

Enterprise E-Marketplace Adoption: from the Perspectives of Technology Acceptance Model, Network Externalities, and Transition Costs

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Abstract

By empirically surveying over 200 responding firms, the study found that network externalities greatly affected adopting firms' willingness to stay in existing or current e-marketplaces and/or to switch to another one, but both network externalities and transition costs are not antecedents of firm-level technology adoption. Also, transition costs did not play an influential role on enterprise e-marketplace adoption at the post-decision stage. The empirical evidence also verified that TAM effectively forecasts enterprise e-marketplace adoption, and selling technology-based new products to firm-level customers with a higher push from the external environment is more effective than that with a higher push from the internal environment of the firm. Findings derived from this empirical survey may pave the theoretical ground for a better understanding of how a general technology is adopted by business firms.

Key words: E-marketplace, technology acceptance model, network externality, transition cost



企業電子市集的採用： 科技接受模式、網路外部性與轉換成本的觀點

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摘要

經由 2 百多家企業的實際調查，本研究發現：雖然網路外部性會大幅度地影響已採用電子市集的企業是否會離開現有市集或轉換到另一電子市集的意願，但網路外部性與轉換成本不會影響尚未採用電子市集的企業是否會採用電子市集的意願，而且轉換成本對電子市集已採用的企業也不具有任何的影響力。實證的結果也顯示：科技接受模式可有效地解釋企業對電子市集採用的意願，同時，企業會不會購買新的科技產品，外在的競爭推力會比內部需要的拉力更具有影響力。這些實證結果的發現，建立了進一步瞭解一般企業採用新科技產品的理論基礎。

關鍵字：電子市集、科技接受模式、網路外部性、轉換成本



1. INTRODUCTION

With the unprecedented rapid development of e-commerce that provides enterprises an opportunity to reach out to global markets and conduct business through the Internet, many enterprises have shifted bricks-and-mortar trading activities to Internet-based cybernetic trade platforms called e-marketplaces that enable automated transactions and collaboration between buyers and sellers. Although e-marketplaces have received much attention from both academics and practitioners with a leaping number of studies in recent years, the prevailing theory-based e-marketplace literature, dominated by economic theory (Bakos, 1991, 1997; Strader and Shaw, 1999; Benslimane et al., 2005), stresses on examining whether or not enterprise e-marketplace adoption is affected by transaction cost such as search costs and coordination costs, while ignoring the provision of empirical evidence to test whether or not the effect of other economic considerations such as network externalities and transition costs greatly impact enterprise e-marketplace adoption.

Some articles (Lee and Clark, 1996; Strader and Shaw, 1999; Zhu et al., 2006) noted that transaction risks, prices, taxes, marginal costs, distributions costs, network effects, and market costs¹ also impact firms in their decisions to adopt or not to adopt e-marketplaces, but among these few studies noticing other economic considerations, most of which were descriptive in that they only provided theoretical discussions and thus fell short of empirically testing the theory. More empirical examination of how other economic considerations such as network externalities influence firm migration to open inter-organizational systems such as e-marketplaces is thus needed, as reported by Zhu et al. (2006). Motivated by narrowing and fulfilling this gap, this work conducts an empirical study to probe the effect of network externalities and transition costs on enterprises' e-marketplaces adoption.

Additionally, as compared to understanding individual-level technology adoption which has been comprehensively investigated over the last two decades, the literature on understanding firm-level technology adoption is relative few. Extant research has demonstrated that end-user technology adoption can be effectively predicted by the Technology Acceptance Model (TAM), and much literature has supported that including TAM in the R&D and marketing contexts is quite useful for launching new technology-based products, services, or ideas (hereafter product) to end-consumers. However, the underlying TAM at the firm level has not been studied and ascertained. Since each year, enterprises allocate a large portion of their budget on procuring information

¹ Market costs can take the form of fixed monthly market access fees, fixed fees per transaction, or variable fees based on the value of the transaction (Strader and Shaw, 1999).

technology/system (IT/IS) (hereafter IT)-based products, and such trend will be more obvious as the development of e-century and e-business progresses, understanding firm-level technology adoption will therefore be as important as individual-level technology adoption. Motivated by this phenomenon, this study thus attempts to employ TAM and diffusion of innovation (DOI) to construct a theoretical foundation in examining whether or not enterprise e-marketplace adoption can also be predicted by TAM.

To address the above two issues regarding e-marketplace adoption and firm-level technology adoption, this study intends to pave the theoretical foundation for conducting an empirical study on business-to-business (B2B) e-marketplace adoption. Since an e-marketplace is one of IT-based products, some business and theoretical implications concluded from the empirical results might be generalized to other organizational-level technology adoption contexts. The rest of this work is organized as follows. Section 2 presents the theoretical background and reviews the literature regarding business-to-business (B2B) e-marketplace adoption. Section 3 presents the hypotheses development, and Section 4 briefly describes the questionnaire design and data collection procedure. Section 5 then discusses the hypotheses tests and statistical analysis. Business and theoretical implications concluded from the empirical study are given in Section 6, and finally, the research limitations and concluding remarks are given in Section 7.

2. BACKGROUND

2.1 Theoretical Foundation

Since individual behavior is traceable and explainable by social psychology theories, during the past two decades, numerous studies have employed such theories (e.g., theory of reasoned action) to construct a research model (e.g., TAM). The aim of this is to investigate what influences individual attitudes and decisions in many IT adoption cases, and how such influence takes place. Since in practice, the whole organization's behavior is a collective behavior, organizational behavior must therefore have a certain origin for observation and research, and this gave rise to the development of the organizational behavior discipline (Thompson, 2002; Miner, 2002).

Organizational behavior is an important discipline of organizational science, which mainly comprises individual behavior within an organization, inter-person and inter-group behavior in an organization, the behavior between individuals and the organization, and the behavior between the whole organization and the external environment. Many studies have found that organizational decision behavior has not only inherited the rational and

irrational components of individual decisions but must also satisfy the concerns of multi-dimensional stakeholders rather than a single individual only. Consequently, the collective decision within an organization is very often more tedious and inefficient than the decision of a single person (Yu and Ru, 2002), and the final decision outcome may usually not be the best and most promising for all the participants in such organizational decision (Miner, 2002; Nelson and Quick, 2006).

In contrast to the prevailing DOI/TAM-based literature which generally takes individual-level users as a survey unit, this study takes collective organizations (firm-level users) as an analysis unit to explore whether or not TAM can still work at firm-level technology adoption in the prior-decision stage, and whether network externalities and transition costs could affect enterprises' willingness to adopt e-marketplaces in the prior-decision stage and/or alter their original decision in the post-decision stage. Accordingly, the term "end-consumer" hereafter used in this work refers to a firm, enterprise, or organization.

2.1.1 DOI

DOI, devised by Rogers in 1962 (Rogers, 2003), is used as a process-oriented viewpoint to explain how an innovation could be accepted and disseminated among end-consumers. DOI contends that the adoption or rejection of an innovation begins with the awareness of the end-consumer with an innovation, and the process of transformation of messages regarding an innovation through certain channels over time among end-consumers is called the diffusion process. Meanwhile, time is used to trace the sequential flow of an innovation through many end-consumers who engage in consideration decision about the adoption of an innovation. Innovation is defined as an idea, practice, product, service, or object perceived as new by an end-consumer. Accordingly, the model of the firm-level DOI process is illustrated in Fig. 1.

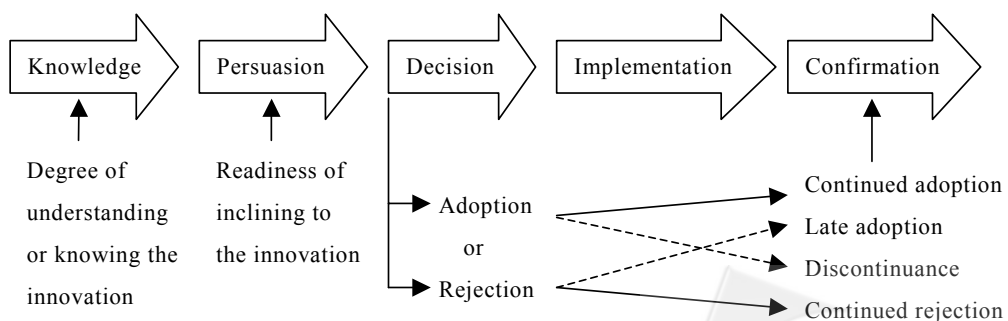


Fig. 1 Adapted from the diffusion of innovation (Roger, 2003)

2.1.2 TAM

TAM, presented by Davis in 1986 (Davis, 1989), is used to effectively explain people's computer adoption by two simple but significant constructs of usefulness and ease-of-use. Over the past two decades, a tremendous number of works have extended TAM to predict people's attitudes and use behavior for legion IT-based product adoption. In firm-level TAM, usefulness can be defined as the number of benefits which can be obtained by using the product, and ease-of-use can be defined as the degree to which the firm can effortlessly use the product. For a firm, this effort could be in the form of budget investment, employer training time, maintenance cost, and so forth. Accordingly, the firm-level TAM can be pictured as shown in Fig. 2.

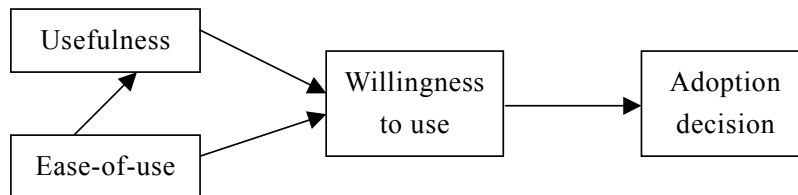


Fig. 2 Adapted from technology acceptance model (Davis et al., 1989)

2.1.3 Network Externality and Transition Cost

Numerous studies have exploited the economic theory in investigating e-marketplace adoption (Bakos, 1991, 1997; Lee and Clark, 1996; Strader and Shaw, 1999; Benslimane et al., 2005; Zhu et al., 2006), and have widely attributed the emergence and development of the e-marketplace to economic advantages (Bakos, 1998; Yu, 2006). Examples of such advantages include the reduction of searching costs that buyers must pay when sourcing suitable products and comparing prices and product data, and the reduction of marketing cost that sellers must pay when attempting to attract prospective customers and promote products. However, except for the transaction cost such as search costs, marketing costs, and order processing costs, the economies of scale and scope, network effects, switching costs, and path dependency may be also associated with the growth of the e-marketplace (Xiao et al., 2005; Viswanathan, 2005; Zhu et al., 2006). Nevertheless, since most economic theory-based e-marketplace studies are frequently limited to the transaction cost and ignores other economic considerations, this work aims to explore the effect of network externalities and switching costs on enterprise e-marketplace adoption. In fact, that e-marketplace adoption could be influenced by network externality or transition cost is not a new idea (Bakos, 1991; Shapiro and Varian, 1998; Xiao et al., 2005; Viswanathan, 2005;

Zhu et al., 2006), but the argument or implication has not been proven because it lacks examination using empirical evidence.

The analysis of the network market can date back to the 1970s (Squire 1973, Rohlfs 1974), and some studies (Wang and Seidmann, 1995; Choi and Thum, 1998; Frambach and Schillewaert, 2002; Fabiani et al., 2005) have shown that network externalities also exist in organizational technology/innovation adoption. In fact, the literature (Katz and Shapiro, 1994) contends that network externalities are an economic-scale phenomenon that depicts the utility derived by the end-consumer from the product and the rises/falls that occur with a change in the number of end-consumers using the product. Since e-marketplaces seem to be a typical network market just like telecommunications, mass media, and packaged computer software, as well as Web-based services such as electronic mail systems, bulletin board systems, online games, and instant message services (e.g., ICQ, MSN), whether or not network externalities significantly affect firm e-marketplace adoption is worth empirically examining.

Likewise, numerous studies (Clemons and Kleindorfer, 1992; Choi, 1994; Wang and Seidmann, 1995; Economides, 1996; Choi and Thum, 1998; Hoppe, 2000; Kauffman et al., 2000; Au and Kauffman, 2001; Gallagher and Wang, 2002; Asvanund et al., 2004) during the last 30 years or so have revealed that an inferior technological product may not be replaced by superior alternatives for as long as transition costs play a crucial role in its adoption and use. Transition costs can be deemed as a phenomenon of “economic lock” in which the money invested by the end-consumer for using a product will be sunk when discarding it because it incurs a switch barrier. The market share of 2.5G and 3G cellphone systems provide good examples of this phenomenon. Accordingly, whether or not transition costs considerably influence enterprise e-marketplace adoption is also worth exploring.

2.2 Literature Regarding B2B E-marketplace Adoption

Although the development of the e-marketplace has just steadily taken off in recent years and represents a new wave of Internet-based commerce propagation aiming primarily at the B2B area, the initial idea of establishing a cybernetic buying and selling platform has been depicted by several authors during the period long before the inception of the Internet or of e-commerce (McFarlan, 1984; Malone et al., 1987; Bakos, 1991). Over the past decade, e-marketplaces have experienced ups and downs, witnessed tremendous failures and successes, and undergone rapid changes in their business models to survive and grow in an unstable environment.

It is difficult to separate the e-marketplace evolving stages and accurately assess the number of e-marketplaces in each stage. Roughly, in the early stage between mid-1998 and

mid-2000, globally operated public e-marketplaces were estimated to be approximately 1,900 by Deloitte Research (Ganesh et al., 2004), and almost 75% of them were closed down or were acquired by others by 2004 as estimated by Forrester Research (Stockdate and Standing, 2002; Madanmohan, 2005). The e-marketplace business model centered on the e-catalogue brings buyers and sellers together to transact with one another. During the period between mid-2000 and mid-2004, it was estimated that known e-marketplaces worldwide numbered close to 4,000 (Lu and Antony, 2003), and only approximately less than 10% of these were expected to be successful as estimated by Forrester Research (Eisenmann, 2005). The dominant e-marketplace business models focus on coordinating information exchanges and requirements between buyers and sellers as well as offering negotiating and trading mechanisms. After mid-2004, the rapid growth of e-marketplaces was largely attributed to the increasing efficiency of Internet-enabled supply chains (Lu and Antony 2003; White and Daniel 2004; Yu, 2006). E-marketplace business models spotted light in underpinning buyer-supplier relationships and optimizing buyer-seller matching by sharing sale and inventory data.

Accordingly, the e-marketplace business model has evolved and been updated with the advancements in Internet technology and e-commerce. Today, Web-based e-marketplaces are widely deemed as a cybermarket space that facilitates and coordinates transaction processes between buyers and sellers, exchanges and analyzes specific business/industry information for trading partners, and offers and supports valued/customized services to e-marketplace participants (Yu, 2006). Although there is a large body of e-marketplace studies, and the literature regarding B2B e-marketplace adoption goes back to as early as the 1990s (Bakos, 1991; Lee and Clark, 1996), the literature directly relating to firm-level e-marketplaces adoption is not much and is briefly summarized in Table 1. Through comprehensively reviewing the literature on firm e-marketplace adoption, therefore, the determinants influencing firms to adopt e-marketplaces can generally be classified into the factors incurred from the e-marketplace itself (similar to the concept of “technology-push”), from the firm itself (similar to the concept of “need-pull”), and from the market itself (similar to the concept of economics such as network effects).



Table 1 Literature regarding B2B e-marketplace adoption

Sources	Theory	Study Type(Method)	Main Conclusions
Bakos (1991)	Economic theory	Non-empirical (From strategic viewpoint to analyze e-marketplace adoption)	Presented e-marketplaces' four economic characteristics (namely, network externalities, technology uncertainty, switching costs, and economies of scale and scope).
Lee and Clark (1996)	None	Non-empirical (Interviewing and studying two successful and two failure market-making firms)	Transaction risk, market power, standard, trust, and critical mass are barriers/facilitators for firm e-marketplace adoption.
Strader and Shaw (1999)	Economic theory	Empirical (Collecting data from 58 firm-level consumers)	Economic incentives from reduction of costs and creation of revenue encourage firms to participate in e-marketplaces.
Grewal et al. (2001)	Organizational motivation and ability	Empirical (Collecting data from 306 jewelry traders)	Organizational motivation and ability are two major antecedents of organizational participation in B2B e-marketplaces.
Gottschalk and Abrahamsen (2002)	None	Empirical (Collecting data from 65 companies in Norway)	Cost reduction holds higher influence on encouraging firm to adopt e-marketplace than revenue increase. Critical mass and fulfilling participants' needs enhance the probability of continued participation.
Stockdale and Standing (2002)	None	Non-empirical (Content analysis of over 100 articles)	Firm-level e-marketplace participation are influenced by two sources: company internal factors (i.e., motivation, size, degree of outsourcing) and e-marketplace business drivers and facilitators (e.g., ownership models, transaction mechanisms, critical mass).
Holzmuller and Schluchter (2002)	None	Empirical (Collecting data from 94 experts in Germany)	Participants using B2B e-marketplaces are motivated by increasing their competitiveness such as improving their business processes. The selecting criteria about BEB e-marketplace rely on potential benefits, kind of goods, and market structure.
White and Daniel (2004)	None	Non-empirical (Interviewing managers of healthcare e-marketplaces in UK, and suppliers and buyers in those e-marketplaces)	The findings revealed that the adoption of e-marketplaces has led to a deepening of supplier-buyer relationships, and reduction in the errors in orders, the cost in purchasing processes, and the time in queries.
Stockdale and Standing (2004)	none	Non-empirical (Literature review from the perspective of small to medium-sized firms)	The initiatives regarding firm e-marketplace adoption come from the push from major trading partners and the motivation for expanding their traditional customer bases.
Ganesh et al. (2004)	Theory on adaptive strategies and paths	Non-empirical (Interviewing three firms' top management)	The adaptation-evolution strategies are significantly influenced by network effects such as supplier enablement and participation, path dependency, asset specificity, privacy issues, technology learning, and price competition and commoditization.

Driedonks et al. (2005)	Market theory and DOI	Non-empirical (Data collected from interviews in a B2B e-marketplace case)	Economic factors do not fully explain the e-marketplace adoption, relative advantage does not relate to the adoption, and the social viewpoint can help explain part of the reason on no adoption.
Ho et al. (2005)	none	Non-empirical (Literature review from the academic and practical perspective)	Factors affecting firm e-marketplace adoption fall on four dimensions: market and customer, technology and capital, organization and collaboration, and basic infrastructure.
Zhu et al. (2006)	Economic theory	Empirical (Collecting data from 1394 respondents in 10 countries)	Network effects, expected benefits, and adoption costs prominently impact firm's migration to open inter-organizational systems (e.g., e-marketplaces).

3. RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT

As depicted in Fig. 1, Rogers separated the innovation process into five phases that were simplified by Zmud into two stages of initiation and implementation, as reported by Damanpour (1991) and Aguila-Obra and Padilla-Melendez (2006). Accordingly, this work presents a two-stage (prior-decision and post-decision) model to investigate enterprises' e-marketplace adoption. The goal of which was to verify whether or not enterprises' e-marketplace adoption can be effectively explained by TAM at the prior-decision stage, and whether or not network externalities and transition costs influence enterprises' e-marketplace adoption at both prior-decision and post-decision stages. The two-stage research model is illustrated in Figs. 3 and 4 respectively, in which the hypothesis will be explained later on. With reference to Chau and Tam's (2000) "technology-push, need-pull" perspective in the organizational adoption of open systems, usefulness and ease-of-use can be deemed as technology-push factors, while IC-of-Firm and ECE-of-Firm (will be defined and discussed later on) can be classified into need-pull factors in an organizational e-marketplace adoption scenario.

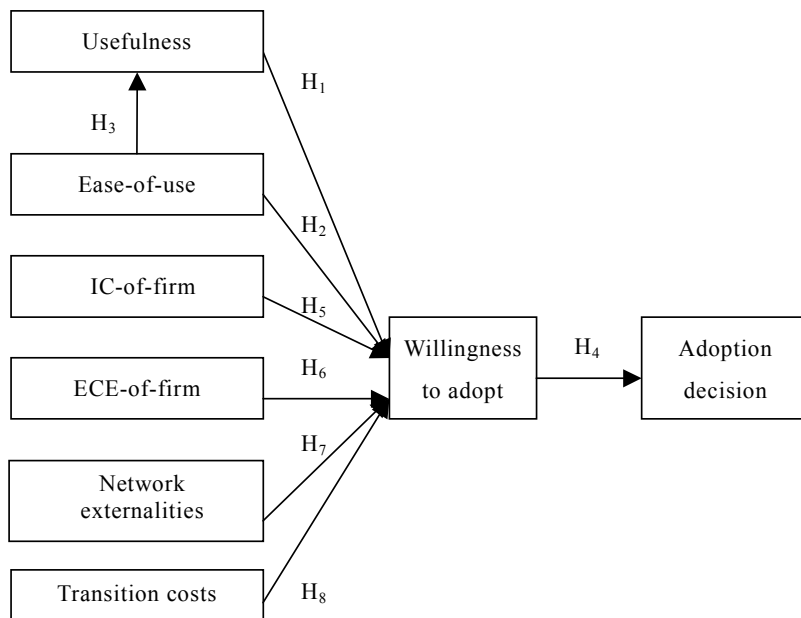


Fig. 3 The research model – Prior-decision stage

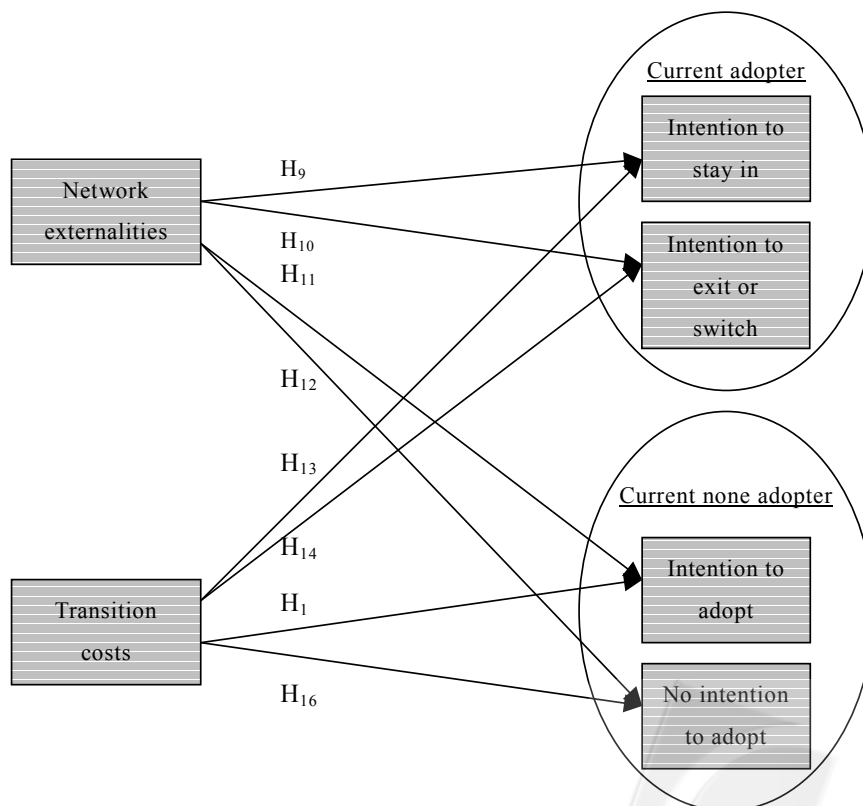


Fig. 4 Research model – Post-decision stage

Just as the adoption of B2C e-commerce, participants accept B2B e-marketplaces only when they can benefit from these, which is usually by saving or making money. Therefore, to a business, usefulness in terms of e-marketplace adoption refers to how many benefits can be obtained and/or how much costs can be reduced by using e-marketplaces. Meanwhile, ease-of-use refers to minimal effort such as time, capital, training, and so on as a requirement in investing. The idea of using TAM to understand organizational-level technology adoption is not totally novel (Zain et al., 2005; Gengatharen and Standing, 2005). By surveying 329 managers and executives in Malaysian manufacturing firms based on TAM, Zain et al. (2005) concluded that usefulness and ease-of-use significantly affect firm-level IT adoption. Since this study is also grounded in TAM, the following four hypotheses are posited:

- H1: Usefulness significantly influences a firm management's willingness to adopt an e-marketplace.
- H2: Ease-of-use significantly influences a firm management's willingness to adopt an e-marketplace.
- H3: Ease-of-use significantly influences usefulness.
- H4: The firm management's willingness to adopt an e-marketplace significantly influences its actual decision in e-marketplace adoption.

A firm management's willingness represents the whole organizational-level willingness in this study because the organizational-level perception is a collective perception by an organization's decision-making members (Frambach and Schillewaert, 2002), in which group decision is concluded by decision makers' joint preference (Fisher and Ellis, 1990). Although TAM is quite simple and employs only two constructs—usefulness and ease-of-use—instead of many constructs to reasonably explain individual computer adoption, many studies suggest that a specific technology product must include additional variables into the original TAM in order to enhance its applicability and explanatory ability (Davis, 1993; Hu et al., 1999; Legris et al., 2003; Wu and Wang, 2005). Therefore, not only is the survey unit the firm instead of the individual in this study, but additional crucial constructs drawn from relevant literature are also necessary and will be analyzed next.

Since e-marketplaces may be regarded as having evolved from electronic data interchange (EDI) systems that originated from the needs of e-procurement (Ganesh et al., 2004) and are fully supported by IT, IS, and communication technologies (Guilherme and Aisbett, 2003), those variables influencing e-marketplace adoption may refer to the literature on the adoption of e-procurement (Aisbett et al., 2005), IT (Davis, 1989; Karahanna et al., 1999), IS (O' Callaghan et al., 1992; Thong, 1999; Gefen and Straub, 2000), EDI (Premkumar et al., 1994; Angeles, 2000), e-commerce (Poon and Swatman,

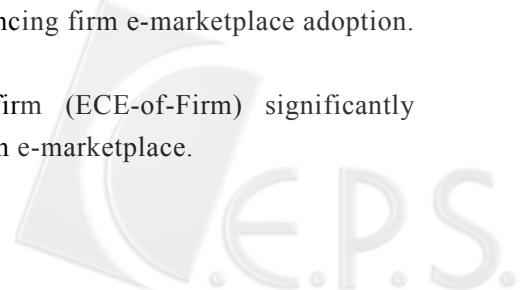
1999; Kendall et al., 2001; Travica, 2002), telecommunication (Grover and Goslar, 1993; Pollard, 2003), and Internet-related technologies (Slade and Van Akkeren, 2002; King and Gribbins, 2003).

In Grover and Goslar's study (1993), they identified that (1) firm scale will influence firm decisions regarding new technology adoption, (2) the extent of standardization and documentation in company workflow also influences the likelihood of new technology adoption, and (3) companies that have well-established IS are more willing or ready to adopt new technologies. By surveying 166 businesses and examining company decisions to adopt new IT, Thong and Yap (1995) and Thong (1999) discovered that (1) larger companies are more likely to adopt new IT; (2) companies that depend on complete, rapid, and reliable information exchange are likely to adopt new IT; (3) the greater the compatibility between the new IT and the existing company workflow and systems, the more likely the adoption of the new IT; and (4) if an enterprise's decision-making team is dispersed globally rather than regionally, the company is more likely to adopt new technologies to facilitate effective and efficient information flow. Accordingly, these findings demonstrate that the internal characteristics of an enterprise may be treated as an antecedent of influencing the firm's e-marketplace adoption. Consequently, the following hypothesis is posited:

H5: The internal characteristics of a firm (IC-of-Firm) significantly influence its management's willingness to adopt an e-marketplace.

By researching 1,242 agencies to determine the influence on the decision to adopt EDI, O'Callaghan et al. (1992) identified that adoption by important customers within the supply chain or by other companies in the same industry and governmental or regulatory incentives are the key external influences on EDI adoption decision. Moreover, Grover and Goslar (1993) surveyed 154 firms and found that the stability of the enterprise's competitive environment has an impact on the firm's intention to adopt or not to adopt new technologies. If the competitive environment is complicated and volatile, then firms are generally aware of innovation and new technology adoption to remain competitive. Many studies also pointed out that B2B e-marketplaces have evidently played a central role in facilitating e-supply chain development (Singh et al., 2005; Lu and Antony, 2003), and in fact, it is deemed as one of the most significant industry structure changes since the Industrial Revolution (Rayport and Sviokla, 1994; Ratnasingam et al., 2005). To sum up, these findings lead to the conclusion that the external competitive environment of a company may become an important antecedent of influencing firm e-marketplace adoption. Thus, the following hypothesis is posited:

H6: The external competitive environment of a firm (ECE-of-Firm) significantly influences its management's willingness to adopt an e-marketplace.



Drawing upon the economic perspective which views the adoption decision in terms of benefits and costs, network externalities (or called network effects) is deemed as a key factor influencing the adoption of e-marketplaces (Bakos, 1991; Shapiro and Varian, 1998; Frambach and Schillewaert, 2002; Zhu et al., 2006). In a network market comprised of products with network externalities, the value/effectiveness of a product is always enhanced as long as new consumers are entering the market. In other words, an end-consumer is considered to have a network externality on the behaviors of other end-consumers as long as his/her actions can directly impact the economic utility of other end-consumers (Allen, 1988; Brynjolfsson and Kemerer, 1996; Au and Kauffman, 2001; Lee et al., 2003). Therefore, the following hypothesis is posited:

H7: Network externalities significantly influence a firm management's willingness to adopt an e-marketplace.

Drawing upon the path dependence perspective which views the adoption decision with a first comer advantage, a large body of literature on technology adoption (Fabiani et al., 2005) has illustrated that for a variety of reasons, a new technology (even if superior to old ones) requires time before taking most of the market share. Accordingly, old technologies (even if inferior to new ones) might have competitive advantages only if they occupied the market first and built up switching cost barriers between old technologies and new technologies. Given an environment where IT evolves stochastically over time, potential users choosing among IT-based products must consider whether or not the available product today will not be an obsolete one in the future. This is particularly important when the choice is largely irreversible. Hence, in reality, a transition cost occurs as long as there are users migrating from the current product to a new one. Accordingly, the following hypothesis is posited:

H8: Transition costs significantly influence a firm management's willingness to adopt an e-marketplace.

According to the two-stage model (Fig. 3-4) rooted from DOI, information about the innovation received by end-consumers at the prior-decision stage will shape the end-consumer's favorable or unfavorable decision regarding the adoption of an innovation (Rogers, 2003). The post-decision stage occurs immediately after end-consumers make a choice about putting an innovation into use or not. During the post-decision stage, end-consumers seek reinforcement for their previous decision and may reverse their choice if exposed to dissonant messages regarding the innovation (Rogers, 2003). That is, non-adopters may either continuously reject using the innovation or choose to adopt the innovation. Non-adopters accept an innovation if they are motivated to do so after obtaining further information or evidence that can influence their original decision of not adopting the innovation. Conversely, adopters may continuously use the innovation or

alternatively reject using it at the post-decision stage. As a result, the following hypotheses are posited:

- H9: Network externalities significantly influence adopting firms to continue using the current e-marketplace.
- H10: Network externalities significantly influence adopting firms to switch to or exit from the current e-marketplaces.
- H11: Network externalities significantly influence non-adopting firms to plan to use an e-marketplace.
- H12: Network externalities significantly influence non-adopting firms to continue not to use any e-marketplace.
- H13: Transition costs significantly influence adopting firms to continue using the current e-marketplace.
- H14: Transition costs significantly influence adopting firms to switch to or exit from the current e-marketplaces.
- H15: Transition costs significantly influence non-adopting firms to plan to use an e-marketplace.
- H16: Transition costs significantly influence non-adopting firms to continue not to use any e-marketplace.

4. QUESTIONNAIRE DESIGN AND DATA COLLECTION

4.1 Construct Operationalizations

To operationalize the constructs of usefulness, ease-of-use, IC-of-Firm, ECE-of-Firm, network externalities, and transition costs displayed in Fig. 3, survey items were adapted from questionnaires used by the extant literature (Chau and Tam, 2000). Accordingly, usefulness was measured by eight items adapted from the works of Davis (1989), Davis et al.(1989), O' Callaghan et al. (1992), Premkumar et al. (1994), Premkumar and Roberts (1995), Thong and Yap (1995), Thong (1999), and Gottschalk and Abrahamsen (2002). The respondents were asked to give their level of agreement or disagreement with the following eight potential benefits of adopting the e-marketplace: 1. Beneficial trading relationships with partners; 2. Enhanced collaboration with partners; 3. Increased competitive advantages; 4. Increased variety of trade; 5. Increased diversity of trade; 6. Increased speed of trade; 7. Increased chances of trade, and 8. Decreased cost of trade.

Ease-of-use was operationalized with four items drawn from Davis (1989), Davis et al. (1989), O' Callaghan et al. (1992), Premkumar et al. (1994), Premkumar and Roberts (1995), Thong and Yap (1995), Thong (1999), and Gottschalk and Abrahamsen (2002). The respondents were asked to indicate the extent to which they agreed with the statements relating to e-marketplace adoption, which are as follows: 1. E-marketplace adoption requires a large capital investment in infrastructure building; 2. E-marketplace adoption requires a large time investment in process restructuring; 3. E-marketplace adoption requires a large effort investment in training, and 4. E-marketplace adoption causes a large waste of investment in existing IS.

The IC-of-Firm was assessed by 12 items adapted from the works of O' Callaghan et al. (1992), Grover and Goslar (1993), Thong and Yap (1995), Thong (1999), and Gottschalk and Abrahamsen (2002). The respondents were asked to express their degree of agreement to the following questions using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree): 1. A majority of data communication tasks are processed via IS; 2. A majority of business reports are generated by IS; 3. A majority of problems are communicated via IS; 4. A majority of business processes are interconnected with IS; 5. All trade processes are clear and distinct; 6. All trade processes are documented; 7. All questions regarding trade processes can be answered from the documentation; 8. All trade processes are easy to computerize; 9. The timing for locating/attracting prospective traders is absolutely important; 10. The timing for exchanging offerings with traders is absolutely important; 11. The timing for instant communication with traders is absolutely important, and 12. The timing for completing a transaction is absolutely important.

Based on the works of O' Callaghan et al. (1992), Grover and Goslar (1993), and Gottschalk and Abrahamsen (2002), ECE-of-Firm was operationalized by asking the respondents the following 13 questions: 1. A majority of leading enterprises within the supply chain use an e-marketplace; 2. A majority of trading parties within the supply chain use an e-marketplace; 3. Using an e-marketplace can benefit the trading relationship with partners; 4. Using an e-marketplace can enhance the collaboration with partners; 5. A majority of peer competitors have adopted e-marketplaces; 6. Using an e-marketplace is helpful in gaining competitive advantages; 7. The government is actively promoting e-marketplaces; 8. Using an e-marketplace is easier to get government grants; 9. The transparency of market information is very high in your industry; 10. The transparency of trading party information is very high in your industry; 11. The transparency of product information is very high in your industry; 12. The transparency of procurement information is very high in your industry; and 13. The transparency of competition information is very high in your industry.

Network externalities were measured using six items from the works of Farrell and Saloner (1985, 1986), Katz and Carl (1985, 1992), and Sohen et al. (2002). The six questions, based on a seven-point Likert scale with the items ranging from strongly disagree to strongly agree, are described as follows:

If more and more companies join the same e-marketplace as you do or will, then your company will: 1. obtain increased quality of service; 2. obtain increased variety of service; 3. obtain increased response speed of service; 4. obtain increased value of information; 5. obtain increased chances of trade, and 6. obtain increased ratio of benefits over costs.

Referring to the works of Heide and Weiss (1993), Klemperer (1995), and Shapiro and Varian (1998), the construct of transition costs was operationalized by asking the respondents to assess the following statements: 1. Adopting an e-marketplace requires a large capital investment in infrastructure; 2. Adopting an e-marketplace requires a large time investment in process reengineering; 3. Adopting an e-marketplace requires a large effort investment in training; 4. Adopting an e-marketplace incurs a large waste of investment in the existing IS; 5. Switching to another e-marketplace causes a large waste of investment in the existing e-marketplace; 6. Switching to another e-marketplace requires much time and effort, and 7. Switching to another e-marketplace causes a large loss of benefit accumulated under existing e-marketplace (e.g., discounts, member credits, bonuses, or other incentives).

4.2 Data Collection

Building on the above construct of operationalization drawn from related literature, the questionnaire comprises of two sections. The first section contains 51 questions that are assessed using a Likert-type scale with items ranging from 1 (strongly disagree) to 7 (strongly agree), and collects the assessment of six constructs and the willingness of adoption by the responding companies. The second section, containing 12 questions, gathers basic data on each respondent company and aims to determine the intention of each respondent firm in adopting an e-marketplace, whether or not the responding firm has joined an e-marketplace, what type of e-marketplace the respondent firms have joined, whether or not those adopting firms plan to continue using, switch, or stop using e-marketplaces, and whether or not those non-adopting firms plan to adopt or continue not using e-marketplaces.

Before officially sending out the questionnaires to the respondents, a pretest was conducted on scholars and participants of e-marketplaces in order to reword and refine the survey questions. Instead of mailing out the questionnaires, the pretest was conducted via face-to-face interviews to ensure that all questions and terms used in the questionnaire can be clearly understood by the respondents. Like dominant organizational-level survey

studies (Chau and Tam, 2000; Grewal et al., 2001; Lucchetti and Sterlacchini, 2004; Ganesh et al., 2004; Zhu et al., 2006; Aguila-Obra and Padilla-Melendez, 2006; Teo, 2007), the key informant method was used in this study. Hence, concise statements describing the purpose of the research were given at the beginning of the questionnaire, and executives or managers who are familiar with e-marketplace operation were invited to complete the questionnaire. To validate the responding enterprises with attention to the procurement or sales manager in charge of e-marketplace adoption, 1500 large Taiwanese firms were randomly selected from the Top 5000 Company List published by China Credit Information Service LTD (<http://www.credit.com.tw/newweb/DB/index.htm>).

Among 295 responses, 202 were considered valid, which corresponded to a 13.5% valid response rate. As compared to survey return rates ranging from 11.5% to 16.5% in empirical industry studies in Taiwan within the last five years (Yu, 2006), a 13.5% valid response rate generated from an overall 19.7% response rate was compatible with the recent surveys on Taiwanese firms. The profile of 202 surveying firms is briefly profiled in Table 2. Notably, the figures in Table 2 reveals that over 80% of the adopting firms reported that the revenue generated by the use of e-marketplaces comprised of less than 30% of their total revenue, but only one-third of firms said that the benefits brought by e-marketplaces were less than expected. This phenomenon may imply that Taiwanese firms consider e-marketplaces as just one of their trading channels at the time this survey was conducted.

Table 2 Respondent profile

Category	Item	Mean or frequency	Std. dev. or %
Respondent Firms	Number of employees (person)	1,069	2,494
	Capital (millions of NT\$*)	2,067	2,902
	Revenue (millions of NT\$*)	7,690	37,705
Industry Type	Chemistry, cement, petrochemistry	22	10.9%
	Semiconductor	12	5.9%
	Textile	14	6.9%
	Optics, Machinery, and Metal	28	13.9%
	Electronics and Information	63	31.2%
	Automobile	15	7.4%
	Steel	12	5.9%
	Medicine	5	2.5%
	Food	7	3.5%
	Others	24	11.9%
Percentage of Revenue Generated from e-Marketplaces for Adopted Firms	< 10%	39	41.49%
	10%~20%	15	15.96%
	20%~30%	23	24.47%
	30%~40%	5	5.32%

	40%~50%	3	3.19%
	50%~60%	2	2.13%
	60%~70%	3	3.19%
	70%~80%	2	2.13%
	80%~90%	2	2.13%
	>90%	0	0%
	Benefits gained less than expected	30	31.71%
Benefits gained versus expected	Benefits gained equal to expected	23	24.39%
	Benefits gained more than expected	41	43.90%

5. RELIABILITY, VALIDITY, AND HYPOTHESES TEST

Since the survey questions were constructed based on empirical studies, the content validity was verified. Meanwhile, the construct validity was examined by factor analysis, and the consistency reliability was measured using the Cronbach alphas. Therefore, following the factor analysis through SPSS 12.0 software, six constructs and nine sub-constructs are identified as shown in Table 3. Based on the judging criterion, questions 4, 12, and 44 were discarded. The judging criterion is for each sorted question pertaining to each factor in which the corresponding intra-factor loading must exceed 0.6, and the difference between the corresponding intra-factor loading and each other-factor loading must exceed 0.3. Notably, each sub-construct name is given by the one best reflecting the context of the corresponding items. The computed Cronbach alpha coefficients for all dimensions exceeded 0.78, as shown in the last column of Table 3, indicating that the content consistency between the questions relating to each of the constructs is very high. Additionally, the inter-item correlation matrixes under each construct were examined and were all found to be very significant ($p < 0.01$). As a result, the above statistical analysis demonstrates that the survey has good predictive, convergent, and discriminant properties (Davis et al., 1989; Adams et al., 1992).

Table 3 Summary of factor analysis

Construct	Named dimension	Q#	Factor loading	Eigenvalue	Cumulated Variance	Cronbach α	
Usefulness	Upgrade transaction efficiency	Q6	0.930	3.282	46.89%	0.910	0.87
		Q7	0.903				
		Q5	0.882				
		Q8	0.842				
	Expand transaction opportunities	Q2	0.958	2.585	83.82%	0.895	
		Q1	0.936				
Q3		0.830					
Ease-of-use		Q10	0.936	2.557	85.23%	0.91	
		Q11	0.926				
		Q9	0.907				

IC-of-firm	Degree of workflow speed (Speed)	Q21	0.840	3.085	25.712%	0.875	0.78
		Q22	0.839				
		Q23	0.812				
		Q24	0.796				
	Degree of workflow standardization (Standardization)	Q17	0.806	2.837	49.351%	0.825	
		Q18	0.772				
		Q19	0.738				
		Q20	0.732				
	Extent of workflow computerization (Computerization)	Q13	0.847	2.552	70.618%	0.840	
		Q14	0.783				
		Q15	0.712				
		Q16	0.641				
ECE-of-firm	Stimulation from partners, competitors, or government (Peers and Government)	Q25	0.773	5.285	40.652%	0.927	0.91
		Q26	0.829				
		Q27	0.881				
		Q28	0.871				
		Q29	0.805				
		Q30	0.778				
	Level of transparency of a competitive environment (Industry Transparency)	Q31	0.741	4.076	72.007%	0.935	
		Q32	0.754				
		Q33	0.886				
		Q34	0.906				
Network externalities		Q35	0.906	3.976	79.92%	0.94	
		Q36	0.828				
		Q37	0.874				
		Q39	0.894				
		Q40	0.930				
Transition cost	Sunk cost	Q41	0.873	4.342	43.552%	0.933	0.89
		Q42	0.886				
		Q43	0.885				
		Q44	0.854				
	Switch loss	Q45	0.853	1.148	78.417%	0.941	
		Q46	0.905				
		Q47	0.895				
		Q48	0.651				
		Q49	0.853				
		Q50	0.755				
		Q51	0.871				

From the research model depicted in Fig. 3, it looks reasonable to apply the structural equation model with software like LISREL for hypothesis testing. However, since there is lack of sufficient literature integrating TAM and DOI as a research ground to investigate firm-level technology adoption, this work conducts the data analysis through factor analysis for the construct validity, and regression analysis for the hypothesis testing to examine the presented model. We also noted that Davis, who first presented TAM in 1986, has long used the regression method to examine the hypotheses grounded from TAM, extended TAM, TAM 2, and unified TAM (Davis, 1989; Davis et al., 1989; Davis, 1993;

Venkatesh and Davis, 1996 and 2000; Venkatesh et al., 2003). This might be attributed to the finding that the regression technique not only can use a limited number of predictor variables to clarify the tendency of the response variable in a systematic fashion (Neter et al., 1999), but can also quantify the relationship between the dependent and independent variables as well as the explanatory power of the entire model. As a result, Hypotheses 1-3 and 5-8 were tested via a linear regression model. Since “firm decision on e-marketplace adoption,” “adopting firms continue to use the current e-marketplaces,” “adopting firms switch to or exit from the current e-marketplaces,” “non-adopting firms plan to use e-marketplaces,” and “non-adopting firms continue not to use any e-marketplaces” are dichotomous variables, Hypothesis 4 and Hypotheses 9-16 were verified using t-test.

Table 4 Summary of regression-test results

Dependent variables	Independent variables	Standardized beta value	t-value	F-value	Adjusted R ²
Management willingness to adopt	Usefulness	0.141	3.117**(H1)	260.128***	0.860
	Ease-of-use	0.895	17.830*** (H2)		
	IC-of-firm	0.104	3.404** (H5)		
	ECE-of-firm	0.664	12.404*** (H6)		
	Network externalities	0.054	0.894 (H7)		
	Transition costs	0.032	0.648 (H8)		
Management willingness to adopt	Usefulness	0.148	3.165** (H1)	310.243***	0.863
	Ease-of-use	0.869	28.830*** (H2)		
	IC-of-firm	0.106	3.476** (H5)		
	ECE-of-firm	0.636	15.117*** (H6)		
Usefulness	Ease-of-use	0.471	7.549*** (H3)	56.992***	0.218
Management willingness to adopt	Usefulness Ease-of-use			235.108***	0.691
Management willingness to adopt	IC-of-firm ECE-of-firm			34.495***	0.254

*significant at 0.05 level, ** significant at 0.01 level, *** significant at 0.001 level

Table 5 T-test results

	Adopt decision								t-Value
	Yes				No				
Management willingness to adopt	4.0174				3.7425				3.924*** (H4)
	Adopting-firm				Non-adopting-firm				t-value
	Continuous usage		Planning to exit or switch		Continuous no usage		Planning to use		
	Yes	No	Yes	No	Yes	No	Yes	No	

Network externalities	5.357	4.756	N/A ¹		N/A			2.245* (H9)	
	N/A		4.756	5.350				-2.206* (H10)	
	N/A				5.355	5.014	N/A		1.354 (H11)
					N/A		5.047	5.015	0.142 (H12)
Transition costs	N/A				4.774	4.736	N/A		0.162 (H13)
					N/A		4.772	4.615	0.765 (H14)
	4.844	4.836	N/A		N/A			0.024 (H15)	
	N/A		4.836	4.819				0.055 (H16)	

N/A means Not Applicable; *** P value < 0.001; ** P value < 0.01; * P value < 0.05

The second row in Table 4 demonstrates that the proposed extended TAM predicted 86% of the variance observed in firm managements' willingness to adopt e-marketplaces. After removing two statistically insignificant constructs of network externalities and transition costs, the presented extended TAM and the regression testing results are shown in the third row of Table 4. We were curious to know whether or not the original TAM containing only usefulness and ease-of-use can also effectively explain firm e-marketplace adoption. As such, the regression results as displayed in the fifth row of Table 4 revealed that using only two constructs, usefulness and ease-of-use, can explain 69.1% of the variance in firm managements' willingness to adopt e-marketplaces. For TAM's counterpart, the IC-of-firm and ECE-of-firm only provide 25.4% variance as can be seen from the sixth row of Table 4. This may imply that strong stakeholders' opinions have made a contribution to the group decisions in our sample.

Overall speaking, Hypotheses 1-3 and 5-6 were accepted, while Hypotheses 7-8 were rejected. This is in contrast to prevailing individual-level TAM studies in which the variance explained by usefulness and ease-of-use in people's willingness to adopt IT is usually less than 40% (Hung et al., 2005). The findings from the current empirical study have demonstrated that the TAM explanatory power in firm-level technology adoption is stronger than that in individual-level technology adoption. A plausible explanation might be that corporate decisions are made by a group that deliberates its needs during collective meetings (need-pull), while individual decision is usually made in a more emotional environment and a shorter process/time (technology-push). That is, since the process of forming the whole corporate decision is much longer and may be subjected to multiple stakeholders' experiences and judgments such as usefulness (how many benefits can be

brought to the firm by adopting the new product) and ease-of-use (how much effort is required for the firm to adopt the new product), need-pull factors hold more influential strength than technology-push factors at the firm-level decision regarding the adoption of a new product.

The figures in Table 5 reveal that only Hypotheses 4 and 9-10 were accepted, while Hypotheses 11-16 were rejected. This means that only adopting firms will be influenced by network externalities when intending to stay in, switch to another one, or exit from current e-marketplaces. For non-adopting firms, neither network externalities nor transition costs will impact their decision in continuously not using e-marketplaces or planning to use. For transition costs, this kind of economic factor does not play an influential role in the decision of both adopting firms and non-adopting firms at the implementation stage in order to change their original decisions. Regarding Hypothesis 4, a logical regression analysis is further conducted as listed in Table 6. Both Tables 5 and 6 confirmed that firm managements' willingness to adopt e-marketplaces significantly affects their decision to do so, which is consistent with individual-level TAM-based literature's conclusion that individual willingness extensively influences the decision to adopt e-marketplaces.

Table 6 Summary of logical regression test for Hypothesis 4

Dependent variables	Independent variables	Beta value	S.E.	Wald chi-square	Model summary
Adoption decision	Management willingness to adopt	1.176	0.323	13.278***	$X^2 (df=1) = 15.187$, P-value=0.000, -2 log likelihood = 258.794, Overall correct classification rate = 62.1% (60.6% for adopters and 63.5% for non-adopters)

6. IMPLICATIONS AND DISCUSSIONS

Five implications for business and two theoretical implications are drawn from this investigation, which are briefly discussed in the following two subsections.

6.1 Business Implications

Since a large body of literature and many industry reports reveal that e-marketplaces had experienced a period of struggle before stably growing, it is important to understand enterprise e-marketplace adoption from a theoretical basis. By surveying 202 large Taiwanese firms, two important findings are first derived. First, the extended TAM involving four constructs of usefulness, ease-of-use, IC-of-Firm, and ECE-of-Firm can explain 86.3% of the variance in firm managements' willingness to adopt e-marketplaces. Second, as displayed in the third row of Table 4, ease-of-use (t-value = 28.830) and

ECE-of-Firm (t -value = 15.117) extremely significantly impact firms' management to adopt e-marketplaces (p -value = 0.000). Meanwhile, usefulness (t -value = 3.165) and IC-of-Firm (t -value = 3.476) only very significantly impact firms' management willingness to adopt e-marketplaces (p -value < 0.01). As a result, two business implications are made as follows:

The first business implication

Evidence from the study concluded that in promoting e-marketplace adoption by firms, minimizing the required effort (i.e., time, money, and training investment for a firm to adopt the product) is more critical than usefulness (i.e., how many benefits can be obtained and how much costs can be reduced by adopting the product). Therefore, for product owners who desire to shorten the struggling period and increase the adoption rate, the promotional activity should emphasize on ease-of-use instead of usefulness during the launching of a new IT product.

The second business implication

Evidence from the study concluded that the impact from the external firm environment holds a more powerful influence on firm e-marketplace adoption than that from the internal firm environment. Consequently, the second business implication is that industrial product marketers should put those companies experiencing instability or stiff competition on the first-priority list of prospective customers when marketing a new IT product. On the other hand, those companies having higher readiness in terms of their internal characteristics could be placed in the second-priority list of potential consumers.

Notably, Table 6 shows that the overall correct classification rate is only 62.1%. Likewise, Table 4 also implies that there exists around 13.7% of unexplained variance in firm managements' willingness to adopt e-marketplaces. Accordingly, a lot of uncertainties still exist during the time lag from "aware of e-marketplace" to "intention to use" and from "intention to use" to "actual use," which leads to the third business implication below.

The third business implication

Some uncertainties still exist in the corporate decision made by the management from "willingness to adopt" to "actual adoption." Furthermore, some uncovered factors also exist in influencing firms' willingness to adopt e-marketplaces. Accordingly, the third business implication deduces two foremost marketing steps. First, it is essential to determine those companies which have higher willingness to adopt the product before devising a marketing or R&D program. Second, priority must be given to gathering the specific concerns of firms which have higher willingness to adopt the new product.

Consequently, these concerns in the R&D stage must be resolved, or customized selling programs must be devised in order to address firms' concerns at the marketing stage.

Table 4 reveals that network externalities significantly affect adopting firms' decision to stay in a current e-marketplace, and to exit from or switch to another one, which is a valuable clue used to enhance firm-level consumers' loyalty. That is, network externalities can be employed as enhancing factors for Web-based service marketers to retain current customers. Notably, some studies (Frambach and Schillewaert, 2002; Driedonks et al., 2005) combine the concept of network externalities and critical mass together. That is, the more businesses use e-marketplace, the higher is the value of e-marketplace in the eyes of enterprises, and vice versa. As a result, we have the fourth implication for business which is as follows.

The fourth business implication

Evidence from the study concluded that participants may leave current e-marketplaces when influenced by network externalities, or may have enhanced current loyalty as influenced by network externalities. Accordingly, the fourth business implication is that after attracting firms to use the product by either technology-pull (usefulness and ease-of-use) or need-push (external competitive environment and internal enterprise characteristics), quickly increasing the member size over the critical mass and maintain the status quo are crucial to making adopters continuously use the e-marketplace.

Unlike the antecedents to e-marketplaces which lie in the domain of closed inter-organizational systems such as EDI requiring a relatively high cost of participation in or switching to such networks, no switching barriers exist in the e-marketplace sector. During the period of e-marketplace emergence, switching barriers did exist because Internet-based technologies were not well prepared at that time (Daniel et al., 2004). However, at present, the switching costs incurred by technology are no longer a big deal as concluded by the current empirical study. Table 5 also clearly reveals that transition cost does not play an important role in either adopting or non-adopting firms' decision toward abandoning/switching e-marketplaces, as well as firms' e-marketplace adoption at the prior-decision stage. As a result, the fifth business implication is formed, which is as follows.

The fifth business implication

Unlike EDI which is built on a closed network without a standard exchange format, participating in an e-marketplace is not an irreversible choice and does not incur a technology-switch barrier since e-marketplaces are built on open Internet technology using compatible format and with a usually annual-based membership fee. Hence, the fifth business implication is as follows. For as long as firms realize tangible benefits in terms of

prospective trade ventures and size to be gained from switching to another e-marketplace, the transition cost, such as contract termination cost, training cost, loss of accumulated discounts, bonuses, member credits, or other incentives, will not be a showstopper. In contrast, as long as the concrete benefits to be gained from joining e-marketplaces are not significant, a non-adopting firm will remain at a standstill and will be reluctant to adopt e-marketplace in the near future.

From the strategic perspective, the first and second business implications are useful for quickly increasing the number of e-marketplace participants up to the critical mass, which is an important factor for an e-marketplace to succeed (Driedonks et al., 2005). Two foremost marketing steps derived from the third business implication may be considered as a pre-adoption business strategy because they give industrial product marketers practical insights for conducting promotion events to attract prospective (new) customers. Meanwhile, the fourth business implication is useful for enhancing current (old) customers' loyalty, which is deemed as a post-adoption business strategy. Regarding the fifth business implication, two points can be derived. First, early commitment to an e-marketplace does not deprive a firm of subsequent opportunities to join other e-marketplaces. Second, provided that sufficient benefits can be gained by joining an e-marketplace, the transition cost is considered trivial for enterprises. By putting the above five business implications together, these findings may give e-marketplace owners valuable insights in designing an effective business model for competitiveness and success.

6.2 Theoretical Implications

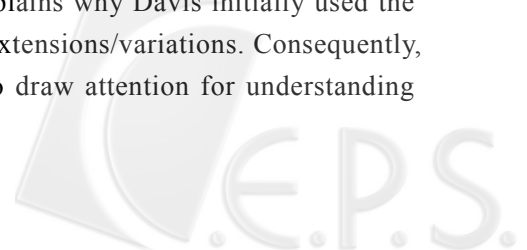
By surveying 94 firms that had adopted e-marketplaces and 108 firms that had not yet adopted e-marketplaces, this empirical study has verified that two economic factors (network externalities and transition costs) do not statistically significantly influence firm e-marketplace adoption at the prior-decision stage. Notably, one of two economic factors, network externality, does influence adopting firms' decision to switch to another e-marketplace or exit from the current one at the post-decision stage, while the transition cost is still ineffective in influencing the decision of either adopting or non-adopting firms to alter their initial technology adoption choices at the post-decision stage. Restated, network externalities greatly impact adopting firms' previous choice, while non-adopting firms' original decision will not be influenced by both transition costs and network externalities. Nevertheless, the first theoretical implication is that network externalities may play a role in the enhancement of variables, and no switching barriers exist in the e-marketplace sector. Moreover, the participants will either switch to another e-marketplace or simply exit from the current one if they realize that they cannot benefit from the current e-marketplace. This empirical finding might be considered as an

economic-theory basis which can be applied to explain other network markets' industrial products. Certainly, more empirical studies to support/examine the inferred implication are absolutely necessary.

Compared with individual-level TAM studies in which the variance explained by usefulness and ease-of-use in individual willingness to adopt IT is usually less than 40% (Hung et al., 2005), the findings from this empirical study have demonstrated that industrial products' usefulness and ease-of-use not only have strong influences, but these influences are even higher than those of selling products made available to the general public. As displayed in the fifth row of Table 4, 69.1% of the variance in firm managements' willingness to adopt e-marketplaces can be explained by usefulness and ease-of-use. Therefore, concluding from this empirical study, the second theoretical implication is that TAM not only effectively foresees individual-level e-marketplace decision but is also quite useful in predicting firm-level technology adoption (even generated a higher explanatory power in firm-level than individual-level technology adoption). This may be attributed to the fact that collective decision is more rational than single-person decision. Moreover, individual-user decision is more easily influenced by emotional factors and is usually made in a relatively short time. In contrast, a collective decision in an enterprise usually involves less subjectivity and emotion. Since TAM is adopted from the theory of reasoned action, and an e-marketplace involves IT-based products, the finding might be generalized as a theoretical basis for general organizational-level technology adoption. Certainly, more empirical studies to support/examine the presented research model are required.

7. CONCLUSIONS AND FUTURE RESEARCH

Since the current literature lacks empirical evidence to determine the effect of TAM, network externalities, and transition costs on firm e-marketplace adoption, this is the first work that took DOI, TAM, network externalities, and transition costs into a two-stage theoretical structure to investigate firm-level technology adoption. The results show that network externality and transition costs may fit some Web-based services or other open inter-organizational systems (Zhu et al., 2006), but they may not completely fit into firm e-marketplace adoption. As we know, the statistical severance of the structural equation model is more rigorous than that of the regression model and t-value test (Joreskog and Sorbom, 1993; Gefen and Straub, 2000), which may explains why Davis initially used the regression model to examine the presented TAM or its extensions/variations. Consequently, this investigation only represents a preliminary work to draw attention for understanding



organizational technology adoption. More research is definitely required to verify and enhance the validity and generalizability of the methodology used in this study.

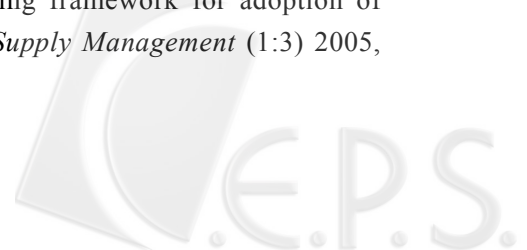
Like other empirical studies, limitations do exist in this research. First, this work is not a longitudinal study. That is, the two-stage analysis is based on a snapshot questionnaire survey rather than observing the same respondents over time from initiation to implementation. Therefore, future works may conduct a longitudinal study to examine the effect of network externalities and transition costs on enterprise technology adoption, and whether or not TAM and DOI can effectively explain enterprise technology adoption and diffusion. Second, since the samples are limited to Taiwanese enterprises, caution is needed in generalizing the findings of this study to other countries with different industry structures or cultures. Third, the work collected responding firms' data from a single person in each company just like many other business survey studies (Cooper and Zmud, 1990; Grewal et al., 2001; Lucchetti and Sterlacchini, 2004; Zhu et al., 2006). However, this approach is increasingly criticized by organizational behavior research as having common method variance and reliability problems (Gerhart et al., 2000; Podsakoff et al., 2003) because relying on a single key person to represent an entire company may result in insufficient, biased, and/or unbalanced information (Soliman et al., 2001; Yu, 2005). Therefore, future research may conduct qualitative case studies through face-to-face approach to collect data, which could further examine the methodology used in this study.

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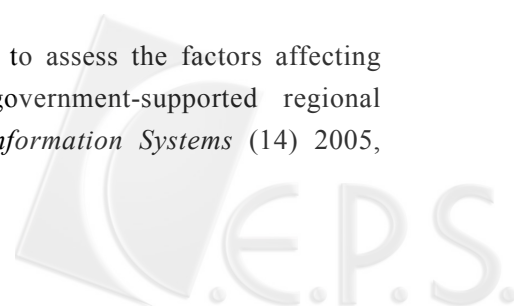
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