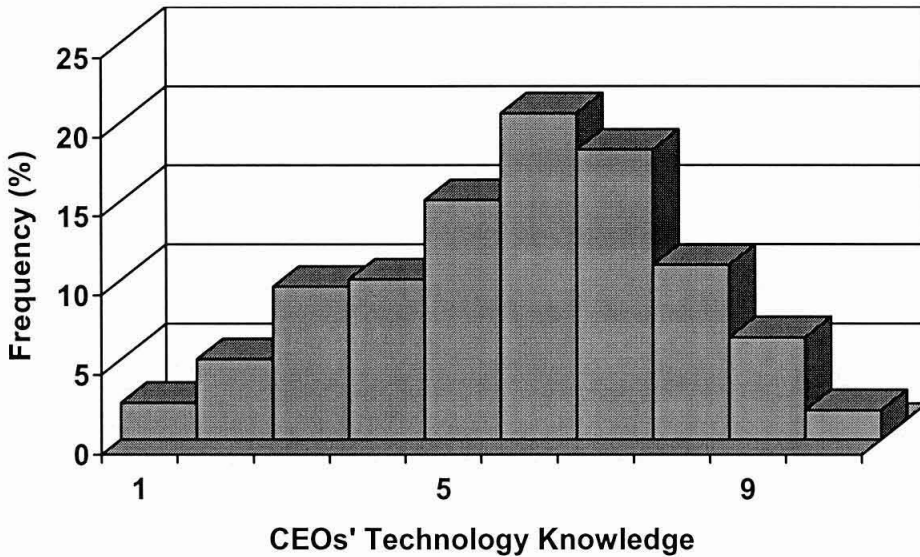


Figure 15. Distribution of sample by CEOs' technology knowledge.

Table 32

Descriptive Statistics of CEOs' Technology Knowledge

N	Mean	S.D.	Skewness	Kurtosis
219	5.71	2.053	-.236	-.482

Pearson *r* correlation analysis was employed to examine the association between CEOs' technology knowledge and the extent of EC adoption. As shown in Table 33, only the association between CEOs' technology knowledge and the extent of EC adoption on B2C communications was statistically significant ($p = .041$) at the significant level of .05. The correlation coefficient (r) was .138, which indicated that CEOs' technology knowledge had a positive relationship with the extent of EC adoption on B2C communications, and the effect size was considered small. Hence, the finding supported only Hypothesis 4c. Hypothesis 4 and the remaining sub-hypotheses of Hypothesis 4 (Hypothesis 4a, Hypothesis 4b, and Hypothesis 4d) were rejected.

Table 33

Correlation Analysis of CEOs' Technology Knowledge

		Correlation <i>r</i> or ϕ	Sig. (p)	Effect Sizes
B2B	Communications	.061	.369	-
	Procurement	.026	.697	-
B2C	Communications	.138*	.041	Small
	Order Taking	.069	.309	-
Overall EC Adoption		.078	.252	-

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Summary for Research Question 1

Among four organizational factors, the results indicated that only two factors, organizational size and CEOs' attitudes toward EC adoption, had positive relationships with the extent of EC adoption. Moreover, between these two factors, the average effect size of CEOs' attitudes toward EC adoption was larger than organizational size. Hence, Hypothesis 1 and Hypothesis 2 and their sub-hypotheses were supported. The factor of CEOs' technology knowledge correlated only with the extent of EC adoption on B2C communications, even though the effect size was small. Thus, only the sub-hypothesis 4c of Hypothesis 4 was supported.

Research Question 2: Technological Factors

The second research question of this study was "What is the association between the technological factors and the extent of EC adoption." The technological factors included CEOs' perceptions of EC on relative advantage, compatibility, and complexity. To answer this research question, three research hypotheses were presented. Correlation analysis was employed to test these research hypotheses. The following sections analyze each research hypothesis in detail.

Research Hypothesis 5: Relative Advantage

In this study, the measurement of CEOs' perception of EC on relative advantage was the composite of four items on the questionnaire. The frequency distribution is shown in Figure 16 with a mean score of 4.024, which indicated that most Taiwanese CEOs of SMEs believed that EC could bring advantages for their

organization on different fields, such as increase of sales, reduction of costs, development of new market, and enhancement of relationship with suppliers. The details of descriptive data of CEOs' perception of EC on relative advantage are presented in Table 34.

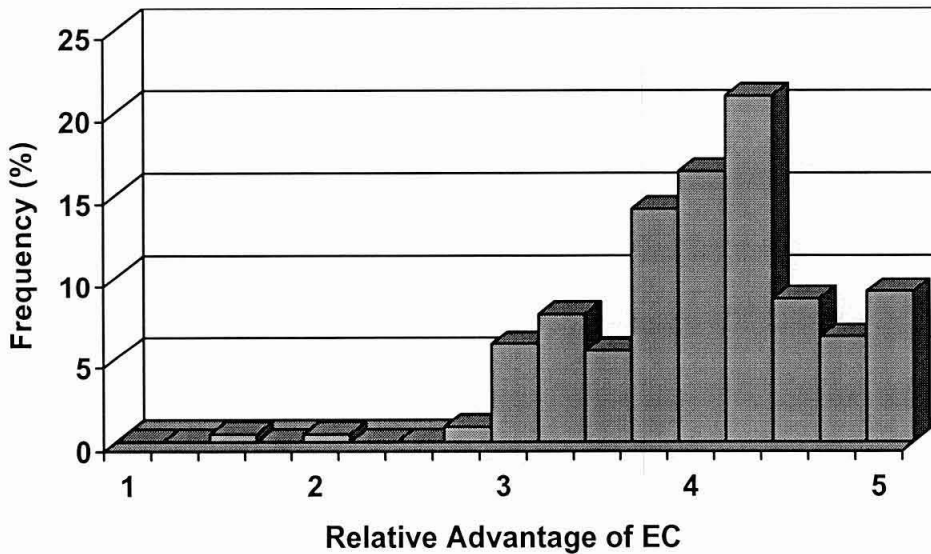


Figure 16. Distribution of sample by relative advantage of EC.

Table 34

Descriptive Statistics of Relative Advantage of EC

N	Mean	S.D.	Skewness	Kurtosis
219	4.024	.601	-.574	.959

Pearson r correlation analysis was employed to examine the association between the CEOs' perception of EC on relative advantage and the extent of EC adoption. As shown in Table 35, the correlation coefficient (r) between the CEOs' perception of EC on relative advantage and the overall extent of EC adoption was .347, with statistical significance at the significant level of .01. The

direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 5. The strength of the relationship between CEOs' perception of EC on relative advantage and each of the four categories of EC adoption from highest to lowest were as follows:

1. B2B Communications: The correlation coefficient (r) between the CEOs' perception of EC on relative advantage and the extent of EC adoption on B2B communications was .420, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 5a.
2. B2C Order Taking: The correlation coefficient (ρ) between the CEOs' perception of EC on relative advantage and the extent of EC adoption on B2C order taking was .288, with statistical significance at the significant level of .01. The direction of effect was positive with small effect size. Hence, the findings supported Hypothesis 5d.
3. B2B Procurement: The correlation coefficient (r) between the CEOs' perception of EC on relative advantage and the extent of EC adoption on B2B procurement was .277, with statistical significance at the significant level of .01. The direction of effect was positive with small effect size. Hence, the findings supported Hypothesis 5b.
4. B2C Communications: The correlation coefficient (r) between the CEOs' perception of EC on relative advantage and the extent of EC adoption on B2C communications was .253, with statistical

significance at the significant level of .01. The direction of effect was positive with small effect size. Hence, the findings supported Hypothesis 5c.

Table 35

Correlation Analysis of Relative Advantage of EC

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.420**	.000	Medium
	Procurement	.277**	.000	Small
B2C	Communications	.253**	.000	Small
	Order Taking	.288**	.000	Small
Overall EC Adoption		.347**	.000	Medium

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 6: Compatibility

In this study, the measurement of CEOs' perception of EC on compatibility was the composite of three items on the questionnaire. The frequency distribution is shown in Figure 17 with a mean score of 4.066, which indicated that most Taiwanese CEOs of SMEs agreed that EC was compatible with their organizations as to experiences, values, beliefs, business needs, and activities. The details of descriptive data of CEOs' perception of EC on compatibility are presented in Table 36.

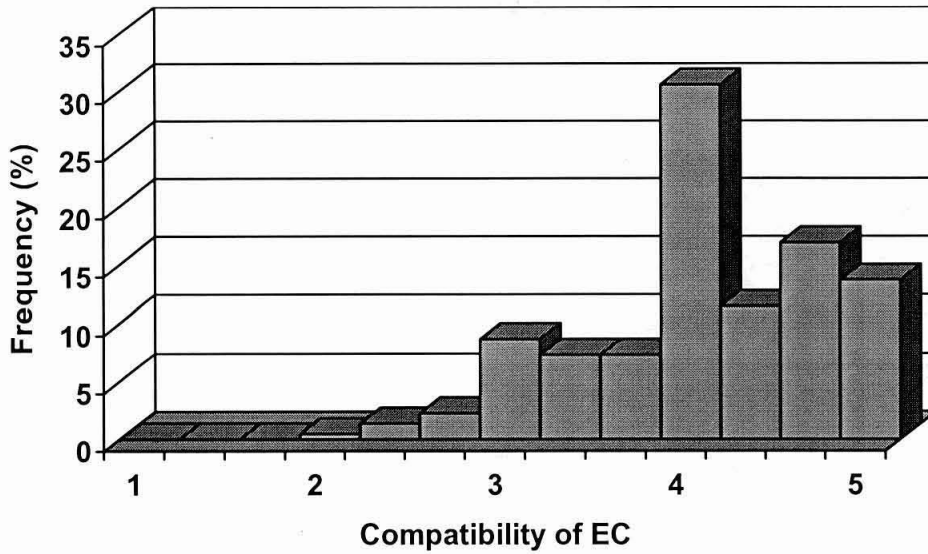


Figure 17. Distribution of sample by compatibility of EC.

Table 36

Descriptive Statistics of Compatibility of EC

N	Mean	S.D.	Skewness	Kurtosis
219	4.066	.668	-.548	-.167

Pearson *r* correlation analysis was employed to examine the association between the CEOs' perception of EC on compatibility and the extent of EC adoption. As shown in Table 37, the correlation coefficient (*r*) between the CEOs' perception of EC on compatibility and the overall extent of EC adoption was .518, with statistical significance at the significant level of .01. The direction of effect was positive with large effect size. Hence, the findings supported Hypothesis 6. The strength of the relationship between CEOs' perception of EC on compatibility and each of the four categories of EC adoption from highest to lowest were as follows:

1. B2C Order Taking: The correlation coefficient (ϕ) between the CEOs' perception of EC on compatibility and the extent of EC adoption on B2C order taking was .518, with statistical significance at the significant level of .01. The direction of effect was positive with large effect size. Hence, the findings supported Hypothesis 6d.
2. B2B Communications: The correlation coefficient (r) between the CEOs' perception of EC on compatibility and the extent of EC adoption on B2B communications was .462, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 6a.
3. B2B Procurement: The correlation coefficient (r) between the CEOs' perception of EC on compatibility and the extent of EC adoption on B2B procurement was .432, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 6b.
4. B2C Communications: The correlation coefficient (r) between the CEOs' perception of EC on compatibility and the extent of EC adoption on B2C communications was .336, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 6c.

Table 37

Correlation Analysis of Compatibility of EC

		Correlation <i>r</i> or φ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.462**	.000	Medium
	Procurement	.432**	.000	Medium
B2C	Communications	.336**	.000	Medium
	Order Taking	.518**	.000	Large
Overall EC Adoption		.518**	.000	Large

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 7: Complexity

In this study, the measurement of CEOs' perception of EC on complexity was the composite of four items on the questionnaire. The frequency distribution is shown in Figure 18 with a mean score of 3.259. Unlike other technological factors, around 50% of Taiwanese CEOs were neutral on the perception of EC on complexity, which indicated that even though the organizations had adopted EC, they did not perceive any complexity of EC. The details of descriptive data of CEOs' perception of EC on complexity are presented in Table 38.

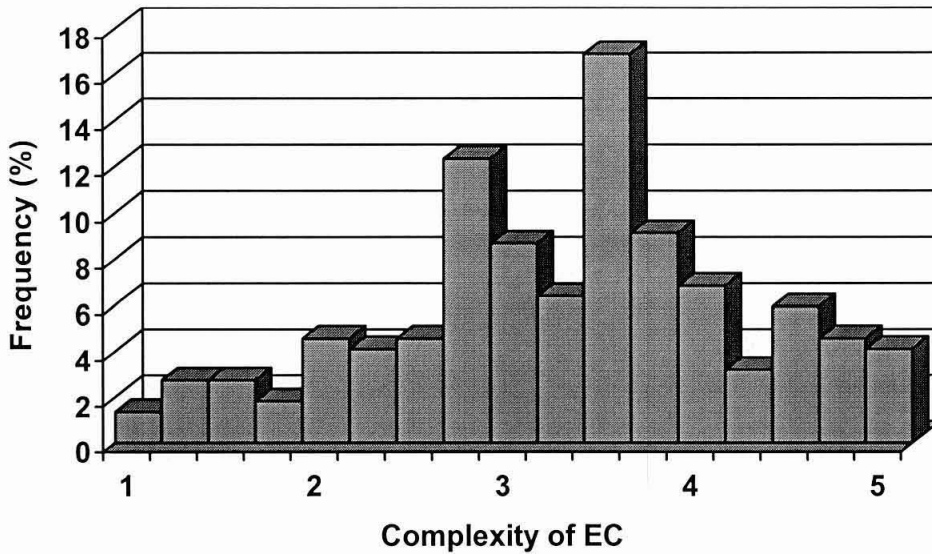


Figure 18. Distribution of sample by complexity of EC.

Table 38

Descriptive Statistics of Complexity of EC

N	Mean	S.D.	Skewness	Kurtosis
219	3.259	.953	-.246	-.356

Pearson *r* correlation analysis was employed to examine the association between the CEOs' perception of EC on complexity and the extent of EC adoption. As shown in Table 39, although complexity was the only factor that hypothesized a negative relationship with the extent of EC adoption, the results showed that the association between the CEOs' perception of EC on complexity and the overall extent of EC adoption was not statistically significant, with $p = .601$. Moreover, the relationships between the CEOs' perception of EC on complexity and each of the four categories of EC adoption were not statistically significant. Hence, these findings did not support Hypothesis 7 and its sub-hypotheses, Hypothesis 7a to Hypothesis 7d.

Table 39

Correlation Analysis of Complexity of EC

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	-.012	.858	-
	Procurement	.027	.686	-
B2C	Communications	-.021	.761	-
	Order Taking	.092	.177	-
Overall EC Adoption		.036	.601	-

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Summary for Research Question 2

Among three technological factors, the results indicated that only two factors, CEOs' perceptions of EC on relative advantage and compatibility, had positive relationships with the extent of EC adoption. Moreover, between these two factors, the average effect size of compatibility was larger than that of relative advantage. Hence, Hypothesis 5 and Hypothesis 6 and their sub-hypotheses were supported. The factor of complexity did not correlate with the extent of EC adoption. Thus, Hypothesis 7 and the sub-hypotheses of Hypothesis 7 (Hypothesis 7a through Hypothesis 7d) were rejected.

Research Question 3: Environmental Factors

The third research question of this study was "What is the association between the environmental factors and the extent of EC adoption." The environmental factors included information intensity and competition intensity. To answer this research question, two research hypotheses were presented.

Correlation analysis was employed to test these research hypotheses. The following sections analyze each research hypothesis in detail.

Research Hypothesis 8: Information Intensity

In this study, the measurement of information intensity was the composite of three items on the questionnaire. The frequency distribution is shown in Figure 19, with a mean score of 3.944. The frequency distribution indicated that most Taiwanese CEOs believed that their organizations were in an industry of high information intensity, which meant that the organizations needed up-to-date, reliable, and accurate information any time. The details of descriptive data of information intensity are presented in Table 40.

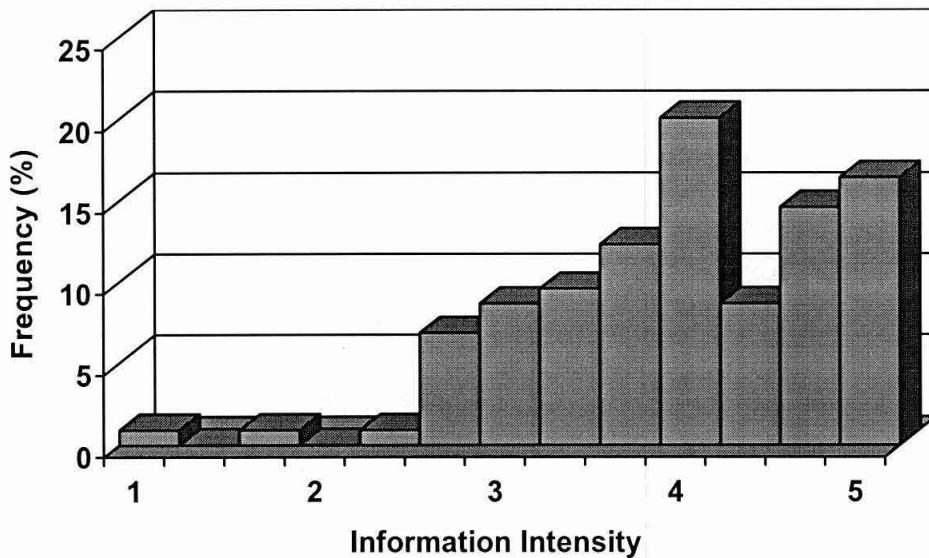


Figure 19. Distribution of sample by information intensity.

Table 40

Descriptive Statistics of Information Intensity

N	Mean	S.D.	Skewness	Kurtosis
219	3.944	.813	-.688	.514

Pearson r correlation analysis was employed to examine the association between the information intensity and the extent of EC adoption. As shown in Table 41, the correlation coefficient (r) between the information intensity and the overall extent of EC adoption was .532, with statistical significance at the significant level of .01. The direction of effect was positive with large effect size. Hence, the findings supported Hypothesis 8. The strength of the relationship between information intensity and each of the four categories of EC adoption from highest to lowest were as follows:

1. B2B Communications: The correlation coefficient (r) between the information intensity and the extent of EC adoption on B2B communications was .564, with statistical significance at the significant level of .01. The direction of effect was positive with large effect size. Hence, the findings supported Hypothesis 8a.
2. B2C Order Taking: The correlation coefficient (ϕ) between the information intensity and the extent of EC adoption on B2C order taking was .479, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 8d.
3. B2B Procurement: The correlation coefficient (r) between the information intensity and the extent of EC adoption on B2B

procurement was .421, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 8b.

4. B2C Communications: The correlation coefficient (r) between the information intensity and the extent of EC adoption on B2C communications was .402, with statistical significance at the significant level of .01. The direction of effect was positive with medium effect size. Hence, the findings supported Hypothesis 8c.

Table 41

Correlation Analysis of Information Intensity

		Correlation r or ϕ	Sig. (p)	Effect Sizes
B2B	Communications	.564**	.000	Large
	Procurement	.421**	.000	Medium
B2C	Communications	.402**	.000	Medium
	Order Taking	.479**	.000	Medium
Overall EC Adoption		.532**	.000	Large

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Research Hypothesis 9: Competition Intensity

In this study, the measurement of competition intensity was the composite of three items on the questionnaire. The frequency distribution is shown in Figure 20 with a mean score of 4.116. Just as with the information intensity, the frequency distribution also indicated that most Taiwanese CEOs believed that their organizations were in an industry of high competition intensity, which meant

that the organizations had intense rivals in the same industry. The details of descriptive data of competition intensity are presented in Table 42.

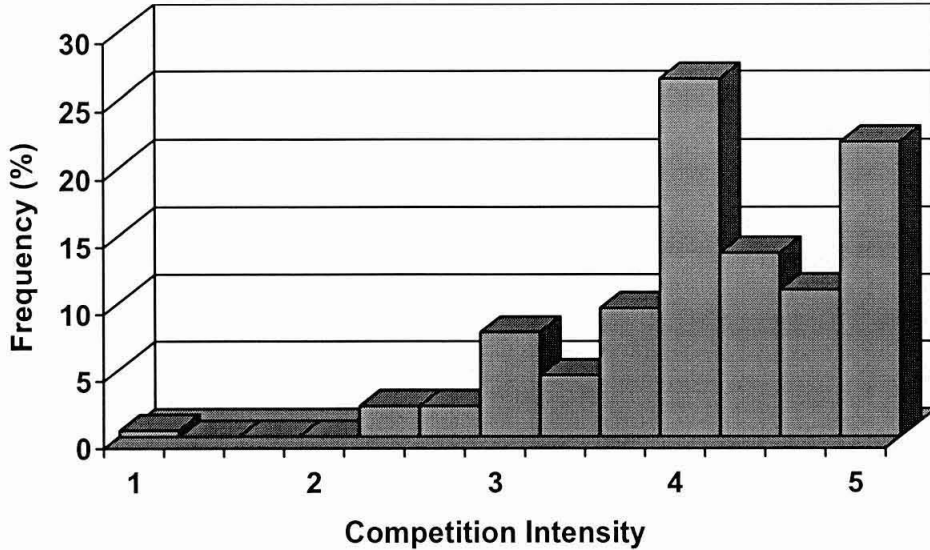


Figure 20. Distribution of sample by competition intensity.

Table 42

Descriptive Statistics of Competition Intensity

N	Mean	S.D.	Skewness	Kurtosis
219	4.116	.725	-.809	.869

Pearson r correlation analysis was employed to examine the association between the competition intensity and the extent of EC adoption. As shown in Table 43, only the association between the competition intensity and the extent of EC on B2B communications was statistically significant at the significant level of .01. The correlation coefficient (r) was .238, which indicated that the competition intensity had a positive relationship with the extent of EC adoption on B2B communications, and the effect size was considered small. Hence, the

finding supported only Hypothesis 9a. Hypothesis 9 and the remaining sub-hypotheses of Hypothesis 9 (Hypothesis 9b, Hypothesis 9c, and Hypothesis 9d) were rejected.

Table 43
Correlation Analysis of Competition Intensity

		Correlation <i>r</i> or ϕ	Sig. (<i>p</i>)	Effect Sizes
B2B	Communications	.238**	.000	Small
	Procurement	-.030	.658	-
B2C	Communications	.027	.696	-
	Order Taking	-.009	.891	-
Overall EC Adoption		.031	.644	-

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

Summary for Research Question 3

Between two environmental factors, the results indicated that only the information intensity had a positive relationship with the extent of EC adoption. The factor of the competition intensity correlated only with the extent of EC adoption on B2B communications, even though the effect size was small. Hence, Hypothesis 8 and its sub-hypotheses, and Hypothesis 9a were supported.

Multiple Regression Analysis

The purpose of multiple regression analysis is to predict a dependent variable from a combination of several independent variables. Furthermore, multiple regression analysis can provide the possible multiple correlations of these variables with the dependent variables from highest or lowest. The

method of simultaneous regression, which considers all the variables at the same time, was employed in this study to answer Research Question 4, and sub-questions (Research Question 4a to Research Question 4d). For each research question, the significance of the regression model, R^2 value, unstandardized coefficients, and standardized coefficients are reported in this study. According to Leech, Barrett, and Morgan (2005), the definitions are as follows:

1. Significance of the regression model: ANOVA analysis was employed to test the significance of the regression model. If significant level (p) is less than .05, the results indicated that the combination of the independent variables significantly predicted the dependent variables.
2. R^2 value: This value varied from 0.0 to 1.0 and indicated that the percentage of the variance could be predicted from the combination of the independent variables. According to Leech, Barrett, and Morgan (2005), if the R^2 value is greater than .49, the strength of relationship is considered very large; If the R^2 value is between .26 and .49, the strength of relationship is considered large; If the R^2 value is between .13 and .49, the strength of relationship is considered medium; If the R^2 value is between .02 and .13, the strength of relationship is considered small.
3. Unstandardized coefficients (B): The coefficient of the independent variables in the regression equation.

4. Standardized coefficients (β): The average amount the dependent variables increases when the independent variable increases by one standard deviation. This value varied from -1.0 to 1.0. If the value is negative, that means the independent variable has a negative relationship with the dependent variable. If the value is positive, that means the independent variable has a positive relationship with the dependent variable. This value also indicates the weight of each independent variable on influencing the dependent variable.

Research Question 4: Overall EC Adoption

Research Question 4 was “What factors can predict the overall extent of EC adoption from a combination of organizational factors, technological factors and environmental factors.” The correlation analysis of the overall extent of EC adoption is summarized in Table 44. The results indicated that five factors had influenced the extent of overall EC adoption. Hence, the independent variables for multiple regression analysis were organizational size, CEOs’ attitudes toward EC adoption, CEOs’ perceptions of EC on relative advantage and compatibility, and information intensity. The dependent variable was the extent of overall EC adoption in this research question.

Table 44

Correlation Analysis of Overall EC Adoption

	Correlation	Sig. (p)
Organizational Size	.423**	.000
Attitudes toward EC Adoption	.769**	.000
CEOs' Innovativeness	-.027	.687
CEOs' Technology Knowledge	.078	.252
Relative Advantage of EC	.347**	.000
Compatibility of EC	.518**	.000
Complexity of EC	.036	.601
Information Intensity	.532**	.000
Competition Intensity	.031	.644

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

As shown in Table 45, the results of multiple regression analysis indicated that the combination of five variables significantly predicted the extent of overall EC adoption, $F(5,206) = 95.73$, $p < .001$. The R^2 value was .69, which meant that 69% of the variance in the extent of overall EC adoption was explained by this model. Moreover, according to Leech, Barrett, and Morgan (2005), the effect size of this model was very large.

Table 45

Multiple Regression Analysis of Overall EC Adoption

F	df	Residual df	Sig. (p)	R²
95.727	5	206	.000	.692

The B values that are shown in Table 46 were the coefficient of each independent variable in the regression model. The prediction model of the extent of overall EC adoption was:

The Extent of Overall EC Adoption

$$\begin{aligned} &= -0.535 + 0.077 \text{ Organizational Size} + 0.553 \text{ Attitudes} \\ &+ 0.105 \text{ Relative Advantage} + 0.151 \text{ Compatibility} \\ &+ 0.185 \text{ Information Intensity} \end{aligned}$$

As shown in Table 46, the β weight indicated the contribution that an individual factor makes to the model. The factors of β weight from highest to lowest were CEOs' attitudes toward EC adoption, organizational size, information intensity and CEOs' perception of EC on compatibility. The factor of CEOs' perception of EC on relative advantage did not significantly contribute to the model for predicting the extent of overall EC adoption from the whole set of predictors. All of these factors had a positive influence on the extent of overall EC adoption prediction.

Table 46

Multiple Regression Coefficients of Overall EC Adoption

	<i>B</i>	<i>Std. Er.</i>	β	<i>t</i>	<i>Sig. (p)</i>
(Constant)	-.535	.265			
Organizational Size	.077	.017	.183**	4.505	.000
Attitudes toward EC	.553	.045	.578**	12.346	.000
Relative Advantage	.105	.066	.071	1.585	.115
Compatibility	.151	.063	.113*	2.387	.018
Information Intensity	.185	.050	.172**	3.689	.000

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

Research Question 4a: B2B Communications

The Research Question 4a was "What factors can predict the extent of EC adoption on B2B communications from a combination of organizational factors,

technological factors and environmental factors.” The correlation analysis of the extent of EC adoption on B2B communications is summarized in Table 47. The results indicated that six factors had influenced the extent of EC adoption on B2B communications. Hence, the independent variables for multiple regression analysis were organizational size, CEOs’ attitudes toward EC adoption, CEOs’ perceptions of EC on relative advantage and compatibility, information intensity, and competition intensity. The dependent variable was the extent of EC adoption on B2B communications in this research question.

Table 47
Correlation Analysis of B2B Communications

	Correlation	Sig. (p)
Organizational Size	.325**	.000
Attitudes toward EC Adoption	.623**	.000
CEOs’ Innovativeness	.077	.257
CEOs’ Technology Knowledge	.061	.369
Relative Advantage of EC	.420**	.000
Compatibility of EC	.462**	.000
Complexity of EC	-.012	.858
Information Intensity	.564**	.000
Competition Intensity	.238**	.000

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

As shown in Table 48, the results of multiple regression analysis indicated that the combination of six variables significantly predicted the extent of EC adoption on B2B communication, $F(6,205) = 47.03, p < .001$. The R^2 value was .57, which meant that 57% of the variance in the extent of EC adoption on

B2B communications was explained by this model. Moreover, according to Leech, Barrett, and Morgan (2005), the effect size of this model was very large.

Table 48

Multiple Regression Analysis of B2B Communications

<i>F</i>	<i>df</i>	<i>Residual df</i>	<i>Sig. (p)</i>	<i>R²</i>
47.029	6	205	.000	.567

As shown in Table 55, the prediction model of the extent of EC adoption on B2B communications was:

$$\begin{aligned}
 & \textit{The Extent of EC adoption on B2B Communications} \\
 & = -0.594 + 0.024 \textit{ Organizational Size} + 0.395 \textit{ Attitudes} \\
 & + 0.216 \textit{ Relative Advantage} + 0.126 \textit{ Compatibility} \\
 & + 0.193 \textit{ Information Intensity} + 0.184 \textit{ Competition Intensity}
 \end{aligned}$$

The factors of β weight from highest to lowest were CEOs' attitudes toward EC adoption, information intensity, competition intensity and CEOs' perception of EC on relative advantage. The factors of organizational size and CEOs' perception on compatibility of EC did not significantly contribute to the model for predicting the extent of EC adoption on B2B communications from the whole set of predictors. All of these factors had a positive influence on the extent of EC adoption on B2B communications prediction.

Table 49

Multiple Regression Coefficients of B2B Communications

	<i>B</i>	Std. Er.	β	<i>t</i>	Sig. (<i>p</i>)
(Constant)	-.594	.335			
Organizational Size	.024	.018	.063	1.304	.194
Attitudes toward EC	.395	.049	.455**	8.112	.000
Relative Advantage	.216	.071	.161**	3.025	.003
Compatibility	.126	.068	.103	1.834	.068
Information Intensity	.193	.057	.197**	3.362	.001
Competition Intensity	.184	.054	.168**	3.440	.001

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

Research Question 4b: B2B Procurement

The Research Question 4b was “What factors can predict the extent of EC adoption on B2B procurement from a combination of organizational factors, technological factors and environmental factors.” The correlation analysis of the extent of EC adoption on B2B procurement is summarized in Table 50. The results indicated that five factors had influenced on the extent of EC adoption on B2B procurement. Hence, the independent variables for multiple regression analysis were organizational size, CEOs’ attitudes toward EC adoption, CEOs’ perceptions of EC on relative advantage and compatibility, and information intensity. The dependent variable was the extent of EC adoption on B2B procurement in this research question.

Table 50

Correlation Analysis of B2B Procurement

	Correlation	Sig. (<i>p</i>)
Organizational Size	.393**	.000
Attitudes toward EC Adoption	.728**	.000
CEOs' Innovativeness	-.153	.053
CEOs' Technology Knowledge	.026	.697
Relative Advantage of EC	.277**	.000
Compatibility of EC	.432**	.000
Complexity of EC	.027	.686
Information Intensity	.421**	.000
Competition Intensity	-.030	.658

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

As shown in Table 51, the results of multiple regression analysis indicated that the combination of five variables significantly predicted the extent of EC adoption on B2B procurement, $F(5,206) = 58.89, p < .001$. The R^2 value was .58, which meant that 58% of the variance in the extent of EC adoption on B2B procurement was explained by this model. Moreover, according to Leech, Barrett, and Morgan (2005), the effect size of this model was very large.

Table 51

Multiple Regression Analysis of B2B Procurement

<i>F</i>	<i>df</i>	Residual <i>df</i>	Sig. (<i>p</i>)	R^2
58.889	5	206	.000	.578

As shown in Table 52, the prediction model of the extent of EC adoption on B2B procurement was:

The Extent of EC Adoption on B2B Procurement

= -0.783 + 0.092 *Organizational Size* + 0.688 *Attitudes*

+ 0.095 *Relative Advantage* + 0.118 *Compatibility*

+ 0.101 *Information Intensity*

Only two factors had statistical significance on predicting the extent of EC adoption on B2B procurement from the whole set of predictors. The largest influence on predicting the extent of EC adoption on B2B procurement was the CEOs' attitudes toward EC adoption, with β weight of .599, and next largest was organizational size, with β weight of .183. Both factors had a positive influence on the extent of EC adoption on B2B procurement prediction. The factors of CEOs' perceptions of EC on relative advantage and compatibility, and information intensity did not significantly contribute to the model for predicting the extent of EC adoption on B2B procurement from the whole set of predictors.

Table 52

Multiple Regression Coefficients of B2B Procurement

	B	Std. Er.	β	t	Sig. (p)
(Constant)	-.783	.372			
Organizational Size	.092	.024	.183**	3.863	.000
Attitudes toward EC	.688	.063	.599**	10.942	.000
Relative Advantage	.095	.093	.054	1.023	.307
Compatibility	.118	.089	.074	1.330	.185
Information Intensity	.101	.071	.078	1.429	.155

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

Research Question 4c: B2C Communications

Research Question 4c was “What factors can predict the extent of EC adoption on B2C communications from a combination of organizational factors, technological factors, and environmental factors.” The correlation analysis of the extent of EC adoption on B2C communications is summarized in Table 53. The results indicated that six factors had influenced the extent of EC adoption on B2C communications. Hence, the independent variables for multiple regression analysis were organizational size, CEOs’ attitudes toward EC adoption, CEOs’ technology knowledge, CEOs’ perceptions of EC on relative advantage and compatibility, and information intensity. The dependent variable was the extent of EC adoption on B2C communications in this research question.

Table 53

Correlation Analysis of B2C Communication

	Correlation	Sig. (p)
Organizational Size	.300**	.000
Attitudes toward EC Adoption	.404**	.000
CEOs’ Innovativeness	.121	.074
CEOs’ Technology Knowledge	.138*	.041
Relative Advantage of EC	.253**	.000
Compatibility of EC	.336**	.000
Complexity of EC	-.021	.761
Information Intensity	.402**	.000
Competition Intensity	.027	.696

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

As shown in Table 54, the results of multiple regression analysis indicated that the combination of six variables significantly predicted the extent of EC

adoption on B2C communications, $F(6,205) = 13.21, p < .001$. The R^2 value was .29, which meant that 29% of the variance in the extent of EC adoption on B2C communications was explained by this model. Moreover, according to Leech, Barrett, and Morgan (2005), the effect size of this model was large.

Table 54

Multiple Regression Analysis of B2C Communications

<i>F</i>	<i>df</i>	<i>Residual df</i>	<i>Sig. (p)</i>	<i>R²</i>
13.206	6	205	.000	.258

As shown in Table 55, the prediction model of the extent of EC adoption on B2C communications was:

$$\begin{aligned}
 & \textit{The Extent of EC Adoption on B2C Communications} \\
 & = 0.849 + 0.085 \textit{ Organizational Size} + 0.238 \textit{ Attitudes} \\
 & + .001 \textit{ Technology Knowledge} + 0.078 \textit{ Relative Advantage} \\
 & + 0.108 \textit{ Compatibility} + 0.256 \textit{ Information Intensity}
 \end{aligned}$$

The results indicated that three factors had statistical significance on predicting the extent of EC adoption on B2C communications from the whole set of predictors. The factors of β weight from highest to lowest were CEOs' attitudes toward EC adoption, information intensity, and organizational size. These factors had a positive influence on the extent of EC adoption on B2C communications prediction. The factors of CEOs' technology knowledge and CEOs' perceptions of EC on relative advantage and compatibility did not significantly contribute to the model for predicting the extent of EC adoption on B2C communications from the whole set of predictors.

Table 55

Multiple Regression Coefficients of B2C Communications

	<i>B</i>	Std. Er.	β	<i>t</i>	Sig. (<i>p</i>)
(Constant)	.849	.480			
Organizational Size	.085	.029	.184**	2.915	.004
Attitudes toward EC	.238	.077	.226**	3.105	.002
Technology Knowledge	.001	.030	.003	.049	.961
Relative Advantage	.078	.114	.048	.685	.494
Compatibility	.108	.109	.073	.992	.323
Information Intensity	.256	.090	.216**	2.860	.005

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

Research Question 4d: B2C Order Taking

Research Question 4d was “What factors can predict the extent of EC adoption on B2C order taking from a combination of organizational factors, technological factors, and environmental factors.” The correlation analysis of the extent of EC adoption on B2C order taking is summarized in Table 56. The results indicated that five factors had influenced the extent of EC adoption on B2C order taking. Hence, the independent variables for multiple regression analysis were organizational size, CEOs’ attitudes toward EC adoption, CEOs’ perceptions of EC on relative advantage and compatibility, and information intensity. The dependent variable was the extent of EC adoption on B2C order taking in this research question.

Table 56

Correlation Analysis of B2C Order Taking

	Correlation	Sig. (<i>p</i>)
Organizational Size	.384**	.000
Attitude toward EC Adoption	.759**	.000
CEOs' Innovativeness	-.072	.687
CEOs' Technology Knowledge	.069	.309
Relative Advantage of EC	.288**	.000
Compatibility of EC	.518**	.000
Complexity of EC	.092	.177
Information Intensity	.479**	.000
Competition Intensity	-.009	.891

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).

As shown in Table 57, the results of multiple regression analysis indicated that the combination of five variables significantly predicted the extent of EC adoption on B2C order taking, $F(5,206) = 63.40$, $p < .001$. The R^2 value was .62, which meant that 62% of the variance in the extent of EC adoption on B2C order taking was explained by this model. Moreover, according to Leech, Barrett, and Morgan (2005), the effect size of this model was very large.

Table 57

Multiple Regression Analysis of B2C Order Taking

<i>F</i>	<i>df</i>	Residual <i>df</i>	Sig. (<i>p</i>)	R^2
69.398	5	206	.000	.618

As shown in Table 58, the prediction model of the extent of EC adoption on B2C order taking adoption was:

$$\begin{aligned}
 & \textit{The Extent of EC Adoption on B2C Order Taking} \\
 & = -2.223 + 0.107 \textit{ Organizational Size} + 0.914 \textit{ Attitudes} \\
 & + .0.019 \textit{ Relative Advantage} + 0.271 \textit{ Compatibility} \\
 & + 0.125 \textit{ Information Intensity}
 \end{aligned}$$

The results indicate that three factors had statistical significance on predicting the extent of EC adoption on B2C order taking from the whole set of predictors. The factors of β weight from highest to lowest were CEOs' attitudes toward EC adoption, organizational size, and CEOs' perception of EC on compatibility. These factors had a positive influence on the extent of EC adoption on B2C order taking prediction. The factors of CEOs' perception on the relative advantage of EC and information did not significantly contribute to the model for predicting the extent of EC adoption on B2C order taking from the whole set of predictors.

Table 58
Multiple Regression Coefficients of B2C Order Taking

	<i>B</i>	<i>Std. Er.</i>	β	<i>t</i>	<i>Sig. (p)</i>
(Constant)	-2.223	.457			
Organizational Size	.107	.029	.165**	3.652	.000
Attitudes toward EC	.914	.077	.617**	11.833	.000
Relative Advantage	.019	.114	.008	.163	.871
Compatibility	.271	.109	.131*	2.474	.014
Information Intensity	.125	.087	.075	1.444	.150

* significant at the 0.05 level (2-tailed).
 ** significant at the 0.01 level (2-tailed).

Socio-Demographic Correlation and MANOVA Analysis

Bivariate Pearson correlation was employed to examine the relationship between the extent of EC adoption and CEOs' profiles, including CEOs' age, education level, and tenure. As shown in Table 59, the CEOs' age had a statistically significant relationship with the extent of overall EC adoption at the significant level of .01. The direction of effect was positive with small effect size. There was no relationship between CEOs' education level and the extent of EC adoption. The CEO tenure had a statistically significant relationship with only the extent of EC adoption on B2B procurement and B2C order taking at the significant level of .01. The direction of effect was positive with small effect size. There was no relationship between CEO tenure and the extent of EC adoption on B2B and B2C communications.

Table 59
Correlation Coefficients of Socio-Demographic

	Age	Education	Tenure
B2B Communications	.231**	.055	.100
B2B Procurement	.294**	-.026	.292**
B2C Communications	.201**	.070	.132
B2C Order Taking	.221**	.084	.245**

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

MANOVA was employed to examine the differences between groups of the nominal variables (e.g., CEOs' gender, organizational location, and organizational web site) on the extent of EC adoption. The results indicated that only the factor of whether the organization had a web site had differences in the extent of EC

adoption. As shown in Table 60, the extent of EC adoption on B2B communications, B2B procurement, and B2C order taking had a statistically significant difference between the organizations with web site and the organizations without web site at the significant level of .01. Table 61 presents the average rating on the extent of EC adoption. The results indicated that the organizations with web sites were more willing to adopt EC. The effect size of this factor was medium.

Table 60
MANOVA of Organizational Web Site

	<i>F</i>	<i>Sig. (p)</i>	η^2
B2B Communications	12.691**	.000	.055
B2B Procurement	21.930**	.000	.092
B2C Communications	3.537	.061	.016
B2C Order Taking	18.518**	.000	.079

* significant at the 0.05 level (2-tailed).

** significant at the 0.01 level (2-tailed).

Table 61
Descriptive Statistics of Organizational Web Site

	Owned web site	Mean	SD
B2B Communications	Yes	3.8742	.74517
	No	3.4542	.86049
B2B Procurement	Yes	3.3994	1.00714
	No	2.6750	1.05696
B2C Order Taking	Yes	3.2327	1.32580
	No	2.3722	1.30347

CHAPTER V

DISCUSSION

Chapter five presents a final review of this study and provides recommendations for practical implementations and future research. To identify the critical factors that influence the decisions of Taiwanese SMEs on the extent of EC adoption, the first section summarizes the findings of this study. The next section describes the research findings in relation to the current literature and provides rational explanations of the results of this study. The following section provides recommendations of practical implementation based on the findings of this study to Taiwanese CEOs of SMEs, EC consultants, suppliers or value chain partners with EC adoption, and government agencies. The final section reviews this study and addresses the limitations, recommendations for future research, and conclusions.

Research Findings

The purpose of this study was to seek the determinants that influence the decisions of Taiwanese SMEs on the extent of EC adoption. Three research questions based on Tornatzky and Fleischer's (1990) OTE model, including organizational, technological, and environmental contexts, were examined to identify the critical factors that influence the decisions of Taiwanese SMEs on the extent of EC adoption. The major findings of each research question of this study were as follows.

Research Question 1: Organizational Context

Among four organizational factors, the results indicated that only two factors, organizational size and CEOs' attitudes toward EC adoption, had a positive relationship with the extent of EC adoption. Moreover, between these two factors, the average effect size of CEOs' attitudes toward EC adoption was larger than organizational size. The factor of CEOs' technology knowledge correlated only with the extent of EC adoption on B2C communications, even though the effect size was small. Hence, the following research hypotheses were supported in this study:

1. H1 and H1a ~ H1d: Organizational size had a significantly positive relationship with the overall extent of EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking.
2. H2 and H2a ~ H2d: CEOs' attitudes toward EC had a significantly positive relationship with the overall extent of EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking.
3. H4c: CEOs' technology knowledge had a significantly positive relationship with the extent of EC adoption on B2C communications

Research Question 2: Technological Context

Among three technological factors, the results indicated that only two factors, CEOs' perceptions of EC on relative advantage and compatibility, had a positive relationship with the extent of EC adoption. Moreover, between these

two factors, the average effect size of compatibility was larger than relative advantage. The factor of complexity did not correlate with the extent of EC adoption. Hence, the following research hypotheses were supported in this study:

1. H5 and H5a ~ H5d: CEOs' perception of EC on relative advantage had a significantly positive relationship with the overall extent of EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking.
2. H6 and H6a ~ H6d: CEOs' perception of EC on compatibility had a significantly positive relationship with the overall extent of EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking.

Research Question 3: Environmental Context

Between two environmental factors, the results indicated that only information intensity had a positive relationship with the extent of EC adoption. The factor of competition intensity correlated only with the extent of EC adoption on B2B communications, even though the effect size was small. Hence, the following research hypotheses were supported in this study:

1. H8 and H8a ~ H8d: Information intensity of the industry had a significantly positive relationship with the overall extent of EC adoption and the extent of EC adoption on B2B communications, B2B procurement, B2C communications, and B2C order taking.

2. H9a: Competition intensity of the industry had a significantly positive relationship with the extent of EC adoption on B2B communications.

Research Question 4: Extent of EC Prediction

To predict the extent of EC adoption, multiple regression analysis was employed to explore the relationship between the extent of EC adoption and the combination of the predictors. The results of prediction models were as follows:

1. According to the correlation analysis, the results indicated that five factors had influenced the extent of overall EC adoption, and according to multiple regression analysis, the prediction model was as follows:

The Extent of Overall EC Adoption

= -0.535 + 0.077 Organizational Size + 0.553 Attitudes

+ 0.105 Relative Advantage + 0.151 Compatibility

+ 0.185 Information Intensity

The result of multiple regression analysis indicated that the combination of five factors significantly predicted the extent of overall EC adoption, with 69% of the variance, and the effect size of this model as very large.

2. According to the correlation analysis, the results indicated that six factors had influenced the extent of EC adoption on B2B communications, and according to multiple regression analysis, the prediction model was as follows:

The Extent of EC Adoption on B2B Communication

$$\begin{aligned} &= -0.594 + 0.024 \text{ Organizational Size} + 0.395 \text{ Attitudes} \\ &+ 0.216 \text{ Relative Advantage} + 0.126 \text{ Compatibility} \\ &+ 0.193 \text{ Information Intensity} + 0.184 \text{ Competition Intensity} \end{aligned}$$

The result of multiple regression analysis indicated that the combination of six factors significantly predicted the extent of EC adoption on B2B communications, with 57% of the variance, and the effect size of this model as very large.

3. According to the correlation analysis, the results indicated that five factors had influenced the extent of EC adoption on B2B procurement, and according to multiple regression analysis, the prediction model was as follows:

The Extent of EC Adoption on B2B Procurement

$$\begin{aligned} &= -0.783 + 0.092 \text{ Organizational Size} + 0.688 \text{ Attitudes} \\ &+ 0.095 \text{ Relative Advantage} + 0.118 \text{ Compatibility} \\ &+ 0.101 \text{ Information Intensity} \end{aligned}$$

The result of multiple regression analysis indicated that the combination of five factors significantly predicted the extent of EC adoption on B2B procurement, with 58% of the variance, and the effect size of this model as very large.

4. According to the correlation analysis, the results indicated that six factors had influenced the extent of EC adoption on B2C

communication, and according to multiple regression analysis, the prediction model was as follows:

$$\begin{aligned} & \textit{The Extent of EC Adoption on B2C Communication} \\ & = 0.849 + 0.085 \textit{ Organizational Size} + 0.238 \textit{ Attitudes} \\ & + .001 \textit{ Technology Knowledge} + 0.078 \textit{ Relative Advantage} \\ & + 0.108 \textit{ Compatibility} + 0.256 \textit{ Information Intensity} \end{aligned}$$

The result of multiple regression analysis indicated that the combination of five factors significantly predicted the extent of EC adoption on B2C communication, with 26% of the variance, and the effect size of this model as large.

5. According to the correlation analysis, the results indicated that five factors had influenced the extent of EC adoption on B2C order taking and according to multiple regression analysis, the prediction model was as follows:

$$\begin{aligned} & \textit{The Extent of EC Adoption on B2C Order Taking} \\ & = -2.223 + 0.107 \textit{ Organizational Size} + 0.914 \textit{ Attitude} \\ & + .0019 \textit{ Relative Advantage} + 0.271 \textit{ Compatibility} \\ & + 0.125 \textit{ Information Intensity} \end{aligned}$$

The result of multiple regression analysis indicated that the combination of five factors significantly predicted the extent of EC adoption on B2C order taking, with 62% of the variance, and the effect size of this model as very large.

Interpretations

This section examines the research findings in relation to the current literature. The findings of socio-demographic factors, and the factors of organizational context, technological context, and environmental context are individually discussed below:

Socio-Demographic

The social-demographic factors in this study included CEOs' gender, age, educational level, and tenure, and organizational number of employees, annual sales, location, and web site. Based on the data collected from 219 Taiwanese CEOs of SMEs, the major Taiwanese CEOs of SMEs were male (72.6%). Over 70% of Taiwanese CEOs of SMEs were between the age of 40 and 60 years. The majority Taiwanese CEOs of SMEs (80% of participants) had achieved an educational level of bachelor's degree and higher. The average Taiwanese CEOs' length of service was 13 years. Moreover, more than 75% of Taiwanese CEOs had at least 10 years of CEO tenure. For the organizational profiles, 20% of Taiwanese SMEs had less than 20 employees and over 20% of Taiwanese SMEs had more than 120 employees. This result indicated that some organizations increased their size to gain the advantages of greater capability to support research and development, whereas some organizations maintained fewer employees to gain the advantages of greater flexibility and ability to adapt to change in the market (Rothwell & Dodgson, 1993). The annual sales of these SMEs were distributed in the average range from 5 million to 75 million Taiwan dollars (around 170 thousand to 2.5 million U.S. dollars). The descriptive

statistics of socio-demographic factors in this study were consistent with the latest population statistics published by Small and Medium Enterprise Administration (2004). Hence, this study can properly represent all SMEs in Taiwan.

The findings of sampled organizations showed that 72.6% organizations had web site and 27.4% of organizations did not. As cross-analysis with organizational location, the proportion of Taiwanese SMEs that had built their own web site showed a significant difference in different areas of Taiwan. The organizations located in northern Taiwan were more likely than expected to have a company web site. Moreover, the strength of the association was considered to be medium to large. Northern Taiwan had abundant resources in terms of finance, technology information, and human resource compared to central and southern Taiwan. Hence, this finding confirmed that the organizations that established their headquarters in more advanced cities may have more technology usage in the organization.

Regarding the extent of EC adoption, this study found the factor of whether the organization had a web site had differences only in the extent of EC adoption on B2B communications, B2B procurement, and B2C order taking. There was no difference in the extent of EC adoption on B2C communications. This result indicated that the organizations had to build their web sites on the Internet to carry out the tasks of B2B communications, B2B procurement, and B2C order taking. Due to popularity of email as a communication tool, the organization did not need to build a web site in order to contact with customers via email.

The results of this study also indicated that Taiwanese CEOs' age and tenure had a statistically significant relationship with the extent of EC adoption. The prior study found that older CEOs were more reluctant to adopt EC innovation because they are less recently educated on technology-related knowledge (Kitchell, 1997). Moreover, some psychological theorists proposed that learning ability decreases with age and older CEOs did not be able to evaluate new ideas effectively in decision making (Burke & Light, 1981; Taylor, 1975). However, the results of this study were not consistent with prior studies. The findings indicated that Taiwanese CEOs' age was positively related with the extent of EC adoption. The likely explanation was that EC adoption in Taiwan had been popular and the government had incentive programs on computerization in SMEs in recent years. The older CEOs had more experience to realize the advantages of EC. Hence, they were more willing to adopt EC. The factor of CEO tenure also had a similar positive correlation with the factor of age. The finding of this study showed that the longer CEOs' length of service, the more willing they were to adopt EC on B2B procurement and B2C order taking. Hence, CEOs who had been with the organization for a long time could be expected to have greater abilities to adopt the new technology to gain competitive advantages.

Organizational Context

Organizational factors were the most often used factors to examine the influence on the decision to adopt technological innovation. Tornatzky and Fleischer (1990) indicated that the organizational context can be analyzed from two aspects: organizational structure and processes. In this study,

organizational size represented the organizational structure. For the organizational processes, CEOs' characteristics that include attitudes toward EC adoption, innovativeness and technology knowledge were analyzed in this study.

Organizational Size

Organizational size was one of the most frequently examined determinants in the studies of innovation adoption. Correlation analysis showed that the association between organizational size and the extent of overall EC adoption was statistically significant at the significant level of .01, and the direction of effect was positive, with medium degree of effect. The strength of the relationship between organizational size and each of the four categories of EC adoption from highest to lowest were B2B procurement, B2C order taking, B2B communications, and B2C communications. This result reflected that organizational size had a stronger influence on buying and selling processes than it did on communication processes.

The result of this study was consistent with the empirical study by Thong (1999), who concluded that only those organizations with sufficient resources would consider expanding by EC adoption. This finding also supported Alpar and Reeves' (1990) argument that even in the SMEs, the larger organizations had more ability to adopt innovation by hiring employees with specialized skills. Hence, having sufficient resources is the first step toward the decision of expanding EC adoption in SMEs.

CEOs' Attitudes toward EC Adoption

Attitudes referred to the extent of individual favorable or unfavorable reaction toward a given behavior (Fishbein & Ajzen, 1975). In this study, the average score on this factor was 3.4, which indicated that most Taiwanese CEOs of SEMs had a positive attitude toward EC adoption. Correlation analysis showed that the association between CEOs' attitudes toward EC adoption and the extent of overall EC adoption was statistically significant at the significant level of .01, and the direction of effect was positive, with a very large degree of effect. The strength of the relationship between CEOs' attitudes toward EC adoption and each of the four categories of EC adoption from highest to lowest were B2C order taking, B2B procurement, B2B communications, and B2C communications. Just as with the determinant of organizational size, the result also reflected that CEOs' attitudes toward EC adoption had a stronger influence on buying and selling processes than communication processes. The only difference was that the effect on the selling process was stronger than the effect on the buying process.

The result of this study was also consistent with prior studies which indicated that CEOs' attitudes had a positive influence on the decision of EC adoption because CEOs of SMEs had great power to control the decision directly (Mehrtens, Cragg, & Mills, 2001; Seyal & Rahman, 2003; Thong & Yap, 1995). Moreover, among nine factors, the factor of CEOs' attitudes toward EC adoption was the most crucial determinant of EC adoption in Taiwanese SMEs. This result confirmed Teo and Tan's (1998) statement that the major determinant on the decision of innovation adoption was the existence of champions and the major

champion of SMEs was CEOs. While CEOs of SMEs had positive attitudes toward EC adoption, they can also ensure the required resources can be rapidly available when they are needed.

CEOs' Innovativeness

Rogers (2003) defined innovativeness as “the degree to which an individual is relatively earlier in adopting new ideas than other members of a system” (p. 267). According to Hurt, Joseph, and Cook (1977), scores above 68 were considered highly innovative, and scores below 64 were considered low in innovativeness. In this study, the average score of innovativeness was 62.39, which indicated that the average CEOs of SEMs in Taiwan had lower innovativeness. Correlation analysis was employed to examine the association between CEOs' innovativeness and the extent of EC adoption. The result showed that the association between CEOs' innovativeness and the extent of EC adoption was not statistically significant.

The result of this study did not confirm prior empirical studies as presented by Thong and Yap (1995), and Thong (1999). A plausible explanation could be that even though CEOs had high innovativeness, EC still was considered a new business strategy for the organization. The level of risk on EC adoption may be perceived by CEOs as much higher than its expectation. Hence, the factor of CEOs' innovativeness may have an influence on the initial stage of EC adoption. When the SMEs increased the extent of EC adoption, the determinants of the extent of EC adoption would be driven by the level of perceived risks and benefits of EC adoption.

CEOs' Technology Knowledge

Correlation analysis showed that only the association between CEOs' technology knowledge and the extent of EC on B2C communications was statistically significant ($p = .041$) at the significant level of .05 and the direction of effect was positive with small effect size. This result did not validate prior studies which indicated that CEOs' technological knowledge had a significant positive relationship with the decision of innovation adoption in SMEs (Thong, 1999; Thong & Yap; 1995). However, the finding of this study confirmed Gable and Raman's (1992) statement that most CEOs focus their knowledge on the management field and tend to lack technological knowledge. The results showed that only the association between CEOs' technology knowledge and the extent of EC on B2C communications was significant because B2C communications was the least complex EC activity among four categories of EC activities.

Technological Context

The technological context presented the pool of technologies available for innovation adoption by an organization (Tornatzky & Fleischer, 1990). In this study, the main focus was on how CEOs' perceptions of technology characteristics can influence the EC adoption decision. Three critical determinants of Rogers' (1962) theory of diffusion of innovations were adopted in this study, including the CEOs' perceptions of EC on relative advantage, compatibility, and complexity.

Relative Advantage

Relative advantage was “the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003, p. 229). In this study, the average score on this factor was 4.02, which indicated that most Taiwanese CEOs of SMEs believed that EC could bring advantages for their organizations. Correlation analysis also showed that the association between the CEOs’ perception of EC on relative advantage and the overall extent of EC adoption was statistically significant at the significant level of .01, and the direction of effect was positive with medium degree of effect. The strength of the relationship between CEOs’ perception of EC on relative advantage and each of the four categories of EC adoption from highest to lowest were B2B communications, B2C order taking, B2B procurement, and B2C communications.

The result of this study confirmed prior studies which found that CEOs’ perception of EC on relative advantage was a significant predictor of EC adoption (Premkumar & Ramamurthy, 1995; Tan & Teo, 1998; Teo & Tan, 2000; Lertwongsatien & Wongpinunwatana, 2003). Moreover, the finding was inconsistent with the study by Seyal and Rahman (2003) who indicated that most CEOs of SMEs were not sure about the direct benefits that can be derived from EC. This study found that the CEOs who adopted EC extensively believed that EC was able to increase sales, enlarge market, reduce costs, develop new business, and enhance the relationship with suppliers and partners.

Compatibility

Compatibility was “the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (Rogers, 2003, p. 240). In this study, the average score on this factor was 4.07, which indicated that most Taiwanese CEOs of SMEs agreed that EC was compatible with their organizations on experiences, values, beliefs, business needs, and activities. Correlation analysis also showed that the association between the CEOs’ perception on compatibility of EC and the overall extent of EC adoption was statistically significant at the significant level of .01, and the direction of effect was positive with large degree of effect. The strength of the relationship between CEOs’ perception of EC on compatibility and each of the four categories of EC adoption from highest to lowest were B2C order taking, B2B communications, B2B procurement, and B2C communications.

Most studies confirmed that compatibility has a positive association with innovation adoption (Grover, 1993; Seyal & Rahman, 2003; Soh, et al., 1997; Thong, 1999). The finding of this study was consistent with these studies. If the innovation was compatible with existing work practices and environments, the organizations would be more likely to adopt it (Lertwongsatien & Wongpinunwatana, 2003; Thong, 1999). This study also found that the influential factors of EC adoption was whether EC was compatible with the earlier experience of technological innovation adoption, and the organizational values, beliefs, and business needs.

Complexity

Complexity was “the degree to which an innovation is perceived as relatively difficult to understand and use” (Roger, 2003, p. 257). Unlike other technological factors, around 50% of Taiwanese CEOs were neutral on the perception of EC on complexity, which indicated that even though the organizations had adopted EC, they did not perceive any complexity of EC. Correlation analysis was employed to examine the association between CEOs’ perception on complexity of EC and the extent of EC adoption. The result showed that the association between CEOs’ perception on complexity of EC and the extent of EC adoption was statistically insignificant. This result confirmed a prior empirical study by Thong (1999), who indicated that CEOs’ perception of EC on complexity affects only the likelihood of EC adoption and did not influence the extent of EC adoption.

Environmental Context

Environmental context was the arena in which an organization conducts its business (Tornatzky & Fleischer, 1990). Lertwongsatien and Wongpinunwatana (2003) indicated that environmental factors create a need for organizations to adopt innovation because environmental factors could not be controlled by organizations. Hence, the environmental factors of information intensity and competition intensity were examined in this study.

Information Intensity

Information intensity refers to the degree of information that is present in the product or service of an organization (Thong, 1999). In this study, the

average score on this factor was 3.94. This result indicated that most Taiwanese CEOs of SMEs believed that their organizations were in an industry of high information intensity, which means that the organizations needed up-to-date, reliable, and accurate information any time. Correlation analysis also showed that the association between information intensity and the overall extent of EC was statistically significant at the significant level of .01, and the direction of effect was positive with large degree of effect. The strength of the relationship between information intensity and each of the four categories of EC adoption from highest to lowest were B2B communications, B2C order taking, B2B procurement, and B2C communications. The finding of this study was consistent with that of the prior study (Thong, 1999) that higher information intensity would lead an organization to perceive EC as a competitive tool and increase the extent of EC adoption.

Competition Intensity

Competition intensity refers to the degree of competitive environment within the industry in which the organizations operate (Lertwongsatien & Wongpinunwatana, 2003). In this study, the average score of competition intensity was 4.12, which indicated that most Taiwanese CEOs believed that their organizations were in an industry of high competition intensity. Correlation analysis was employed to examine the association between competition intensity and the extent of EC adoption. The result showed that the association between competition intensity and the extent of EC adoption was not statistically significant.

Only the extent of EC adoption on B2B communications had an influence on EC adoption with small effect.

The result of this study was inconsistent with prior empirical studies which indicated that competition intensity of the industry had a significantly positive relationship with the overall extent of EC adoption (Lertwongsatien & Wongpinunwatana, 2003). The possible explanation for this finding was that because this study examined only two industries, the sampled organizations were actually operating in similar environments. Hence, the competition intensity did not provide a direct push on the extent of EC adoption in SMEs in Taiwan.

Practical Implications and Recommendations

The findings of this study had significant implications for (1) CEOs of SMEs that had not yet begun and had an intention to adopt EC, or had adopted EC and were looking for full advantages from EC adoption; (2) EC consultants that were advised to target their marketing at EC businesses with SMEs, (3) suppliers or value chain partners that had adopted EC and targeted their marketing at EC businesses with SMEs, and (4) government agencies that were responsible for promoting EC adoption. The practical implications and recommendations in the study are as follows.

1. In this study, the findings indicated that larger organizations with sufficient resources were more willing to adopt EC. According to a resource-based model, Thong (2001) identified three types of resource barriers of SMEs in innovation adoption. They are expertise constraints, financial constraints, and time constraints. The

researcher provides several suggestions regarding three types of resource barriers of SMEs in innovation adoption.

- a. Expertise Constraints: Due to the lack of EC expertise within SMEs, the researcher suggests that the CEOs of SMEs should hire experienced consultants or increase the level of technological knowledge by sending employees for training to undertake EC implementation.
 - b. Financial Constraints: SMES should properly allocate sufficient funds for EC investment. The researcher suggests that even though there may be insufficient funds, SMEs should not choose low cost solutions which may not fulfill the organizational business requirements. Moreover, SMEs can purchase custom EC systems. The well tested and specific systems may well suit organizational needs and bring more benefits in the long term.
 - c. Time Constraints: The CEOs of SMEs had limited time to spend on EC implementation. However, the CEOs of SMEs had great authority to influence employees. The researcher suggests that busy CEOs of SMEs should assign employees with potential ability on EC implementation to participate and monitor the EC implementation process. These employees can provide useful information to better meet the requirements of SMEs.
2. According to correlation analysis in this study, although the factor of CEOs' technology knowledge did not have a statistically significant

influence on the extent of EC adoption, the result cannot support a conclusion that CEOs' technology knowledge did not have an indirect impact on the extent of EC adoption. The researcher suggests that the CEOs of SMEs still need to be trained in technological skills to develop their technological abilities. A better knowledge of EC should be helpful in understanding the current circumstances of Industry and realizing which EC systems were most appropriate to the organization as it has been shown that the appropriate EC adoption can bring more competitive advantages and benefits.

3. According to correlation analysis and multiple regression analysis, the factor of CEOs' attitudes toward EC adoption was most influential on the extent of EC adoption. The CEOs of organizations with lesser extent of EC adoption did not prefer to adopt EC unless they were sure that EC was the one way to do things better, not just differently. Hence, for the suppliers who targeted their marketing at EC businesses with SMEs, the researchers suggested that these suppliers should take steps to create EC awareness for the organizations with lesser extent of EC adoption. When the CEOs understand EC and its potential benefits, they may develop more positive attitudes toward EC adoption, and would be more willing to adopt EC. Moreover, as CEOs' attitudes on innovation become more positive, they were likely to be more receptive toward the new idea adoption. Thereby, suppliers can develop new markets, such as

innovative products, new production processes, and imaginative advertising.

4. Using multiple regression analysis, this study found that most Taiwanese SMEs tended to emphasize the organizational benefits of EC adoption more than the organizational ability to adopt EC. This means that when the organizations thought that they could not gain advantages and benefits from EC adoption, they would maintain the current operational systems. Hence, for the suppliers that target their marketing at EC businesses with SMEs, the researcher suggests that the suppliers put more efforts into promoting the potential advantages and benefits of EC adoption than into helping the organizations with preparing and equipping for EC adoption.
5. According to the result of correlation analysis, the CEOs' perception on the relative advantages of EC had a significantly positive influence on the extent of EC adoption. The researcher suggests that the CEOs of SMEs need to make sure they are aware of the advantages and benefits before fully embracing EC. The SMEs may prefer the advantages of EC over traditional methods of buying and selling processes, or communications with customers or suppliers. However, CEOs have to consider the fit of EC to their organizational objectives. The advantages of EC can take many forms such as enlarging market share, increasing sales, reducing costs, or improving organizational

image, but those advantages must be suited to the organization's desired ways of doing business.

6. EC could be considered as either a totally new business strategy or as just an add-on business tool for those organizations that had an intention to adopt EC. The researcher suggests that if the organization belonged to the scenario that considered EC as a new business strategy, the CEO should reformulate organizational values, beliefs, and business needs in order to understand how to incorporate and implement EC into the existing business. If the later case that considered EC as an add-on business tool was supported, the researcher suggests that the organization seek potential markets where EC is necessary.
7. The findings of this study indicate that the extent of EC adoption by the suppliers and partners had a significant influence on the extent of B2B EC adoption. The organization would like to diffuse the EC to as many suppliers and partners as possible to gain full advantages from the B2B EC system. However, it may encounter suppliers and partners that are not interested in EC adoption. The researcher suggests that the organization could provide incentives, knowledge, and training to induce the suppliers and partners to adopt EC, although this strategy would be costly. If these suppliers and partners realize the benefits of EC and successfully implement EC, the organization would gain competitive advantages in the long term.

8. For the EC system sponsors, the researcher suggests that they should make greater efforts to create powerful and highly compatible EC systems that can be viable over the long term for SMEs. The researcher also suggests that further training is required to increase use. The EC system sponsors should focus on specific requirements of SMEs rather than general principles.
9. The findings of this study had significant implications for the government agencies that are responsible for promoting EC adoption within SMEs. In Taiwan, all SMEs are governed by the Small and Medium Enterprise Administration (SMEA) of the Ministry of Economic Affairs, R.O.C. Currently, SMEA is providing several programs to support SMEs adopting EC. The researcher believes that the findings of this study could extend the knowledge of EC in Taiwan. Thereby, SMEA can facilitate the processes of promoting EC adoption on SMEs. The recommendations for SMEA are as follows.
 - a. First, to increase the proportion of SMEs that adopt EC, the researcher suggests that the best strategy to convince CEOs of SMEs of the benefits of EC is through showcases or exhibitions of successful SMEs that have achieved higher sales and cost reductions via EC adoption. According to the findings of this study, when CEOs of SMEs realize the benefits of EC adoption, positive attitudes toward EC adoption would be formed and the CEOs of SMEs would be more willing to adopt EC.

- b. Second, the SMEA can promote EC adoption of SMEs by conducting EC adoption campaigns. However, many SMEs do not finish the campaign when the funds run out, or they may not implement EC properly even though they finish the campaign. The researcher suggests that this strategy can implement the initial stages of promoting EC adoption. It not only increases EC awareness, but also expands the knowledge of EC. Although the outcomes may not be significant thereby, SMEs can facilitate access to related technologies on the market.
- c. Thirdly, financial support programs should be targeted to SMEs that are seriously motivated to adopt EC. Many SMEs do not have sufficient funds on EC adoption investment. The government could accelerate EC diffusion by providing low interest loans, establishing supportive business, and modifying current tax laws to stimulate EC adoption by SMEs.
- d. Finally, in the B2C EC sector, when consumers are willing to buy online, the organizations will be more willing to adopt EC. Hence, the government could regulate the Internet to make a secured and trustworthy commerce platform such as dealing with fraud and credit card misuse, and promote the diffusion of the EC among consumers.

Limitations

There are several limitations of this study that need to be recognized.

These limitations are as follows:

1. One of the most important limitations was the research model. More than 40 factors had been investigated by many prior studies related to innovation adoption. This study was based on Tornatzky and Fleischer's OTE model that focused only on organizational, technological, and environmental contexts. Although Tornatzky and Fleischer's OTE model had been widely used to examine the factors that influence EC adoption, only nine factors were examined in this study. Some important factors that were not identified in this study, such as government support, vendor support, consultant effectiveness, organizational policy, user satisfaction, and social expectations, etc., may also influence the EC adoption decision.
2. The second limitation was the targeted subjects. Only two industries, wholesale and retail, and manufacturing, were investigated in this study. Although these two industries comprised 65% of total SMEs in Taiwan, due to different organizational and CEOs' characteristics among different industries, this study may not be generalized to all SMEs.
3. The third limitation was the lack of investigation of organizational characteristics. Most variables focused on CEOs' perceptions in this study. Due to organizational size, SMEs would suffer from similar

resource constraints. However, some organizational characteristics, such as centralization, formalization and competitive strategy, may be potential determinants of EC adoption by SMEs.

4. The fourth limitation was the use of a single respondent for each organization. Only CEOs of SMEs were chosen to collect the data for this study. Although the CEO is the main decision maker in the SMEs, one person's authority cannot represent the entire strategy of an organization. In addition, the data provided by the CEO may produce self-report bias.

Recommendations for Future Research

There are some recommendations for future research that would extend the body of this study. The recommendations are listed as follows.

1. Additional empirical studies can be conducted in different methods of data analysis. The major analysis methods of this study were bivariate correlation analysis and multiple regression analysis. Only one level of causality relationships can be inferred. However, some predictors may be the mediate factors of relationship. Hence, further analysis, using tools such as structural equation models (SEM) that analyze relationships among latent factors and manifest factors, can be conducted to explore the moderating effect of some factors and to understand causality relationships on the extent of EC adoption more explicitly.

2. According to multiple regression analysis on the extent of EC adoption in this study, the “adjusted R^2 ” was .69, meaning that 69% of variance in the extent of EC adoption can be predicted from nine independent variables combined. On the other hand, 31% of variance was unpredictable due to several unknown factors not examined in this study. Hence, further studies can extend this research by including other potential determinants from different contexts.
3. Since small and medium enterprises suffer from similar resource constraints, the findings of this study should be applicable in other countries. However, differences of environment and cross-cultural factor among different countries may have a significant influence on EC adoption in SMEs. Hence, further research can be conducted in different countries to compare these differences. The results will help increase generalizability to other nations.
4. This study found that factors of CEOs’ innovativeness and CEOs’ perceptions on complexity of EC had no direct influence on the extent of EC adoption, which did not confirm with the results of prior empirical studies. These factors may have an indirect influence on the extent of EC adoption. More research is needed to deeply examine the relationship between these factors and the extent of EC adoption in SMEs in Taiwan.

Conclusions

Technology has driven organizational change over the last decade. In the Internet age, the development of EC was often considered as a major indicator of overall competitiveness of organizations (United Nations Conference on Trade and Development, 2002). According to a World Bank report entitled "Trade Facilitation and Economic Development: Measuring the Impact" (Wilson, Mann, & Otsuki, 2003), Taiwan was ranked 5th among Asia-Pacific Economic Cooperation (APEC) members, according to Indexed Input of EC Usage in 2004. This ranking reflects that Taiwanese organizations had considerable competitive advantages of EC development.

This study also focused on the Small and Medium Enterprises (SMEs). According to the White Paper on SMEs in Taiwan (Small and Medium Enterprise Administration, 2004), SMEs represent 97.73% of the total number of Taiwanese businesses. Today, most SMEs were forced to adopt EC by their major suppliers and value chain partners in order to carry out business processes more efficiently. Moreover, the EC marketing channel can bring customers more benefits, such as greater shopping convenience and potentially lower prices. However, SMEs faced the disadvantage of less competitiveness due to the insufficient resources and managerial abilities. The question of whether current theories regarding EC adoption was appropriate for Taiwanese SMEs was raised. Hence, the purpose of this study was to identify the determinants of the extent of EC adoption by SMEs in Taiwan.

This study presented a framework based on Tornatzky and Fleischer's (1990) OTE model that has been widely used to examine the factors that influence organizational technology adoption. The research model of this study identified nine determinants that had an influence on EC adoption by Taiwanese SMEs. The determinants can be divided into three contexts that include organizational context, technological context, and environmental context. The results of this study indicate that all three contexts are important in the decision of EC adoption by Taiwanese SMEs. Based on the findings of this study on nine determinants of EC adoption, the conclusions can be made as follows:

1. The organizations with larger size are more willing to expand EC adoption. Moreover, the results reflect that organizational size has a stronger influence on buying and selling processes of EC than communication processes of EC. Even among the SMEs, the larger organizations have more ability to adopt EC by hiring employees with specialized skills. Hence, having sufficient resources is the first step toward the decision of SMEs to expand EC adoption.
2. CEOs with positive attitudes toward EC adoption are more willing to expand EC adoption for their organizations. Moreover, the results also reflect that CEOs' attitudes toward EC adoption have a stronger influence on buying and selling processes of EC than communication processes of EC. While CEOs of SMEs have positive attitudes toward EC adoption, they can ensure that the required resources can be rapidly available when they are needed.

3. The association between CEOs' innovativeness and the extent of EC adoption was not statistically significant. The possible explanation for this finding was that the factor of CEOs' innovativeness may have an influence on the initial stage of EC adoption only. When the SMEs increase the extent of EC adoption, the determinants of the extent of EC adoption would be driven by the level of risks and benefits of EC adoption.
4. For the factor of CEOs' technology knowledge, the findings indicate that Taiwanese CEOs' knowledge of EC did not have significant difference among SMEs. Hence, only the association between CEOs' technology knowledge and the extent of EC on B2C communications was significant because B2C communications was the least complex EC activity among four categories of EC activities.
5. CEOs with positive perceptions on the relative advantages of EC are more willing to expand EC adoption for their organizations. This study also found that the CEOs who believe that EC is able to increase sales, enlarge market, reduce cost, develop new business, and enhance the relationship with suppliers and partners had extensive EC adoption in their organizations.
6. CEOs with positive perception on compatibility of EC are more willing to expand EC adoption for their organizations. This study also found that whether EC was compatible with the earlier experience of

technological innovation adoption, and the organizational values, beliefs, and business needs was the critical factor on EC adoption.

7. The association between CEOs' perception on the complexity of EC and the extent of EC adoption was statistically insignificant. This result confirmed a prior empirical study by Thong (1999), who indicated that CEOs' perception on the complexity of EC only affects the likelihood of EC adoption and does not influence the extent of EC adoption.
8. The association between the information intensity and the extent of EC was statistically significant. Higher information intensity would lead an organization to perceive EC as a competitive tool and increase the extent of EC adoption.
9. The association between competition intensity and extent of EC adoption was not statistically significant. The possible explanation for this finding was that this study examined only two industries, and the sampled organizations were actually operating in similar environments. Hence, the competition intensity did not provide a direct push on the extent of EC adoption by SMEs in Taiwan.

The objective of this study was to identify the critical factors that influence the decisions of Taiwanese SMEs on the extent of EC adoption. The findings of this study may not only expand the current body of EC knowledge, but also contribute to the knowledge of CEOs of SMEs, EC consultants, suppliers or value chain partners, and government agencies. The researcher hopes this study can

provide Taiwanese SMEs useful findings to further understand EC adoption and help to develop better strategies regarding EC to gain potential benefits and competitive advantages.

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Appendix A
Questionnaire (English Version)

Part 1: Organizational Context

Organizational Profile				
# of Employees	<input type="checkbox"/> 5 ~ 20 <input type="checkbox"/> 80 ~ 100	<input type="checkbox"/> 20 ~ 40 <input type="checkbox"/> 100 ~ 120	<input type="checkbox"/> 40 ~ 60 <input type="checkbox"/> 120 ~ 140	<input type="checkbox"/> 60 ~ 80 <input type="checkbox"/> 140+
Annual Sales (NT\$)	<input type="checkbox"/> Under 5 millions <input type="checkbox"/> 15 ~ 25 millions <input type="checkbox"/> 35 ~ 45 millions <input type="checkbox"/> 55 ~ 65 millions	<input type="checkbox"/> 5 ~ 15 millions <input type="checkbox"/> 25 ~ 35 millions <input type="checkbox"/> 45 ~ 55 millions <input type="checkbox"/> 65 millions +		
Organizational Location	<input type="checkbox"/> Northern Taiwan <input type="checkbox"/> Southern Taiwan	<input type="checkbox"/> Central Taiwan <input type="checkbox"/> Eastern Taiwan		
Is There a Company's web site		<input type="checkbox"/> Yes <input type="checkbox"/> No		
CEOs' Profile				
Gender	<input type="checkbox"/> Male <input type="checkbox"/> Female			
Age	<input type="checkbox"/> 18 ~ 30	<input type="checkbox"/> 30 ~ 40	<input type="checkbox"/> 40 ~ 50	<input type="checkbox"/> 50 ~ 60 <input type="checkbox"/> 60 +
Education	<input type="checkbox"/> Below High School <input type="checkbox"/> Associate's Degree <input type="checkbox"/> Master's Degree	<input type="checkbox"/> High School <input type="checkbox"/> Bachelor's Degree <input type="checkbox"/> Doctorate Degree		
CEOs' Tenure (Year)	<input type="checkbox"/> 1 ~ 5	<input type="checkbox"/> 6 ~ 10	<input type="checkbox"/> 11 ~ 15	<input type="checkbox"/> 16 ~ 20 <input type="checkbox"/> 21 +

The following section is about your technology knowledge. Please select following computer skills that you have. (You may select more than one).

CEOs' Technology Knowledge		
1.	<input type="checkbox"/>	I can use a word-processing program (e.g., MS-Word) to organize documents.
2.	<input type="checkbox"/>	I can use a presentation graphics program (e.g., MS-PowerPoint) to present data.
3.	<input type="checkbox"/>	I can use a database program (e.g., MS-Access) to manage data.
4.	<input type="checkbox"/>	I can use a spreadsheet program (e.g., MS-Excel) to analyze data.
5.	<input type="checkbox"/>	I know how to use Web browser programs (e.g., Netscape, Internet Explorer).
6.	<input type="checkbox"/>	I can compose, send, and read an email message.
7.	<input type="checkbox"/>	I use the Internet to gather information in my job or personal life.
8.	<input type="checkbox"/>	I am familiar with basic operation of computer (e.g., move/copy files, save files, print documents, using CD-ROM, etc.).
9.	<input type="checkbox"/>	I had attended computer classes.
10.	<input type="checkbox"/>	I have formal qualifications in the use and operation of a computer.

The following section is about your attitudes toward E-Commerce adoption. For each statement, please indicate by selecting a level that come closest to how you feel about yourself.

CEOs' Attitudes toward E-Commerce Adoption		strongly disagree		neutral		strongly agree	
1.	I believe that soon most businesses will be conducted by using E-Commerce.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	I believe that the use of E-Commerce can enhance the standard of living.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I believe that life will be easier and faster by using E-Commerce.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	I believe that E-Commerce is a fast and efficient way to get information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. CEOs' Attitudes toward E-Commerce Adoption Scale is from "A preliminary investigation of E-Commerce adoption in small & medium enterprises in Brunei," by A. H. Seyal, and M. N. A. Rahman, 2003, *Journal of Global Information Technology Management*, 6(2), p. 6. Adapted with permission of the authors.

The following section is about your Innovativeness. For each statement, please indicate by selecting a level that come closest to how you feel about yourself. Please work quickly in this section, there is no right or wrong answers, just record your first impression.

CEOs' Innovativeness		strongly disagree		neutral		strongly agree	
1.	My peers often ask me for advice or information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	I enjoy trying new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I seek out new ways to do things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	I am generally cautious about accepting new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	I frequently improvise methods for solving a problem when an answer is not apparent.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	I am suspicious of new inventions and new ways of thinking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	I rarely trust new ideas until I can see whether the vast majority of people around me accept them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	I feel that I am an influential member of my peer group.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I consider myself to be creative and original in my thinking and behavior.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I am aware that I am usually one of the last people in my group to accept something new.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	I am an inventive kind of person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	I enjoy taking part in the leadership responsibilities of the group I belong to.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	I am reluctant about adopting new ways of doing things until I see them working for people around me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	I find it stimulating to be original in my thinking and behavior.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	I tend to feel that the old way of living and doing things is the best way.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	I am challenged by ambiguities and unsolved problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	I must see other people using new innovations before I will consider them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	I am receptive to new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	I am challenged by unanswered questions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	I often find myself skeptical of new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. Individual Innovativeness Scale is from "Scales for the measurement of innovativeness," by H. T. Hurt, K. Joseph, and C. D. Cook, 1977, *Human Communication Research*, 4, p. 58. Adapted with permission of the authors.

Part 2: Technological Context

This section is about your perception on technology characteristics. For each statement, please indicate by selecting a level that come closest to how you feel on E-Commerce as a technology.

Relative Advantage		strongly disagree		neutral		strongly agree	
1.	I perceive E-Commerce to be advantageous because it increases sales and enlarges market share for our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	I perceive E-Commerce to be advantageous when it reduces costs for our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	I perceive E-Commerce to be advantageous when it enables the development of new businesses for our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	I perceive E-Commerce to be advantageous because it enhances the relationship with suppliers of our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compatibility		strongly disagree		neutral		strongly agree	
5.	I perceive E-Commerce to be highly compatible with our earlier experience of technological innovation adoption.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	I perceive E-Commerce to be highly compatible with the values, beliefs, and business needs of our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	I perceive E-Commerce to be highly compatible with the E-Commerce activities adopted by our suppliers and partners.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complexity		strongly disagree		neutral		strongly agree	
8.	I perceive E-Commerce to be complex when the company faces lack of appropriate tools.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I perceive E-Commerce to be complex when the company faces lack of funding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I perceive E-Commerce to be complex when the company faces lack of expertise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	I perceive E-Commerce to be complex when the company faces lack of industry standard.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. Attributes of Innovation Adoption Scale is from "A preliminary investigation of E-Commerce adoption in small & medium enterprises in Brunei," by A. H. Seyal, and M. N. A. Rahman, 2003, Journal of Global Information Technology Management, 6(2), p. 6. Adapted with permission of the authors.

Part 3: Environmental Context

This section is about the situation of your organization in the industry. For each statement, please indicate by selecting a level that come closest to how you feel the situation of your organization is in the industry that your organization operates in.

Information Intensity		strongly disagree		neutral		strongly agree	
1.	My company is dependent on up-to-date information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	It is very important for my company to have access to reliable, relevant and accurate information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	It is very important for my company to access information quickly whenever we need the information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competition Intensity		strongly disagree		neutral		strongly agree	
4.	It is easy for a customer to switch to a competitor in this industry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	The rivalry among organizations in this industry is intense.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	The substitutable products and services affect our company in this industry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. Information Intensity and Competition Intensity Scale is from "CEO characteristics, organizational characteristics and information technology adoption in small business," by J. Y. L. Thong, and C. S. Yap, 1995, Omega, 23(4), p. 429. Adapted with permission of the authors.

Part 4: The Extent of E-Commerce Adoption

This section is about the extent to which your organization uses E-Commerce. For each statement, please indicate by selecting a level that come closest to the degree your company uses E-Commerce on this task.

B2B: Inbound Communications		Not at all used			Extensively used	
1.	Send suppliers regular updates about new product plans and other new developments of our company (e. g., via email, newsletter, what's new page).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Provide specific online information about product specifications that our suppliers must meet (e.g., via email, accessible Web page).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Share product and inventory planning information with our suppliers (e.g., via email, accessible Web page)..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Permit suppliers to directly link up to our database (e.g., via Enterprise Resource Planning/ERP systems, Supply Chain Management/SCM systems).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2B: Procurement		Not at all used			Extensively used	
5.	Search and locate potential suppliers online.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Place and track orders with suppliers electronically (e.g., online order placement).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Allow suppliers to submit bids online.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Use online marketplaces to source supplies (e.g., Commerce Online, Taiwan & China Products Online, AsianNet, TaiwanTrade, Trade-Taiwan).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2C: Outbound Communications		Not at all used			Extensively used	
9.	Provide customers with general information about our company (e.g., via web sites, email, information boards).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Allow customers to locate and send information to appropriate contacts within the company (e.g., via accessible online directories).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Send customers regular updates about new products and other developments within our company (e.g., via email, what's new page).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Provide solutions to customer problems (e.g., via Web-based service solutions).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Provide after-sales service to our customers (e.g., via online information about installation and troubleshooting).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Provide information in response to consumer questions or requests (e.g., via Q&A page, intelligent agents).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2C: Order Taking		Not at all used			Extensively used	
15.	Accept orders electronically from customers (e.g., via Web-based shopping cart and catalogs).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Accept payments electronically from customers (e.g., via credit card, PayPal, Okpayment, eCoin, ezPay).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Allow customers to track and inquire about their orders electronically (e.g., via accessible Web page about the status of stock and delivery).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. Extent of EC Adoption Scale is from "An analysis of e-business adoption and its impact on business performance," by F. Wu, V. Mahajan, and S. Balasubramanian, 2003, *Academy of Marketing Science*, 31(4), p. 425. Adapted with permission of the authors.

Appendix B
Questionnaire (Chinese Version)

第一部分：公司組織層面

公司基本資料				
員工人數 (人)	<input type="checkbox"/> 5 ~ 20 <input type="checkbox"/> 80 ~ 100	<input type="checkbox"/> 20 ~ 40 <input type="checkbox"/> 100 ~ 120	<input type="checkbox"/> 40 ~ 60 <input type="checkbox"/> 120 ~ 140	<input type="checkbox"/> 60 ~ 80 <input type="checkbox"/> 140 以上
每年營業額	<input type="checkbox"/> 500 萬以下 <input type="checkbox"/> 1500 萬 ~ 2500 萬 <input type="checkbox"/> 3500 萬 ~ 4500 萬 <input type="checkbox"/> 5500 萬 ~ 6500 萬		<input type="checkbox"/> 500 萬 ~ 1500 萬 <input type="checkbox"/> 2500 萬 ~ 3500 萬 <input type="checkbox"/> 4500 萬 ~ 5500 萬 <input type="checkbox"/> 6500 萬以上	
公司地點	<input type="checkbox"/> 北部 <input type="checkbox"/> 中部 <input type="checkbox"/> 南部 <input type="checkbox"/> 東部			
公司是否有自己的網頁	<input type="checkbox"/> 是 <input type="checkbox"/> 否			
個人基本資料				
性別	<input type="checkbox"/> 男 <input type="checkbox"/> 女			
年齡	<input type="checkbox"/> 18 ~ 30	<input type="checkbox"/> 30 ~ 40	<input type="checkbox"/> 40 ~ 50	<input type="checkbox"/> 50 ~ 60 <input type="checkbox"/> 60 以上
學歷	<input type="checkbox"/> 高中以下 <input type="checkbox"/> 碩士畢業	<input type="checkbox"/> 高中畢業 <input type="checkbox"/> 博士畢業	<input type="checkbox"/> 五專畢業	<input type="checkbox"/> 大學畢業
年資 (年)	<input type="checkbox"/> 1 ~ 5	<input type="checkbox"/> 6 ~ 10	<input type="checkbox"/> 11 ~ 15	<input type="checkbox"/> 16 ~ 20 <input type="checkbox"/> 21 以上

下列問題是關於您的科技知識，請選出你所擁有的電腦技能 (可複選)。

電腦知識		
1.	<input type="checkbox"/>	我會使用文書編輯軟體 (例如：MS-Word) 編輯文件
2.	<input type="checkbox"/>	我會使用簡報軟體 (例如：MS-PowerPoint) 做簡報
3.	<input type="checkbox"/>	我會使用資料庫管理軟體 (例如：MS-Access) 管理資料
4.	<input type="checkbox"/>	我會使用試算表 (例如：MS-Excel) 分析資料
5.	<input type="checkbox"/>	我會使用網頁瀏覽軟體 (例如：Netscape, Internet Explorer) 瀏覽網頁
6.	<input type="checkbox"/>	我會發送及讀取電子郵件 (Email)
7.	<input type="checkbox"/>	工作上或日常生活中我會使用網際網路來取得資訊
8.	<input type="checkbox"/>	我對於電腦的基本操作很熟悉 (例如：移動/複製檔案、儲存檔案、列印文件、使用光碟機)
9.	<input type="checkbox"/>	我有上過電腦相關課程
10.	<input type="checkbox"/>	我有電腦相關證照

下列問題是關於您對採用電子商務之態度，請針對每個問題選出你認同的程度。

採用電子商務的態度		不認同 ----- 認同				
1.	我相信大部分的公司很快地都會採用電子商務。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	我相信公司採用電子商務將會提高公司的水準。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	我相信公司採用電子商務將會使得作業更簡單及迅速。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	我相信公司在取得資訊上，採用電子商務是一種快速且有效的方法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

附註 “採用電子商務的態度” 的衡量方法是取自 Seyal 及 Rahman (2003) 刊登於 *Journal of Global Information Technology Management* 的文章 “A preliminary investigation of E-Commerce adoption in small & medium enterprises in Brunei”，並獲得作者同意使用。

下列問題是關於您的創新度，請憑自己的直覺並針對每個問題快速地選出你認同的程度，這些問題並無絕對正確或錯誤的答案，只是紀錄您對這些問題的直覺反應。

創新度		不認同 ----- 認同				
1.	我的同僚經常來徵求我的建議。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	我喜愛嘗試新想法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	我會尋求新方法來處事情。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	對於接受新想法我會比較謹慎。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	我經常採用即興創作的方式來解決一個沒有明顯答案的問題。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	我對於新發明和新的思惟模式感到懷疑。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	我不太信任新的想法，除非我知道周遭的大多數人會接受這樣的想法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	我認為在同僚中，我是有影響力的成員。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	我認為我在思想和行為上是具有創造性和原創性。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	我發現在同僚中我通常是最後一個能夠接受新事物的人。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	我是屬於有發明才能的人。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	在團體中我喜愛擔任領導者的角色。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	我不願意採用新的做法，除非周遭的人都在採用此做法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	我會讓我的思想及行為具有原創性。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	我傾向認為使用既有的模式來處事情是最好的方法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	我會去挑戰一些模稜兩可和未解決的問題。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	我必須要先瞭解其他人在使用新方法的情況後，才會考慮採用它。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	我對於新的想法是易於接受的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	我會去挑戰一些尚未有答案的問題。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	我經常發現自己會去懷疑新的想法。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

附註 “創新度” 的衡量方法是取自 Hurt, Joseph 及 Cook (1977) 刊登於 *Human Communication Research* 的文章 “Scales for the measurement of innovativeness”，並獲得作者同意使用。

第二部分：科技層面

下列問題關於您對科技的感知，請針對每個問題選出你認同的程度。

相對優勢		不認同 ----- 認同				
1.	我認為採用電子商務可以增加公司的營業額及擴大市場佔有率。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	我認為採用電子商務可以減少公司成本。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	我認為採用電子商務可以開發新業務。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	我認為採用電子商務可以促進和供應商或合作廠商的關係。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
相容性		不認同 ----- 認同				
5.	我認為採用電子商務與之前所採用其他創新科技的經驗是相似的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	我認為採用電子商務與公司的價值觀及需求是一致的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	我認為採用電子商務可以與已採用電子商務的供應商或合作廠商有高度的配合。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
複雜性		不認同 ----- 認同				
8.	我認為當公司缺乏適當的設備時，採用電子商務是不可行的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	我認為當公司缺乏資金時，採用電子商務是不可行的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	我認為當公司缺乏電腦專業技術或人才時，採用電子商務是不可行的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	我認為當公司營運未達到業界標準時，採用電子商務是不可行的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

附註 “創新採用之特性” 的衡量方法是取自 Seyal 及 Rahman (2003) 刊登於 *Journal of Global Information Technology Management* 的文章 “A preliminary investigation of E-Commerce adoption in small & medium enterprises in Brunei”，並獲得作者同意使用。

第三部分：環境層面

下列問題關於您的公司所在產業的狀況，請針對每個問題選出你認同的程度。

資訊密度		不認同 ----- 認同				
1.	相對於其他行業而言，我的公司必須要依靠最新的資訊來營運。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	相對於其他行業而言，取得可靠及精確的資料對我的公司的營運是很重要的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	相對於其他行業而言，是否能夠迅速取得所要的資訊對我的公司營運是很重要的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
競爭密度		不認同 ----- 認同				
4.	在此行業中，客戶很容易轉移到其他競爭對手。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	在此行業中，公司間的競爭是很強烈的。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	在此行業中，替代產品的出現會影響到公司的績效。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

附註 “創新採用之特性” 的衡量方法是取自 Thong 及 Yap (1995) 刊登於 *Omega* 的文章 “CEO characteristics, organizational characteristics and information technology adoption in small business”，並獲得作者同意使用。

第四部分：電子商務採用之程度

下列問題是關於您公司採用電子商務的狀況，請針對每個問題選出使用的程度。

B2B: 公司間的通訊		不常使用 ----- 常使用				
1.	藉由網路定期傳送新產品計畫或公司的新發展給供應商或合作廠商。(例如：藉由電子郵件或電子報)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	藉由網路提供我們所需求的產品資訊給供應商或合作廠商。(例如：藉由電子郵件、電子報或網頁)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	藉由網路分享產品庫存規劃給供應商或合作廠商。(例如：藉由電子郵件、電子報或網頁)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	允許供應商或合作廠商直接連結至公司的電腦資料庫。(例如：企業資源規劃系統/ERP，或供應鏈管理系統/SCM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2B: 採購		不常使用 ----- 常使用				
5.	在網路上找尋可能的供應商或合作廠商。(例如：藉由網路搜尋引擎)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	利用網路向供應商或合作廠商下訂單。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	允許供應商或合作廠商利用網路出價。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	透過網路交易市場去獲得供應原料。(例如：藉由台灣國際商情服務中心 www.commerce.com.tw)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2C: 顧客間的通訊		不常使用 ----- 常使用				
9.	利用網路提供客戶關於本公司的一般資訊。(例如：藉由電子郵件、電子報或網頁)。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	允許客戶利用網路提供資訊給公司相關人員。(例如：藉由電子郵件或線上即時通訊)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	藉由網路定期傳送新產品計畫或公司的新發展給客戶。(例如：藉由電子郵件或電子報)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	針對客戶的需求提供線上解決方案。(例如：藉由網頁)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	提供線上售後服務。(例如：藉由網頁提供安裝及疑難排解等等資訊)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	利用網路回覆客戶的疑問。(例如：藉由常見問題網頁、討論區或即時對話)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2C: 下單		不常使用 ----- 常使用				
15.	接受客戶網路下單。	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	接受客戶網路付款。(例如：藉由信用卡、Okpayment、eCoin、ezPay 等等)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	允許客戶線上追蹤訂單。(例如：藉由網頁提供貨品是否寄出、訂單正在處理中等等資訊)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

附註 “電子商務採用之程度” 的衡量方法是取自 Wu, Mahajan 及 Balasubramanian (2003) 刊登於 *Academy of Marketing Science* 的文章 “An analysis of e-business adoption and its impact on business performance”，並獲得作者同意使用。

Appendix C
Written Informed Consent Letter (English Version)



Lynn University

**THIS DOCUMENT SHALL ONLY BE USED TO PROVIDE AUTHORIZATION FOR VOLUNTARY
CONSENT**

**PROJECT TITLE: ORGANIZATIONAL, TECHNOLOGICAL, AND ENVIRONMENTAL
DETERMINANTS OF ELECTRONIC COMMERCE ADOPTION IN
SMALL AND MEDIUM ENTERPRISES IN TAIWAN**

Project IRB Number: 2005-042. Lynn University. 3601 N. Military Trail, Boca Raton, Florida 33431

I, Chang-Shuo Lin, am a doctoral student at Lynn University. I am studying Global Leadership, with a specialization in Corporate and Organizational Management. Part of my education is to conduct a research study.

DIRECTIONS FOR THE PARTICIPANT

You are being asked to participate in my research study. Please read this carefully. This form provides you with information about the study. The Principal Investigator (Chang-Shuo Lin) will answer all of your questions. Ask questions about anything you don't understand before deciding whether or not to participate. You are free to ask questions at any time before or after your participation in this study. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

PURPOSE OF THIS RESEARCH STUDY: The study is about electronic commerce (EC) adoption in small and medium enterprises (SMEs) in Taiwan. The purpose of this study is to examine the determinants of EC adoption by SMEs in Taiwan. There will be approximately 400 of people participating in this study. These are chief executive officers (CEOs) of SMEs. The participants must be 18 years and older. Since the measurement of the extent of EC adoption is based on business-to-business (B2B) and business-to-customer (B2C) EC activities, the organizations must have implemented either B2B or B2C EC activities.

PROCEDURES:

All participants will be invited to participate via email that provides explanation of the research and a hyper-link to the survey web site. You will be prompted to answer questions about your perception of EC adoption. It takes about 15 minutes to complete. This survey will be anonymous by the degree that technology allows. You will finish the survey in private and the researcher will not collect any identifying information linking the participant to the survey data.

POSSIBLE RISKS OR DISCOMFORT: This study involves minimal risk. You may find that some of the questions are sensitive in nature. In addition, participation in this study requires a minimal amount of your time and effort.

POSSIBLE BENEFITS: There may be no direct benefit to you in participating in this research. But knowledge may be gained which may help organizations extend the body of knowledge on EC as a business process and explore organizational goals, strategies, and experiences. Organizations that have not yet begun EC will gain a better understanding of success factors, resources, competitive technical issues.

Institutional Review Board for the Protection of Human Subjects
Lynn University
3601 N. Military Trail, Boca Raton, Florida 33431

FINANCIAL CONSIDERATIONS: There is no financial compensation for your participation in this research. There are no costs to you as a result of your participation in this study.

ANONYMITY: Anonymity will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. The researcher will not identify you and data will be reported as "group" responses. Your email address, IP address, and individual responses will not be identified nor tracked as part of data collection. Participation in this survey is voluntary and return of the completed survey will constitute your informed consent to participate. The data will be kept confidential and stored electronically on "password protected" computers. The data will be destroyed after five years.

The results of this study may be published in a dissertation, scientific journals or presented at professional meetings. Your anonymity will be maintained in all publications or presentations results from this study.

RIGHT TO WITHDRAW: You are free to choose whether or not to participate in this study. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate.

CONTACTS FOR QUESTIONS/ACCESS TO CONSENT FORM: Any further questions you have about this study or your participation in it, either now or any time in the future, will be answered by Chang-Shuo Lin (Principal Investigator) who may be reached at: [REDACTED] or

[REDACTED] and Dr. Jeanette Francis, faculty advisor who may be reached at: [REDACTED] or [REDACTED]. For any questions regarding your rights as a research subject, you may call Dr. Farideh Farazmand, Chair of the Lynn University Institutional Review Board for the Protection of Human Subjects, at [REDACTED] or email to [REDACTED]. If any problems arise as a result of your participation in this study, please call the Principal Investigator (Chang-Shuo Lin) and the faculty advisor (Dr. Jeanette Francis) immediately.

You may print off a copy of this consent form.

INVESTIGATOR'S AFFIDAVIT: I have carefully explained to the subject the nature of the above project. The person participating has represented to me that he/she is at least 18 years of age, and that he/she does not have a medical problem or language or educational barrier that precludes his/her understanding of my explanation. I hereby certify that to the best of my knowledge the person participating in this project understands clearly the nature, demands, benefits, and risks involved in his/her participation.

[REDACTED]

Signature of Investigator

Date of IRB Approval: 10/16/05 7.7.

[REDACTED]

Appendix D

Written Informed Consent Letter (Chinese Version)



Lynn University

本文件只適用於提供自願參與的同意書

研究計畫名稱：台灣中小企業採用電子商務之決定因素研究

研究計畫 IRB 號碼：2005-042 Lynn University. 3601 N. Military Trail, Boca Raton, Florida 33431

本人林昌碩是美國 Lynn University 博士班學生,目前正在研究全球性之領導統御之議題,我的主修是企業與組織管理。此一學術研究是我教育學習的一個重要階段,真誠的邀請您參與這份研究計畫。

參與者須知

您正被邀請參與這份研究計畫,以下內容將提供您關於這份研究的相關資料,請仔細閱讀。主要研究員林昌碩將回答您所有問題,若有任何疑問,請務必在決定參與前提出。您可以在參與此學術研究之前或之後自由發問。您的參與是完全自願性的,您可以拒絕參與而不用擔心任何權益上的損失或懲罰。

研究目的：這份研究是關於台灣中小企業採用電子商務決定因素之探討。本研究的主要目的在於尋找在台灣中小企業之電子商務採用的決定因素,此研究將從組織、科技及環境等三個層面調查。為了能夠取得深入且可靠的資料,受訪對象將針對中小企業的總經理作為資料收集來源。所有參與者必須年滿 18 歲。

程序：所有參與者將會收到一封 Email 邀請函,此邀請函將會引導你進入問卷網站。問卷將包含個人特質、採用電子商務之看法、同業間的環境因素、以及公司採用電子商務的現況。整份問卷大概需要十五分鐘即可完成。這份問卷將採匿名方式進行,您的身分將無法辨認。這份問卷將不會收集任何足以辨認身分之個人資料。

可能性之風險或不適感：此研究牽涉極微小之風險,但您可能會覺得有些問題比較敏感。此外,參與這份問卷調查將佔用您少量的時間和心力。

可能性之受益：參與這次研究,您將無法直接受益。但研究結果所獲得的知識將幫助公司延伸現行的電子商務知識,並應用在公司的策略上。對於尚未採用電子商務的公司而言,此研究結果將提供更深的理解在電子商務上的採用。

財務考量：參與這次研究您將不會獲得金錢上的報酬,但也不會造成您任何損失。

匿名性：本問卷採匿名方式進行,您的身分將無法辨認,所有資料將集體整理。這份問卷將不會收集任何足以辨認身分之個人資料(例如:姓名、身分證字號等 IP 位址及回應內容將不會被辨認及追蹤。參與這份研究是自願性的,問卷視同您同意參與此學術研究。這份研究報告結果將可能發表於論文、學術期刊等。您的個人隱私在所有發表刊物上將受到同等的保護。

Institutional Review Board for the Protection of Human Subjects

Lynn University

3601 N. Military Trail, Boca Raton, Florida 33431

撤銷之權利：您可以自由選擇是否參與此學術研究，若您選擇不參與，將不會導致任何懲罰或權利的損失。

相關問題的聯絡人：任何進一步與此學術研究相關的問題，將由主要研究員林昌碩（聯絡電話：[REDACTED] Email：[REDACTED]）或此研究之指導教授 Dr. Jeanette Francis（聯絡電話：[REDACTED] Email：[REDACTED]）回答。任何關於此研究之受訪權益問題，您亦可連絡 Lynn University IRB 主席 Dr. Farideh Farazmand（聯絡電話：[REDACTED] EMail：[REDACTED]）。若您因參與此研究而導致任何困擾，請立即通知主要研究員林昌碩以及研究指導教授 Dr. Jeanette Francis。

您可將此一同意書列印出來保存。

研究員誓詞：我已經仔細向受訪者說明此次的研究計畫，我也確認過受訪者的年紀年滿十八歲，並且沒有任何醫療上的問題與語言或教育的障礙，來影響受訪者理解我的說明。我藉此保證在我的最佳認知之下，參與者已清楚瞭解此一研究計畫以及所有參與過程所牽涉的利益及風險。

[REDACTED]

研究員簽名

IRB 核准日期： 10/16/05 7.7.

[REDACTED]

Appendix E

Institutional Review Board Approval and Consent



Lynn University

Principal Investigator: Chang-Shuo Lin

Project Title: Organizational, Technological, and Environmental Determinants of Electronic Commerce Adoption in Small and Medium Enterprises in Taiwan

IRB Project Number 2005-042 :

APPLICATION AND PROTOCOL FOR REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS OF A NEW PROJECT: Request for Exempt Status Expedited Review Convened Full-Board

IRB ACTION by the CONVENCED FULL BOARD

Date of IRB of application and Research Protocol 10/16/05

IRB ACTION: Approved Approved w/provision(s) Not Approved Other

COMMENTS

Consent Required: No Yes Not Applicable Written Signed

Consent forms must bear the research protocol expiration date of 10/16/06

Application to Continue/Renew is due:

- (1) For a Convened Full-Board Review, two month prior to the due date for renewal
- (2) For an Expedited IRB Review, one month prior to the due date for renewal
- (3) For review of research with exempt status, one month prior to the due date for renewal

Other Comments:

Name of IRB Chair (Print) Farideh Farazmand

Signature of IRB Chair

A black rectangular box redacting the signature of the IRB Chair.

Date: 10/16/05

Cc. Dr. Francis

Appendix F

Permission to Use the Instruments

Permission from Seyal and Rahman (2003) to Use the Instruments of Attitudes toward EC Adoption and Attributes of Innovation Adoption

msn  **Hotmail** 

From : Dr A.Seyal [redacted]
Sent : Sunday, May 8, 2005 11:24 PM
To : "Xenos Lin" [redacted]
Subject : Re: Ask for your permission of research instruments

Dear Chang Shou

Thank you indeed for your email. Being a first author of the article, I hereby allow you to use the instrument used in my study. Please quote it in your research and please add our names to your mailing list to send us a copy of your research whenever you wish to publish your work after the completion of your Ph.D.

If you need further assistance, please do not hesitate to contact, I will be happy to help you for your research work.

With good wishes?

Afzaal H. Seyal

-----Original Message-----

From: Xenos Lin [mailto:[redacted]]
Sent: Monday, May 09, 2005 10:34 AM
To: Dr A.Seyal; Hj Noah
Subject: Ask for your permission of research instruments

Dear Dr. Seyal and Dr. Rahman:

How are you? My name is Chang-Shuo Lin and I'm from Taiwan. I'm a PHD student at Lynn University in Florida. I read one of your excellent articles about E-Commerce adoption. The title is "A Preliminary Investigation of E-Commerce Adoption in Small & Medium Enterprises in Brunei" in Journal of Global Information Technology Management (2003). Your measurement items are adopted by many researchers and approved to be an effective instrument in E-Commerce adoption area. So I would like to ask for your permission to use your instruments in my study. Would you please forward your approval letter via this email, or simply reply this mail with the sentence like "you have my permission to use the instrument". I really need this statement due to our school's policy and IRB requirement. Thank you so much for your assistance.

Thank you so much. I look forward to your reply.

Best regards,
Chang-Shuo Lin

Permission from Thong and Yap (1995) to Use the Instruments of Information Intensity and Competition Intensity

msn  **Hotmail**[®]

From : James Thong <[REDACTED]>
Sent : Saturday, June 25, 2005 1:56 AM
To : "Xenos Lin" [REDACTED]
Subject : Re: Ask for your permission of research instruments

Hi Chang-Shuo,

You have my permission to use the instrument.

Regards,
James

Xenos Lin wrote:

Dear Dr. Thong:

How are you? My name is Chang-Shuo Lin and I'm from Taiwan. I'm a PHD student at Lynn University in Florida. I read one of your excellent articles about E-Commerce adoption. The title is "CEO characteristics, organizational characteristics and information technology adoption in small business" in Omega (1995). Your measurement items are adopted by many researchers and approved to be an effective instrument in E-Commerce adoption area. So I would like to ask for your permission to use your instruments in my study. Would you please forward your approval letter via this email, or simply reply this mail with the sentence like "you have my permission to use the instrument". I really need this statement due to our school's policy and IRB requirement. Thank you so much for your assistance.
Thank you so much. I look forward to your reply.

Best regards,
Chang-Shuo Lin

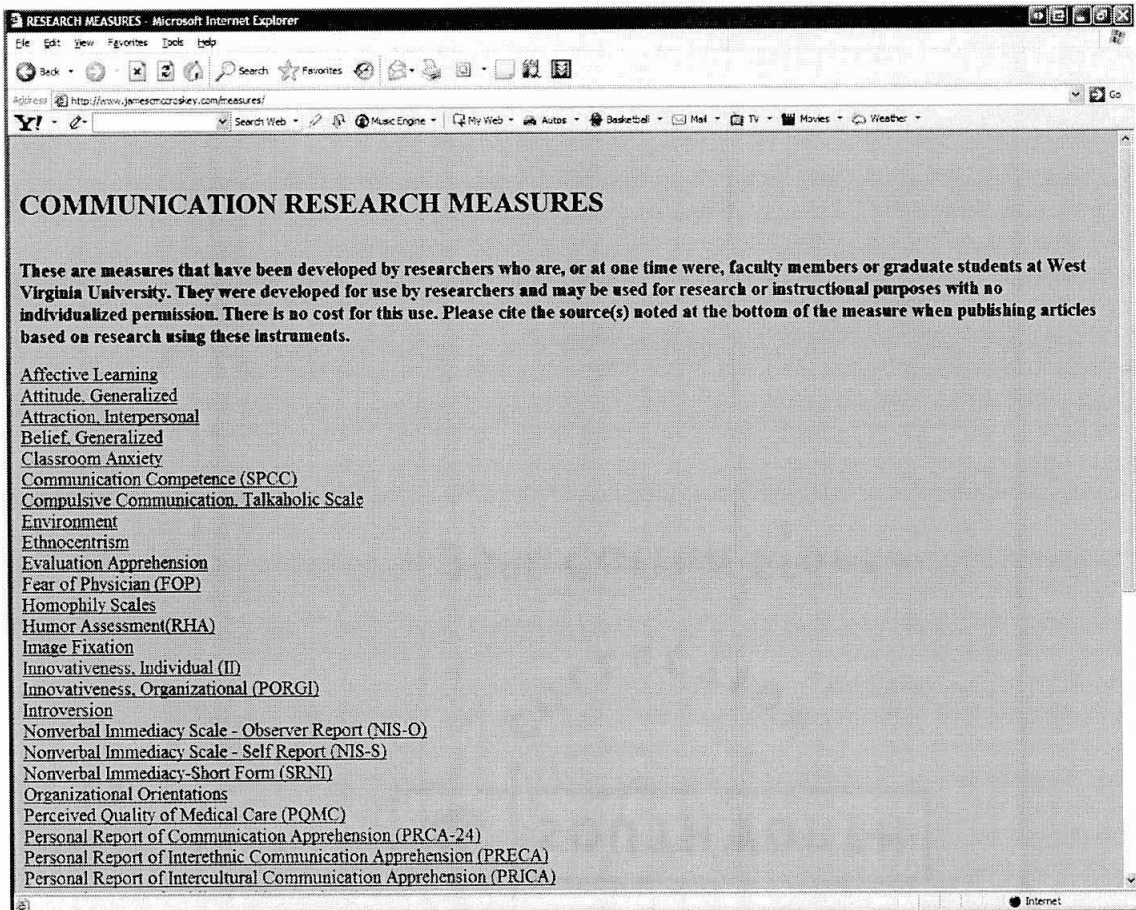
James Y.L. Thong, PhD
Deputy Head and Associate Professor
Dept of Information and Systems Management
School of Business and Management
Hong Kong University of Science and Technology
Clear Water Bay, Kowloon, HONG KONG
email: [REDACTED] tel: [REDACTED]; fax: [REDACTED]

Permission from McCroskey (1995) to Use the Individual Innovativeness

The instrument of Individual Innovativeness by Hurt, Joseph, and Cook can be found on the web site by McCroskey (<http://www.jamesmccroskey.com/measures/innovation.htm>). According to McCroskey (<http://www.jamesmccroskey.com/measures>),

“These are measures that have been developed by researchers who are, or at one time were, faculty members or graduate students at West Virginia University. They were developed for use by researchers and may be used for research or instructional purposes with no individualized permission. There is no cost for this use. Please cite the source(s) noted at the bottom of the measure when publishing articles based on research using these instruments.”

Hence, the instrument of Individual Innovativeness by Hurt, Joseph, and Cook can be used with no individualized permission.



Permission from Wu, Mahajan, and Balasubramanian (2003) to Use the Instrument of the Extent of EC Adoption



From : Fang Wu [redacted] >
Sent : Thursday, May 26, 2005 4:49 PM
To : "Xenos Lin" [redacted]
Subject : Re: Ask for your permission of research instruments

Hi, Chang-Shuo,

You can use the measurement of my paper published in JAMS (2003) as long as you cite them properly in your dissertation and the paper following that.

Good luck to your dissertation!

Fang

----- Original Message -----

From: "Xenos Lin" [redacted]
To: [redacted]
Sent: Thursday, May 26, 2005 2:46 PM
Subject: Ask for your permission of research instruments

> Dear Dr. Wu:

>

> How are you? My name is Chang-Shuo Lin and I'm from Taiwan. I'm a PHD
> student at Lynn University in Florida. I read one of your excellent articles
> about E-Commerce adoption. The title is "An Analysis of E-Business Adoption
> and Its Impact on Business Performance" in Academy of Marketing Science
> (2003). Your measurement items are adopted by many researchers and approved
> to be an effective instrument in E-Commerce adoption area. So I would like
> to ask for your permission to use your instruments in my study. Would you
> please forward your approval letter via this email, or simply reply this
> mail with the sentence like "you have my permission to use the instrument".
> I really need this statement due to our school's policy and IRB requirement.
> Thank you so much for your assistance.
> Thank you so much. I look forward to your reply.

>

> Best regards,
> Chang-Shuo Lin

Appendix G

Permission Letter from SMEA



Jeanette Francis, Ph.D.

August 2, 2005

College of Business and Management

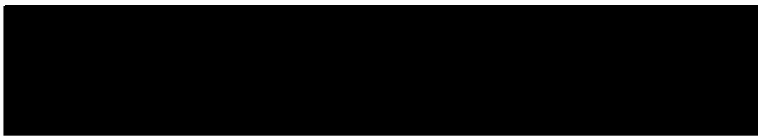
Lynn University

Thank you very much for your letter about requesting the list for your research on the E-Commerce adoption by SMEs in Taiwan. It is our pleasure to provide the list of "the SMEs Entrepreneur Volunteers." They are mainly CEOs of SMEs, who are outstanding in running their businesses and with the enthusiasm to provide guidance and assistance to other SMEs.

The programs have been launched since 1996. The qualifications of SMEs Entrepreneur Volunteers should be a business owner or a manager with at least 5 years of professional experience in business management levels. Their qualifications should be evaluated by the Small and Medium Enterprise Administration, Ministry of Economic Affairs, R.O.C. The key work of the SMEs Entrepreneur Volunteers is to be served as a mediator between government industrial or economical authority and the enterprise owner. Their performance field includes marketing, R&D, financial, high technology, business policy, strategy management, and so on.

You are welcome to visit our web site to find out the list data base through <http://www.e-volunteer.org.tw>. The list includes more than 2,453 CEOs of SMEs who are selected for this honorary position with their contact information. We sincerely hope you would collect the information needed for your study through the survey responded from the SMEs Entrepreneur Volunteers.

Sincerely,



Lai, Sun-Quae,

Director General,
Small & Medium Enterprise Administration
Ministry of Economic Affairs

Small and Medium Enterprise Administration, Ministry of Economic Affairs
95, 3fl, Section 2, Roosevelt Road,
Taipei, Taiwan, ROC, 106

Appendix H
Certification of Translation

LANGUAGE EXCHANGE INTERNATIONAL
TRANSLATION SERVICE

Translation Notarization

To Whom It May Concern:

This is to certify that the attached translation received from

Chang-Shuo Lin, of 1 document

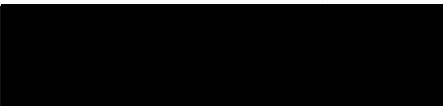
page(s), is an accurate representation of the text received by this office. The translator,

Hsiao-Ming Han attests to the following:

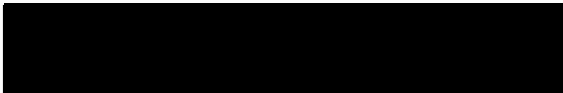
The attached is a true translation to the best of my knowledge. I am fluent in both

English and Chinese

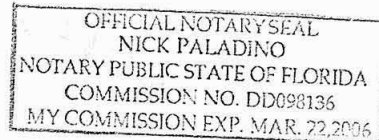
and I am qualified to translate.


Translator

SWORN AND SUBSCRIBED before me appeared Hsiao-Ming Han on
this 14th day of October, 2005.


Notary Public, State of Florida

My Commission Expires: _____



Every effort is made to insure the accuracy of all translations. However, LANGUAGE EXCHANGE INTERNATIONAL shall not be liable for any damages due to error or negligence in translation or typing.

Appendix I
Invitation Email

Chinese Version



From : 林昌碩 [REDACTED]
Sent :
To :
Subject : 問卷調查邀請函

您好,

我是就讀於美國 Lynn University 博士班的研究生，我的名字是林昌碩。

我是從經濟部中小企業處榮指員資料庫 (<http://www.e-volunteer.org.tw>) 得知您的 Email。

你正被邀請參加一份匿名的網路問卷調查，此研究的主要目的在於尋找在台灣中小企業之電子商務採用的決定因素，此研究將從組織、科技及環境等三個層面調查。本研究將試著找出主要影響中小企業採用電子商務的因素及探索電子商務採用的趨勢，相信此研究結果可以延伸現行的電子商務知識，並應用在公司的策略上。對於尚未採用電子商務的公司而言，此研究結果將提供更深入的理解在電子商務上的採用。

整個問卷調查只需花您 10 分鐘的時間，如有意願參與，請點擊下列網址：

<http://www.geocities.com/xenos09101975/survey.htm>

非常感謝您的協助，謝謝。

林昌碩 (Chang-Shuo Lin)

[REDACTED]

Phone: [REDACTED]

E-mail: [REDACTED]

English Version

msn  **Hotmail**[®]

From : Chang-Shuo Lin [REDACTED]
Sent :
To :
Subject : Survey Invitation

Hello,

My name is Chang-Shuo Lin. I found your e-mail from <http://www.e-volunteer.org.tw>. I am a current Lynn University student who is seeking a PhD in Global Leadership, with a specialization in Corporate and Organizational Management.

This email invites you to participate in an online survey about electronic commerce (EC) adoption in small and medium enterprises (SMEs) in Taiwan. Please click the following link to enter a web page, which further describes the survey and provides information about your consent to participate.

This is followed by a link to the online survey:
<http://www.geocities.com/xenos09101975/survey.htm>

Thank you for your assistance with my dissertation.

Chang-Shuo Lin

[REDACTED]
[REDACTED]
Phone: [REDACTED]
E-mail: [REDACTED]

201C22 T 2778
04/18/06 39800